LINEAR STATISTICAL MODELS (PADP 8130)

Course Instructor:

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Course Information:

Time: Monday: 3:35pm-6:35pm
Where: 202 Baldwin Hall
Office Hours: Tuesday:
1:00pm-3:00pm &
By Appointment

COURSE DESCRIPTION

This course provides an introduction to linear regression analysis for Ph.D. students in the Department of Public Administration and Policy. The prerequisites for this course are PADP 8120: *Data Analysis and Statistical Inference* (**Each student is expected to have a working knowledge of this material upon entering this course**). Although the course focuses on data applications using Stata statistical software, it will be preceded by the theoretical basis of the statistical models and methods covered in this course. To make learning the material easier, students should have read and feel comfortable with the assigned readings ahead of its coverage in a given class session. When applicable, students should read any assigned journal article materials that contain applications of any statistical methods covered in the course, with special attention to the statistical methodology and its application to the substantive problem at hand.

The course will involve performing applied data analysis using **Stata (version 16)** statistical software during the semester. I strongly encourage students to purchase a copy of Stata for their own purposes (i.e., computer). Stata can also be used via the UGA virtual lab (http://vlab.uga.edu). Although I will often point students to the necessary Stata program commands to execute problem set assignments & their own research projects, students are ultimately responsible for becoming proficient in using Stata by learning it on their own outside of class. Stata is very easy to use from a programming-syntax orientation and has a terrific set of online tutorials, help menus, manuals, and user-created (***.ado***) program files that should be able to assist you in most instances. However, I will be glad to assist students with computer–related questions outside of class sessions. These times can include office hours, a scheduled appointment, or by sending an e–mail message. Please feel free to contact me in such instances.

The following course text materials are required for each student taking this course:

Required Textbooks

Jeffrey M. Wooldridge. 2016. *Introductory Econometrics: A Modern Approach*. Sixth Edition. Boston, MA: Cengage Learning.

Christopher F. Baum. 2006. *An Introduction to Modern Econometrics Using Stata*. College Station, TX: Stata Press.

Joshua D. Angrist, and Jorn–Steffen Pischke. 2015. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton, NJ: Princeton University Press.

Additional supplementary readings are offered for topics covered in this course. These items can be obtained through electronic links provided by the instructor at the end of the course syllabus.

COURSE OBJECTIVES

1. *Understand the concepts underlying linear and related statistical models covered in this course and be able to competently execute these techniques, including diagnostic tests, substantive interpretation of relationships and effects, and sensitivity analyses. This includes both written and oral presentation of these models and the statistical results produced by them.*

2. *Advancing a promising original scholarly research project that is well-thought out, theoretically informed, and empirically crafted in an appropriate manner.*

3. *Provide effective, constructive feedback on a classmate's research that will facilitate the development of the next stage of their research project.*

The attainment of these course objectives will primarily occur through assigned readings, class session lectures, problem sets, research projects, and consultation with the instructor.

CLASS STRUCTURE

- **SESSION A: 3:35pm – 5:00pm (85 minutes)**
- **BREAK: 5:00pm–5:10pm (10 minutes)**
- **SESSION B: 5:10pm – 6:35pm (85 minutes)**

CLASSROOM RESPECT POLICY

Students will be permitted to only use laptop computers during class sessions when material is being covered by the instructor, and only for the purposes of the material content being covered at that time during class. Any use of electronic devices for reasons other than those pertinent to the lecture material covered will result in a loss of electronic device privileges for students violating this policy. Also, it is important to maintain a healthy learning environment so that everyone can feel free to participate. All members of the class are expected to behave in both a respectful and civil manner towards one another. To ensure that we get through the material of the course, I encourage students to ask questions, but as instructor I reserve the right to meet up with students outside of class sessions who are in need of additional assistance beyond what the instructor can supply during the time allotted for class. **My regularly scheduled office hours will be held on Tuesday afternoons from 1:00pm–3:00pm**. In addition, I will do my best to make myself available after our Monday early evening class sessions conclude. I encourage each of you to stop by on a regular basis to discuss the course content that we are covering, as well as the development of your original scholarly research projects for this course.

STUDENTS WITH DISABILITIES

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Disability Resource Center, Clark Howell Hall at UGA Athens campus (https://drc.uga.edu/) within the first two weeks of the term so that accommodations can be investigated on your behalf. Disability Resource Center will verify your disability and determine reasonable accommodations for this course.

ACADEMIC HONESTY

Cheating, plagiarism, and unauthorized assistance will not be tolerated. Students suspected of violating the University of Georgia's *Academic Honesty Policy* (https://honesty.uga.edu/Academic-Honesty-Policy/) will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score (F grade) for any given assignment, and possibly an F course grade, will be imposed.

REQUIRED ASSIGNMENTS

(1) Three Problem Sets: Stata Applications: 40% (UNIT 1: 20%; UNIT 2: 10%; UNIT 3: 10%)

Students will be graded on problem sets covering material from each of the three units of the course (*Principles of Linear Regression [1 assignment]*; *Nonparametric Methods [1 Assignment]; & Modern Identification Strategies [1 assignment]*). These problem sets will entail

Stata software applications (graphical and/or statistical) and written analyses of statistical findings and results from the various techniques, models, and tests covered during class sessions. These problem set assignments are due at the time assigned by the instructor [this information will appear on each assignment problem set] – without obtaining formal consent from the instructor, late work will be penalized by 50% for each regular day that it is late. The first problem set covering **UNIT 1** will constitute 20% of the final course grade, while the remaining two assignments covering **UNITS 2** and **3** will each count 10% towards the final course grade. Submitted problems sets must consist of a written analysis of the work, plus Stata program output ***.smcl** files (and Stata program ***.do** files) embedded within the corresponding output file. **Although student interaction is encouraged on these problem set assignments, each student is required to perform their own work when completing assignments.**

(2) An Original Scholarly Research Paper: 40% (15% Draft Version; 25% Final Version)

Each student will be required to develop an original scholarly research paper of 30-40 pages in length (double-spaced, 12 point font) during the semester, subject to the instructor's approval. All formatting requirements should conform to current *American Journal of Political Science* guidelines (American Political Science Association's *Style Manual for Political Science* (revised August, 2006)). Students are fully responsible for choosing their own research projects and the resulting product that is the outcome of this process. Students are required to discuss their topic(s) with the instructor to assess suitability for this course. Students need not be limited to statistical material covered by the time of this deadline (nor the course syllabus) – as long as it is broadly related to the content covered by this course. This is an important element of the course since it encourages the practice of developing and executing their own research projects, with the possibility that it can be further developed into an eventual scholarly publication at some later date.

- **Approval of Written Research Proposal**: **Approved by the Instructor (and not merely submitted) by no later than Friday January 31, 2020 at 1:00pm**. *Failure to obtain instructor approval by this deadline results in 10% of one's final course grade being set equal to zero (0%).* Students are strongly encouraged to get their paper projects approved prior to this date. Student research papers can overlap with research papers being written for other seminars, as long as they are substantively distinct from one another (e.g., pose a different question, use different data to answer the question, employ different methods). This determination will be made by the instructor on a case-by-case basis after consulting with both the student and other affected instructor(s). The written

research proposal should be 2-3 single-spaced pages and outline the research question that the paper seeks to answer, its significance/importance, theory and resulting hypotheses used to explain/answer the research question, and empirical strategy (i.e., research design, measurement & statistical models/procedures)

- **Research Paper Completed Draft Version (15%): Due by no later than Monday March 30, 2020 at the beginning of class session**. Copy submitted to the instructor. *Failure to obtain instructor approval by this deadline results in a 50% penalty per day of one's final course grade derived from this assignment (i.e., 0 points for 2 days late).*

- **Research Paper Final Version (25%): Due by no later than Thursday April 17, 2020 at 5:00pm (submit an electronic file format copy to both the instructor and your assigned classmate discussant)**. Copy submitted to the instructor. *Failure to obtain instructor approval by this deadline results in a 50% penalty per day of one's final course grade derived from this assignment (i.e., 0 points for being 2 days late).*

(3) Presentation of Final Version of Research Paper & Discussant on a Classmate's Research Paper: 20% (10% Per Each Assignment)

The final portion of each student's course grade will be determined by a presentation of their own research, as well as their ability to provide constructive feedback to a classmate's research paper. The instructor will be responsible for matching paper authors and discussants. **The paper presentations and discussant remarks will be shared in our final class session on Monday April 21, 2020**. We will try to simulate a professional scholarly panel (e.g., PMRC, APSA) where a paper will be presented by its author (12-15 minute time limit range), followed by the discussant offering their constructive type-written feedback patterned after a quality manuscript review at an academic journal that is intended to improve the author's research project moving forward (5-7 minutes), and concluding with an audience discussion (5-10 minutes). This format will be replicated by the number of students taking this course who have completed a research paper.

- **Presentation of Final Research Paper (10%): Due by no later than Monday April 21, 2020 at beginning of the class session (submit a copy to both your assigned classmate presenter and the instructor)**. Copy submitted to the instructor. *Failure to obtain instructor approval by this deadline results in a 50% penalty per day of one's final course grade derived from this assignment (i.e., 0 points for being 2 days late).*

- **<u>Discussant of a Classmate's Final Research Paper (10%)</u>: Due by no later than Monday April 21, 2020 at the beginning of class session (submit a copy to both your assigned classmate discussant and the instructor)**. Copy submitted to the instructor. *Failure to obtain instructor approval by this deadline results in a 50% penalty per day of one's final course grade derived from this assignment (i.e., 0 points for being 2 days late).*

<u>GRADING SCALE</u>

I will grade items on a letter/point system, and each item will be weighted by the proportion noted above:

Letter Grade	Points	Letter Grade	Points
A+	**4.25**	**B– –/C+**	**2.625**
A+/A	**4.125**	**B–/C+**	**2.50**
A	**4.00**	**B–/C++**	**2.375**
A/A–	**3.875**	**C+**	**2.25**
A–	**3.75**	**C+/C**	**2.125**
A– –/B+	**3.625**	**C**	**2.00**
A–/B+	**3.50**	**C/C–**	**1.875**
B++	**3.375**	**C–**	**1.75**
B+	**3.25**	**C– –/D+**	**1.625**
B+/B	**3.125**	**C–/D+**	**1.50**
B	**3.00**	**C–/D++**	**1.375**
B/B–	**2.875**	**D+**	**1.25**
B–	**2.75**	**D+/D**	**1.125**
		D	**1.00**
		F	**0.00**

The "in-between" grades on individual assignments is to the benefit of students to minimize rounding effects. Because the final grade distribution is based on a series of assignments (as opposed to a single item), the final course grade distribution based on your weighted course average from all assignments is given below as follows (***<u>with no rounding up</u>***):

Letter Grade	Points	Letter Grade	Points
A+	**4.00 – 4.25**	**C**	**2.25 – 2.49**
A	**3.75 – 3.99**	**C–**	**2.00 – 2.24**
A–	**3.50 – 3.74**	**D+**	**1.75 – 1.99**
B+	**3.25 – 3.49**	**D**	**1.50 – 1.74**
B	**3.00 – 3.24**	**D–**	**1.25 – 1.49**
B–	**2.75 – 2.99**	**F**	**0.00 – 1.24**
C+	**2.50 – 2.74**		

COURSE OUTLINE & TIMETABLE

Note: *The tempo may vary throughout the semester. Asterisks (*) denote content that may or may not be covered, conditional on the tempo throughout the semester.*

Session	Date	Course Topics/Subject Material	Required Readings
		UNIT 1: PRINCIPLES OF LINEAR REGRESSION	
1	1/13/2019	**GENERAL LINEAR REGRESSION, I: (Assumptions & Solution/Estimates)**	*Wooldridge (Chapters 1-2)* *Baum (Chapters 1-3)*
	1/20/2019	**MLK, JR. HOLIDAY OBSERVANCE (NO CLASS)**	*Baum (Chapters 1-3)* *A&P (2015: Chapter 2)*
2	1/27/2019	**GENERAL LINEAR REGRESSION, II: (Interpretation and Functional Form)**	*Wooldridge (Chapters 3-5, 7)* *Baum (Chapter 4, 7.1-7.2)*
3	2/3/2019	**GENERAL LINEAR REGRESSION, III: (Diagnostics, I)**	*Wooldridge (Chapter 6)* *Baum (Chapter 5)*
4	2/10/2019	**GENERAL LINEAR REGRESSION, IV: (Diagnostics, II & Heteroskedastic Regression)**	*Wooldridge (Chapters 8-9, 12)* *Baum (Chapter 6)*
		UNIT 2: RELAXING LINEARITY VIA NONPARAMETRIC METHODS	
5	2/17/2019	**NONPARAMETRIC METHODS: (Odd Cases, Functional Form, Local Linear Regression, Quantile Regression, & Kernel Regularized Least Squares)** ***[PROBLEM SET # 1 DUE: WEEKS 1-4]***	*Wooldridge (Chapters 13-14)* *Baum (Chapter 9.1 & 9.4)* *Assigned Readings*
		UNIT 3: MODERN IDENTIFICATION STRATEGIES	
6	2/24/2019	**CAUSAL INFERENCE, I: Panel Designs (Pooling, Random Effects, Fixed Effects, Hybrid Between-Fixed Effects, & Diagnostics)**	*Wooldridge (Chapters 13-14)* *Baum (Chapter 9.1 & 9.4)*
7	3/2/2019	***RESEARCH PAPER WORKSHOP # 1*** ***[PROBLEM SET # 2 DUE: WEEKS 5-6]***	
	3/9/2019	**SPRING BREAK WEEK (NO CLASS)**	
8	3/16/2019	***CAUSAL INFERENCE, II: Traditional Methods (Instrumental Variable Estimation: Two-Stage Two-Stage Least Squares Estimation*)***	*Wooldridge (Chapter 15)* *Baum (Chapter 8)* *A&P (2015: Chapters 3 & 6)*
9	3/23/2019	**CAUSAL INFERENCE, III: Treatment Interventions (Differences-in-Differences, *Synthetic Control Methods**)**	*A&P (2015: Chapter 5)* *Assigned Readings*
10	3/30/2019	**CAUSAL INFERENCE, IV: Threshold Interventions (Regression Discontinuity Designs (RDDs))** **[DRAFT RESEARCH PAPER DUE]**	*A&P (2015: Chapter 1)* *Assigned Readings*
11	4/6/2019	***RESEARCH PAPER WORKSHOP # 2***	
12	4/13/2019	***RESEARCH PAPER WORKSHOP # 3*** **[FINAL *RESEARCH PAPER DUE: 4/17/2019 @ 5:00pm*]**	
13	4/20/2019	**RESEARCH SYMPOSIUM** ***[PROBLEM SET # 3 DUE: WEEKS 8 – 10]***	

ASSIGNED READINGS (Not Covered in Assigned Textbooks)

UNIT 2

- *Local Linear Regression:*
  - *https://blog.stata.com/2017/06/27/nonparametric-regression-like-parametric-regression-but-not/*
  - *http://cameron.econ.ucdavis.edu/nhh2017/norway04_nonparametric.pdf*

- *Quantile Regression:*
  - *https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.15.4.143*
  - *http://fmwww.bc.edu/EC-C/S2013/823/EC823.S2013.nn04.slides.pdf*

- *Kernel Regularized Least Squares:*
  - *https://web.stanford.edu/~jhain/Paper/PA2014a.pdf*
  - *https://www.jstatsoft.org/article/view/v079i03*
  - *https://web.stanford.edu/~jhain/Paper/JSS2015_RR.pdf*

UNIT 3

- *Differences-in-Differences Designs:*
  - *The Most Basic Set-Up: http://www.princeton.edu/~otorres/DID101.pdf*
  - *A more sophisticated example that relaxes the parallel trend assumption using unit-specific trends and matching on observables between treatment and non-treatment groups:*
    https://www.cambridge.org/core/services/aop-cambridge-core/content/view/1A366C3B5FBD35A4CDAEC8EC453FA353/S1537592716000050a.pdf/deterring_wage_theft_altlabor_state_politics_and_the_policy_determinants_of_minimum_wage_compliance.pdf

- *Synthetic Control Designs (Supplementary Resource to the Material Covered in Class):*
  - *http://students.olin.wustl.edu/~sovichd/ECF/Synthetic_Control.pdf*
  - *https://www.tandfonline.com/doi/full/10.1080/10967494.2015.1121178?scroll=top&needAccess=true*
  - *https://www.urban.org/sites/default/files/publication/89246/the_synthetic_control_method_as_a_tool_0.pdf*

- *Regression Discontinuity Designs:*
  - *http://faculty.chicagobooth.edu/max.farrell/research/Calonico-Cattaneo-Farrell-Titiunik2017_Stata.pdf*
  - *https://www.mdrc.org/sites/default/files/regression_discontinuity_full.pdf*
  - *https://www.stata.com/meeting/chicago16/slides/chicago16_cerulli.pdf (TED)*
  - *https://scholar.princeton.edu/sites/default/files/jmummolo/files/sqf_jop.pdf*