Instructor: Angela R. Fertig  
Office: 261 Humphrey  
Email: arfertig@umn.edu  
Office Hours: Tuesdays, 10:00-11:00 AM, or by appointment

Teaching Assistant: Peder Garnaas-Halvorson  
Email: garna020@umn.edu  
Office hours & Location: Fridays, 11:00 AM - noon, or by appointment, HHH 1st floor cube

Lecture: Mondays & Wednesdays 9:45-11:00 AM, HHH 25  
Lab: Fridays 9:45-11:00 AM (Section 002), HHH 85

Course Objectives: This course will cover bivariate and multivariate regression models, including the assumptions behind them and the problems that arise when these assumptions are not met. It covers the same topics as PA5032 (Regression Analysis) but in more depth and using more mathematical notation. Students will also become familiar with the Stata statistical package.

Prerequisites: This course is designed for master’s students with some background in mathematics/statistics/economics in their undergraduate education. At a minimum, students should have completed or waived PA5031. You are also encouraged to watch the video Professors Kleiner, Kudrle, and Johnson made discussing PA5032, 5044, and 5033, available here: https://player.vimeo.com/external/136968066.sd.mp4?s=0ab252117104aedff548ea22c73a01af&profile_id=112

Texts and Readings: The required text for this class is Introductory Econometrics: A Modern Approach by Jeffrey Wooldridge. It is currently in its sixth edition. I highly encourage you to purchase used older editions of the text as they are much cheaper, at around $20 on Amazon. Other readings will be posted on the course’s Moodle site.

Grading: Grades will be based on three assignments, a final exam, and class participation, according to the following weighting scheme:

45% Assignments (3)  
40% Final Exam  
15% Class Participation

All questions on exams and assignments will be given a clearly stated point total. Grades for each assignment and exam will be calculated on a points basis - you will be given the class median point total as well as the minimum and maximum when each assignment is returned. Each assignment will be given equal weight in the final grade. The final grade for the course will be graded on a “curve”, with the likely median grade being a B+. I encourage your
questions during lecture, as well as answering my questions posed to the class, hence the class participation part of the grade.

Incompletes will be only given in the most extenuating of circumstances (documented family crisis, medical emergency, etc.). University and Humphrey policies on incompletes will be followed. There will be no opportunity for extra credit.

**Assignments:** Assignments will consist of questions on concepts and methods (“pencil and paper”) and questions involving the application of the methods to data using Stata. Note that some questions on the assignments, especially those using Stata, will be purposely vague. I do this to approximate how regression analysis is used in the “real world”, such as in your future job! Assignments are due at the beginning of the designated class period. Assignments will be handed in at the beginning of class on the designated due date as well as uploaded to Moodle. Late assignments will be penalized 10 points for every 24-hour period it is late. **All parts of all assignments must be typed.** I will provide guidelines about how assignments must be written up for full credit. You may ask the instructor, TA, and other students for help on the assignments, but you must hand in your own work. **Students who hand in identical (or nearly identical) assignments will receive a score of 0 for that assignment.**

I have specific requirements on the formatting of Stata output for assignments. Not following these requirements will result in reduced grades. I will provide a handout detailing these requirements with the first assignment.

**Access to Stata:** This class will involve the use of Stata both for assignments and lab. You have several options for accessing Stata. First, the Humphrey School has a site license under which you can use Stata free of charge on your own computer. To use Stata in this manner, you must have a Remote Desktop Connection installed as well as a VPN client if you want to use it off campus. For help installing the RDC and VPN clients, I recommend visiting OneStop IT support in Blegen 90. In addition, the Humphrey computer lab has Stata installed on its computers for you to use.

You can also buy Stata, a good option if you’d like to be able to use the software after graduation. Student pricing for the program is actually very good, $200 for a perpetual license for Stata/IC. For most users, Stata/IC is great. Don’t buy Small Stata - you’re limited to only 1200 observations and most datasets we’ll be using in this class will have many more than that! For more information on purchasing Stata see [www.stata.com](http://www.stata.com).

**Exams:** There will be one final exam, held on Wednesday, March 7 from 9:45AM-12:30PM. The exam will be closed-note. You are required to take the exam during the scheduled time. Make-up exams will only be scheduled in extreme cases (family emergency, serious illness etc.) in accordance with the University policy on legitimate absences ([http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html](http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html)).

**Attendance and Class Participation:** Attendance is required. Chronic lateness or multiple absences will reduce the class participation component of your grade. If you need to miss a class, please notify me beforehand. If you miss a class or lab, it is your responsibility to find out what you missed.

**Lecture Notes:** I will try my best to post the day’s slides to Moodle by midnight on the day before class. You are welcome to print out the slides and bring them to class to facilitate note-taking.
Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. Please do not broadly disseminate class notes beyond the classroom community or accept compensation for taking and distributing class notes as this violates shared norms and standards of the academic community. For additional information, please see: [http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html](http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html)

**Use of Electronics in Class:** You are allowed to use your laptop or tablet for taking notes in class, and to run Stata during labs, but not for any other purpose (facebook, email, etc.). I’d also like everyone to keep their mobile phones put away and silent during class unless you have a good reason (small children, etc.), but if so please tell me.

**Student Conduct Code:** The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: [http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf](http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf)

Note that the conduct code specifically addresses disruptive classroom conduct, which means “engaging in behavior that substantially or repeatedly interrupts either the instructor’s ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

**Scholastic Dishonesty:** You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: [http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf](http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf)) If it is determined that a student has cheated, he or she may be given an “F” or an “N” for the course, and may face additional sanctions from the University.

**Sexual Harassment:** “Sexual harassment” means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual’s work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: [http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf](http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf)

**Equity, Diversity, Equal Opportunity, and Affirmative Action:** The University will provide equal access to and opportunity in its programs and facilities, without regard to race,
Mental Health and Stress Management: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: [http://www.mentalhealth.umn.edu](http://www.mentalhealth.umn.edu).

| Table 1: Class Schedule and Topics (subject to change) |
|---------------------------------|----------------|-----------------|-----------------|
| Week | Monday | Wednesday | Friday |
| 1 | January 17 | January 17 | January 19 |
| | Introduction | | Lab: Stata Review |
| 2 | January 22 | January 24 | January 26 |
| | Single Regression | Single Regression | Lab: Expectation & Single Regression |
| | Assignment 1 Posted | | |
| 3 | January 29 | January 31 | February 2 |
| | Single Regression | Multiple Regression | Lab: Single Regression |
| 4 | February 5 | February 7 | February 9 |
| | Multiple Regression | Multiple Regression | Lab: Multiple Regression |
| | Assignment 1 Due | | |
| | Assignment 2 Posted | | |
| 5 | February 12 | February 14 | February 16 |
| | Multiple Regression | Multiple Regression | Lab: Multiple Regression |
| 6 | February 19 | February 21 | February 23 |
| | Nonspherical Errors | Nonspherical Errors | Lab: Nonspherical Errors |
| | Assignment 2 Due | Times Series | |
| | Assignment 3 Posted | | |
| 7 | February 26 | February 28 | March 2 |
| | Data problems | Review | Lab: Time Series |
| 8 | March 5 | March 7 | |
| | Review | Final Exam | |
| | Assignment 3 due | 9:45 AM - 12:30 PM | |
Reading List:

The chapter/section numbers and names are for the sixth edition of Wooldridge. I have provided the names of each chapter and section names as there is slight variation in chapter/section order in older editions. If you have questions about the correspondence of this list to your copy of Wooldridge, see me in office hours.

1. Course Introduction, Causality and Selection - January 17
   Wooldridge, chapter 1 “The Nature of Econometrics and Economic Data”

   Wooldridge, chapter 2 “The Simple Regression Model”
   • 2.1 “Definition of the Simple Regression Model”
   • 2.2 “Deriving the Ordinary Least Squares Estimates”
   • 2.3 “Properties of OLS on Any Sample of Data”
   • 2.5 “Expected Values and Variances of the OLS Estimators”
   Wooldridge, chapter 4 “Multiple Regression Analysis: Inference”
   • 4.1 “Sampling Distributions of the OLS Estimators”
   • 4.2 “Testing Hypotheses about a Single Population Parameter: The t Test” (don’t worry much about 4.2c “Testing Other Hypotheses about $\beta_j$” until later)
   • 4.3 “Confidence Intervals”
   Wooldridge, chapter 7 “Multiple Regression Analysis with Qualitative Information: Binary (or Dummy) Variables”
   • 7.1 “Describing Qualitative Information”
   • 7.2 “A Single Dummy Independent Variable”

3. Multiple Regression: Estimation, Inference, and Further Issues - January 31, February 5, 7, 12, 14
   Wooldridge, chapter 3 “Multiple Regression Analysis: Estimation”
   • 3.1 “Motivation for Multiple Regression”
   • 3.2 “Mechanics and Interpretation of Ordinary Least Squares”
   • 3.3 “The Expected Value of the OLS Estimates”
   • 3.4 “The Variance of the OLS Estimators”
   • 3.5 “Efficiency of OLS: The Gauss-Markov Theorem”
• 3.6 “Some Comments on the Language of Multiple Regression” (Not required, but probably helpful to know!)

Wooldridge, chapter 4 “Multiple Regression Analysis: Inference”

• Review 4.1-4.3 (including all of 4.2)
• 4.4 “Testing Hypotheses about a Single Linear Combination of the Parameters”
• 4.5 “Testing Multiple Linear Restrictions: The $F$ test”

Wooldridge, chapter 2 “The Simple Regression Model”

• 2.4 “Units of Measurement and Functional Form”

Wooldridge, chapter 6 “Multiple Regression Analysis: Further Issues”

• 6.2 “More on Functional Form”

Wooldridge, chapter 7 “Multiple Regression Analysis with Qualitative Information: Binary (or Dummy) Variables”

• 7.3 “Using Dummy Variables for Multiple Categories”
• 7.4 “Interactions Involving Dummy Variables”

4. Nonspherical Errors: Heteroskedasticity and Serial Correlation (including Time Series) - February 19, 21, 26

Wooldridge, chapter 8 “Heteroskedasticity”

• 8.1 “Consequences of Heteroskedasticity for OLS”
• 8.2 “Heteroskedasticity- Robust Inference after OLS Estimation”
• 8.3 “Testing for Heteroskedasticity”
• 8.4 “Weighted Least Squares Estimation”

Wooldridge, chapter 10 “Basic Regression Analysis with Time Series Data”

• 10.1 “The Nature of Time Series Data”

Wooldridge, chapter 12 “Serial Correlation and Heteroskedasticity in Time Series Regressions”

• 12.2 “Testing for Serial Correlation”
• 12.3 “Correcting for Serial Correlation with Strictly Exogenous Regressors”
• 12.5 “Serial Correlation-Robust Inference after OLS”

5. Measurement Error - February 28

Wooldridge, chapter 9 “More on Specification and Data Issues”

• 9.4 “Properties of OLS under Measurement Error”
• 9.5 “Missing Data, Nonrandom Samples, and Outlying Observations” (don’t worry about 9.5c “Outliers and Influential Observations)


