<div align="center">

PAI 804
Quantitative Methods II
Spring 2024

</div>

David Popp   Office Hours:
426 Eggers Hall   Monday 10:00-11:30
office ph: 443-2482   Tuesday 10:00-noon
dcpopp@syr.edu   or by appointment

<div align="center">

***** PLEASE NOTE THAT ALL PLANS FOR THE COURSE ARE TENTATIVE AND MAY CHANAGE AS CONDITIONS WARRANT *****

</div>

Course Description: This course is the second course in the methodology sequence for Public Administration PhD students. The course focuses on the use of regression analysis for social science research. We will begin with a description of the properties and assumptions of the basic multivariate linear regression model using ordinary least squares (OLS), along with the statistical inference tools necessary for hypothesis testing. The course continues by examining the consequences of violating the assumptions of the OLS model. Techniques for dealing with such cases are at the heart of empirical research. We discuss several such techniques, including adjustments for heteroskedasticity and autocorrelation, and the instrumental variables technique.

Computer Resources: This course is designed to prepare you to use regression analysis in your own research, and to make you an educated consumer of the work of others. While the course includes several examples of such analysis, regression analysis is best learned through practice, rather than through a textbook and lectures. Homework assignments will include computer exercises that make use of the techniques covered in class. All such exercises are designed to be completed using Stata, which has become the most commonly used software package regression analysis. Copies of Stata are available on computers in CPR, the Social Sciences grad bay, and Eggers 040. It is also available in various computer labs throughout campus (http://its.syr.edu/labs/). Finally, you can access Stata for class through Remote Desktop Services (RDS). More information on RDS may be found at:

<div align="center">

https://answers.syr.edu/pages/viewpage.action?pageId=105089561

</div>

In addition, Stata is available for purchase at a discounted rate for students at the following link:

<div align="center">

https://www.stata.com/order/new/edu/profplus/student-pricing/

</div>

If you plan on purchasing a license to use Stata in your own research, I highly recommend purchasing Stata SE, rather than Stata BE (formerly Stata IC), as Stata SE is able to handle larger data sets. For the purposes of this class, Stata BE should be sufficient for most exercises (although it may be necessary to find a computer with Stata SE for some exercises in which you use matrix algebra, rather than Stata's own commands, to analyze data).

For those unfamiliar with Stata, it is worth your effort to learn, as you are likely to continue to use Stata for your own research. The Stata website includes several links to introductory tutorials:

<div align="center">

https://www.stata.com/links/resources-for-learning-stata/

</div>

Prerequisites: Students should have successfully completed PAI 803, Quantitative Methods I, or an equivalent course that discusses research design. Students should have basic familiarity with probability and statistical inference. The class will use both matrix algebra and differential calculus. I will provide a brief introduction to matrix algebra, focusing on the tools to be used in class. For those needing review, the text provides a brief introduction to differential calculus. Useful web sites include:

http://www.intmath.com/Calculus/Calculus-intro.php
http://www.sosmath.com/calculus/calculus.html.

If you need other resources, please see me.

E-mail: All students in the class are required to have an e-mail account and to check e-mail regularly. I will use e-mail to make announcements about class, and may distribute supplementary materials for assignments via e-mail. Not checking e-mail is not an appropriate excuse for missing these announcements.

Reading: The required textbook for this class is:

> *Introductory Econometrics: A Modern Approach*, 7th edition, by Jeffrey M. Wooldridge, South-western Cengage Learning, 2019.

In addition, the following text is optional:

> *Mostly Harmless Econometrics: An Empiricist's Companion*, by Joshua D. Angrist and Jörn-Steffen Pischke, Princeton University Press, 2009.

Both texts are available through the Syracuse University Online Textbook Store. Older editions are fine. The level of material covered in class will fall somewhere in between these two books. Wooldridge's *Introductory Econometrics* provides an intuitive introduction to econometric methods, but makes little use of calculus and matrix algebra. However, most advanced textbooks using such tools provide more detail than necessary for this course.

As such, I will occasionally supplement the readings from Wooldridge with material from Angrist and Pischke's book, which introduces econometric techniques in a narrative, rather than textbook, form. At times the mathematics in this book become advanced, so I will use it sporadically throughout the semester. While it is therefore optional, those of you who plan on making extensive use of regression analysis in your research would benefit from purchasing and reading the book. I will include the relevant chapters in the syllabus for those who would like to read them. In addition, I will also make use of journal articles to illustrate the concepts discussed in class. These articles are all available electronically through the Syracuse University Library.

Other textbooks: As noted above, there is no one "perfect" textbook for this course. Most graduate level econometrics texts are aimed at Economics Ph.D. students. They make heavy use of mathematics, and focus on proof of concept as well as application. However, as you go forward in your own research, you may find such texts a useful reference. Below I provide an annotated bibliography of alternative textbooks that you may find useful:

Marno Verbeek, *A Guide to Modern Econometrics:5th Edition*, John Wiley & Sons, 2017.
> The level of this text is closest to what we will use in class. It makes use of calculus and matrix algebra, but focuses on applications, rather than proof of concept. It moves rather quickly, as it includes fewer examples than other books. While the text includes 10 chapters, most of the topics covered in this course are covered in chapters 1-5. However, it is affordable.

Christopher F. Baum, *An Introduction to Modern Econometrics Using Stata*, Stata Press, 2006.
> This book is an introduction to using Stata for econometrics. It reviews the theory (using matrix algebra) and demonstrates how many of the techniques that we cover in class can be done using Stata. While it is not as comprehensive as a traditional textbook, it is a nice supplement, and the level of math use is comparable to what we cover in class. In fact, I use this book as a guide for preparing lectures and examples. It can be ordered from Stata for $62 (https://www.stata.com/bookstore/modern-econometrics-stata/).

A. Colin Cameron and Pravin K. Trivedi, *Microeconometrics Using Stata*, Stata Press, 2010/2022.
> A more advanced book that can complement Baum's text, particularly for those planning on doing extensive regression analysis in their research. Like Verbeek, it moves quickly and includes several chapters that are beyond what we cover in this course. While the level of mathematics is similar to the more advanced econometric textbooks described below, the combination of theory and Stata examples in the presentation makes this book more accessible than other advanced books. The original 2010 edition is a single volume. A new edition came out in 2022. That edition includes two volumes, and is thus more expensive. The second edition can be ordered from Stata (https://www.stata.com/bookstore/microeconometrics-stata/index.html).

Peter Kennedy, *A Guide to Econometrics: 6th Edition*, Blackwell Publishing, 2008
> This book is a classic reference for econometrics. Its style is unique. Each chapter focuses on a specific issue, and provides a short, intuitive explanation of the topic. More detailed technical notes are provided at the end of each chapter. There are older editions, but the newest is much more comprehensive.

Jack Johnston and John DiNardo, *Econometric Methods: 4th Edition*, McGraw-Hill, 1997.
> This book is smaller than the other texts listed here, as its primary focus is technique, rather than applications. It is a good reference for regression techniques, with formal derivations using calculus and matrix algebra. Because it focuses on the math, it is rather dense, and probably most useful as a reference to pull off your shelf when looking for something specific, rather than reading as a text.

William E. Griffiths, R. Carter Hill, and George G. Judge, *Learning and Practicing Econometrics*, John Wiley & Sons, 1993.
> This book was used as the primary textbook for this course for many years. Compared to other econometric texts, the math is a bit lighter, although it still relies on calculus and matrix algebra. The main difference between this text and others is that its focus is on doing empirical work. Thus, the emphasis is on technique, rather than on proofs. Unfortunately, it has not been updated, and thus does not include some topics included in newer books.

William H. Green, *Econometrics: 8th Edition*, Prentice Hall, 2017.
> This text is often used in Ph.D. classes in economic departments. It is a very thorough reference, but more advanced than Griffiths, Hill, and Judge. It includes both applications and formal proofs.

Donald J. Treiman, *Quantitative Data Analysis: Doing Social Research to Test Ideas*, Jossey-Bass, 2009.
> This book is less rigorous than the other books listed here. The only math required is high-school algebra and an introductory statistics course. Unlike the other books here, its focus is on social sciences more broadly, rather than economics. The author is a sociologist. It covers both descriptive data and regression techniques. It is not as comprehensive as other texts. For instance, instrumental variables are only discussed on two pages, and neither heteroskedasticity nor autocorrelation are included in the index.

Grading: Your grade in this course will be based on homework exercises (25%), a referee report (25%) and the various components of your replication exercise (described below): the data summary (5%), replication presentation (10%), and the final replication paper (35%).

Homework assignments: Statistical analysis is best learned by doing. As such, there will be regular homework assignments throughout the semester. These will be a combination of written questions and data exercises using Stata. I will make any data sets needed for the assignments available on the G: drive. Homework assignments will be given in class. If you miss a class, it is your responsibility to find out if you missed any assignments or handouts. Not being present when an assignment was given out is **not** an acceptable excuse for missed or late work!

Referee report: You will prepare a referee report on a paper of your choosing. For this assignment, it is best to choose a working paper, representing a work in progress, rather than a published paper. The referee report is an important task for academics. When you submit articles for publication, the work will be refereed, usually by 2-3 anonymous referees, who will provide the journal editor with guidelines as to the submission's quality for publication. I will provide more details on this assignment, including potential sources for working papers, in a separate document. As there is not a final exam for this course, you may use the exam period to complete this assignment if you wish. As such, the referee report will be due on the last day of the exam period, which is *Tuesday, May 7*.

Replication Assignment: The major project for this class is a paper in which you replicate the results of a published research paper. You may choose any paper of interest to you, with the following guidelines: (1) the paper must make use of methods discussed in class, and (2) you may not replicate a paper using data sets from the Wooldridge text. **Once you have chosen a paper, it must be approved by me.**

To replicate the paper, you will need access to the paper's data. Some journals now require that authors make data available for replication purposes. These include the following:
- Several journals, including *Public Administration Review*, the *American Journal of Political Science* and *Review of Economics and Statistics* require authors to provide a replication package available on the Harvard Dataverse Network (https://dataverse.harvard.edu/).
- American Economic Review (http://www.aeaweb.org/aer/index.php, data sets included with articles). *Please note that articles in the May issue each year are abbreviated conference papers and are too short for the purposes of this assignment.*
- Applied AEA journals also make data available. Applied Economics and Economic Policy are good sources for relevant articles
- Journal of Peace Research (https://www.prio.org/journals/jpr, replication data at https://www.prio.org/Data/Replication-Data/)
- Journal of Conflict Resolution (https://journals.sagepub.com/home/JCR; data sets included with the articles)
- Journal of Applied Econometrics (http://qed.econ.queensu.ca/jae/)
- Oxford Economic Papers (https://academic.oup.com/oep)

In addition, some journals have a policy requiring authors to make data available for replication, although the data is not readily available on the web site. Two examples are the Journal of Human Resources (http://uwpress.wisc.edu/journals/journals/jhr.html) and the Journal of Environmental Economics and Management (https://www.sciencedirect.com/journal/journal-of-environmental-economics-and-management).

Also, some faculty include data sets on their personal websites. Finally, the following website offers links to articles and archives on replication in social science research: http://gking.harvard.edu/pages/data-sharing-and-replication.

Thus, you should first check the journal web site for any article that interests you. If that fails, you should contact the author directly to see if you can obtain the data (again, some journals require authors to do so if asked). I have been asked to do this myself, and it can be a good way for a young researcher to establish contact with a senior person in their field. In some cases, you may find that the data are publicly available, although in those cases it may require some effort to clean the data. *I strongly caution against collecting raw data from publicly available sources unless the data come from only one or two sources. Combining and cleaning data from multiple sources can take much more time than running regressions, and is not an expectation for this assignment!* I would encourage each of you to talk with your faculty mentor for help finding an appropriate paper.

The write-up of your replication exercise should be similar to a research paper. Your introduction should state why the question is important. Based on the original paper, you should provide a brief literature review and describe the theory being tested. However, this can be brief, as I am *not* asking you to copy what has already been written. Paraphrasing is sufficient. You should describe the data and the methodology used to analyze the data. Please be certain to explain *why* the methodology used is appropriate (or, if you think it is not, please explain why, presenting evidence to support your claim). Your write-up of the results should be interpretive. You should consider any potential threats to the validity of the results, as well as how well the results are likely to apply outside of the sample in the paper. In your conclusion, you should consider any modifications and extensions of the work that may be justified. You should also reflect on any challenges you had replicating the paper and what you learned from the exercise.

A typical length for the write-up is 15-20 double spaced pages. Your write-up should include professional tables that would be appropriate to submit to a journal. Do not simply copy and paste output from Stata. However, you are not required to replicate figures. If you are unable to replicate the original paper, your tables should show both the original results and your attempt to replicate.

Throughout the semester, there will be four key deadlines for the replication assignment:

1. **March 8 – Approval of paper and data set:** To ensure that the methods you will be replicating apply the techniques that we'll cover in class, you must show me the paper that you intend to replicate and get my approval. You should meet with me as soon as possible to discuss possible papers.
2. **March 20 – Data Summary**: Once you have my approval and have obtained the data, the first step is to prepare a table of summary statistics. Most published papers will include such a table. This is an opportunity to verify that the data you are using matches that used in the published paper. For this deadline, you should submit a brief write-up of your data summary, including a description of the variables included and a table of summary statistics. Tables should be professionally made, not just copies of Stata output. The summary should also include a brief (no more than one page) description of the research question. What are the authors trying to do with these data?
3. **April 22 & 24 – Replication presentation**: During the last week of class, each student will present their replication to the class. This will take the same format as a conference presentation. Each student will have about 15 minutes to present their findings. We will

then have 5-10 minutes of questions from the audience. You should have completed your analysis by the presentation, but you do not need a finished paper.

4. **May 2 – Final paper due:** The final paper is due after classes end. This allows time to respond to any comments you may receive at your presentation.

Tentative Course Schedule

A tentative schedule for all class assignments appears below. Please note this is subject to change.

Assignment	Hand out	Due Date
Homework #1	Wednesday, January 31	Wednesday, February 7
Homework #2	Wednesday, February 7	Wednesday, February 14
Homework #3	Wednesday, February 14	Wednesday, February 21
Homework #4	Wednesday, February 28	Wednesday, March 6
Approval of replication paper		Friday, March 8
Replication data summary		Wednesday, March 20
Homework #5	Wednesday, March 27	Wednesday, April 3
Homework #6	Wednesday, April 10	Wednesday, April 17
Homework #7	Wednesday, April 17	Wednesday, April 24
Replication presentations		Mon. April 22 & Wed. April 24
Replication paper due		Thursday, May 2
Referee report due		Tuesday, May 7

Academic Honesty: Syracuse University's [Academic Integrity Policy](#) reflects the high value that we, as a university community, place on honesty in academic work. The policy holds students accountable for the integrity of all work they submit and for upholding course-specific, as well as university-wide, academic integrity expectations. The policy governs citation and use of sources, the integrity of work submitted in exams and assignments, and truthfulness in all academic matters, including course attendance and participation. The policy states that any work a student submits for a course must be solely their own unless the instructor explicitly allows collaboration or editing. The policy also requires students to acknowledge their use of other peoples' language, images or other original creative or scholarly work through appropriate citation. These expectations extend to the new, fast-growing realm of artificial intelligence (AI) as well as to the use of websites that charge fees or require uploading of course materials to obtain exam solutions or assignments. Students are required to ask their instructor whether use of these tools is permitted – and if so, to what extent – before using them to complete any assignment or exam. Students are also required to seek advance permission from instructors if they wish to submit the same work in more than one course. Failure to receive this permission in advance may violate the Academic Integrity Policy. Under the policy, instructors who seek to penalize a student for a suspected violation must first report the violation to the Center for Learning and Student Success (CLASS). Students may not drop or withdraw from courses in which they face a suspected violation. Instructors must wait to assign a final course grade until a suspected violation is reviewed and upheld or overturned. Upholding Academic Integrity includes abiding by instructors' individual course expectations, which may include the protection of their intellectual property. Students should not upload, distribute, or otherwise share instructors' course materials without permission. Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered, as outlined in the Violation and Sanction Classification Rubric. Students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

The Violation and Sanction Classification Rubric establishes recommended guidelines for the determination of grade penalties by faculty and instructors, while also giving them discretion to select the grade penalty they believe most suitable, including course failure, regardless of violation level. Any established violation in this course may result in course failure regardless of violation level.

Original class materials (handouts, assignments, tests, etc.) and recordings of class sessions are the intellectual property of the course instructor. It is important that everyone feel free to participate in class and not worry about recordings being distributed further. Thus, while you may download these materials for your use in this class, you may not provide these materials to other parties (e.g., web sites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

Important Resources: Mental health and overall well-being are significant predictors of academic success. As such it is essential that during your college experience you develop the skills and resources effectively to navigate stress, anxiety, depression, and other mental health concerns. Please familiarize yourself with the range of resources the Barnes Center provides (https://ese.syr.edu/bewell/) and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000, and I encourage you to explore the resources available through the Wellness Leadership Institute, https://ese.syr.edu/bewell/wellness-leadership-institute/.

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to contact me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process. If you would like to discuss disability-accommodations or register with CDR, please visit Center for Disability Resources. Please call (315) 443-4498 or email disabilityresources@syr.edu for more detailed information.

The CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin this process.

Religious holidays: Syracuse University's Religious Observances Policy recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Under the policy, students are given an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors no later than the academic drop deadline. For observances occurring before the drop deadline, notification is required at least two academic days in advance. Students may enter their observances in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification.

Course Outline

I. Introduction
 Wooldridge, chapter 1-2, Appendices C.1-C.3 & D
 MHE, chapters 1-2

II. The Multiple Regression Model
 Wooldridge, chapter 3 & Appendices C.4 & E
 MHE, chapter 3.1-3.2 & 3.4.3 (optional)

III. Inference & Large Sample Theory
 Wooldridge, Chapters 4 & 5
 McCloskey, Deirdre N. and Stephen T. Ziliak (1996), "The Standard Error of
  Regressions," *Journal of Economic Literature*, 34(1), 97-114.
 Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer
  (2010), "Disclosure by Politicians," *American Economic Journal: Applied
  Economics*, 2(2), 179-209.

IV. Model Specification
 Functional Form
 Wooldridge, Chapter 6
 Mehdi, Qasim and Tina Nabatchi (2023), "Saving the Salmon: Examining the Cost-
  Effectiveness of Collaboration in Oregon," *Journal of Public Administration
  Research and Theory*, 33(3), 498-511.

 Dummy Variables & Regression Discontinuity
 Wooldridge, Chapter 7
 MHE, chapter 6.1
 Howell, Sabrina T. (2017), "Financing Innovation: Evidence from R&D Grants," *American
  Economic Review*, 107(4), 1136-1164.

V. Limited Dependent Variable Models: Probit and Logit
 Wooldridge, Chapter 17.1
 Houston, David J. (2005), "'Walking the Walk' of Public Service Motivation: Public
  Employees and Charitable Gifts of Time, Blood, and Money," *Journal of Public
  Administration Research and Theory*, 16(1), 67-86.

VI. Relaxing the Assumptions of OLS: Heteroskedasticity
>   Wooldridge, Chapter 8
>   MHE, chapter 8 (optional – this chapter is very technical)
>   Moulton, Brent R. (1990), "An Illustration of a Pitfall in Estimating the Effects of
>   Aggregate Variables on Micro Units," *Review of Economics and Statistics*, 72(2),
>   334-338.

VII. Relaxing the Assumptions of OLS: Autocorrelation
>   Wooldridge, Chapters 10 & 12

VIII. Specification & Data Issues
>   Wooldridge, Chapter 9.1, 9.2, & 9.4

IX. Panel Data
>   Wooldridge, Chapter 13 & 14.1, 14.2, 14.4 & 14.5
>   MHE, Chapter 5.1-5.2
>   Shybalkina, Iuliia and Robert Bifulco (2019), "Does Participatory Budgeting Change the
>   Share of Public Funding to Low Income Neighborhoods?" *Public Budgeting and
>   Finance*, 39(1), 45-66.
>   Frakes, Michael D. and Melissa F. Wasserman (2017), "Is the Time Allocated to Review
>   Patent Applications Inducing Examiners to Grant Invalid Patents? Evidence from
>   Microlevel Application Data," *Review of Economics and Statistics*, 99(3), 550-
>   563.

X. Instrumental Variables
>   Wooldridge, Chapter 15
>   MHE, chapter 4.1-4.4 (optional)
>   Aichele, Rahel and Gabriel Felbermayr (2012), "Kyoto and the carbon footprint of
>   nations," *Journal of Environmental Economics and Management*, 63, 336-354.
>   Bound, John, David A. Jaeger, and Regina M. Baker (1995), "Problems With
>   Instrumental Variables Estimation When the Correlation Between the Instruments
>   and the Endogenous Explanatory Variable Is Weak," *Journal of the American
>   Statistical Association*, 90(430), 443-450.
>   Murray, Michael P. (2006), "Avoiding Invalid Instruments and Coping with Weak
>   Instruments," *Journal of Economic Perspectives*, 20(4), 111-132
>   Baum, Christopher F., Mark E. Schafer, and Steven Stillman (2003), "Instrumental
>   Variables and GMM: Estimation and Testing," Boston College Department of
>   Economics Working Paper No. 545. (optional)
>   Levitt, Steven D. (1997), "Using Electoral Cycles in Police Hiring to Estimate the Effect of
>   Policy on Crime," *American Economic Review*, 87(3), 270-290. (optional)