UNIVERSITY OF GEORGIA

SYLLABUS

POLS 8501
Section 24636
Fall 202?

Advanced Quantitative Methods 1
I want to estimate a regression, but…
Baldwin ???

Course Description and Prerequisites

Maximum likelihood estimation and advanced regression applications. Topics include models with qualitative or limited dependent variables (binary, ordered, and unordered logit and probit; event count models), regression with time series cross-sectional data, models with missing data and measurement models.
Prerequisites: POLS 7050, 7014

Learning Outcomes or Course Objectives

Students will be able to:
Estimate regression models for qualitative and limited dependent variables using maximum likelihood
Understand the assumptions necessary to interpret regression coefficients causally
Communicate the results of regression models using tables, figures, and text
Pursue more advanced techniques like machine learning and semiparametric models

Instructor Information

Dr. Garrett N. Vande Kamp
garrettvandekamp@uga.edu
Baldwin 409
Office Hours: ???

Textbook and/or Resource Material

Textbooks: Students must purchase two textbooks: one teaching the statistical methods of the course, and one teaching how to implement them in statistical software. The textbooks that are underlined use Stata and are designed to be approachable. The textbooks in bold use R and are designed for rigorous study. All other textbooks are simply my recommendations for learning more about a particular topic.

Arel-Bundock, Vincent. 2026. *Model to Meaning: How to interpret statistical results using marginaleffects for R and Python*. CRC Chapman & Hall. https://marginaleffects.com/

Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. Cambridge: Cambridge University Press. (the seminal book for any duration model)

Cameron, A. Colin and Pravin K. Trivedi. 2013. *Regression Analysis of Count Data, Second Edition.* Cambridge: Cambridge University Press. (the seminal book for any count model)

Fox, John. 2016. Applied Regression Analysis and Generalized Linear Models, 3rd edition. Thousand Oaks, CA: Sage Publications.

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables.* Thousand Oaks, CA: SAGE Publishing.

Long, J. Scott and Jeremy Freese. 2014. *Regression Models for Categorical Dependent Variables Using Stata, Third Edition*. College Station, TX: Stata Press.

Ward, Michael D., and John S. Ahlquist. 2018. *Maximum Likelihood for Social Science.* Analytical Methods for Social Research. Cambridge: Cambridge University Press.

Software: All in-class examples will be given in R, RStudio, and the tidyverse. Office hours will offer support for Stata. No other software will be supported in this class.

In addition, journal articles will be required reading during the semester. They can be accessed through the university's resources available freely to students.

Class Format and Attendance Policy

The class will be taught in an in-person format, with exceptions occasionally made if the professor is travelling. Attendance is mandatory and will be taken in class for the instructor's records. Repeated absences will be reported to the graduate student coordinator overseeing the student.

Make-up opportunities will only be provided for students with unforeseen, unavoidable absences. Foreseen and avoidable absences can schedule earlier testing, if necessary. Unforeseen and unavoidable absences will require documentation for verification.

In the absence of written authorization from Accessibility and Testing at UGA, students may not make a video or audio recording of any aspect of this course. In the event an authorization, the student and faculty must come to a written agreement that ensures recordings will only be used for personal academic use, not to violate the privacy of those in attendance, nor to monetize off the content of the lectures. Violation of these terms may subject them to discipline under the Student Code of Conduct or subject them to liability under copyright laws.

Grading Policies and Grading Scale

Homework	40%	A = 90-100
Final Exam	30%	B = 80-89
Research Paper	30%	C = 70-79
		D = 60-69
		F < 60

Homework: Students will assigned homework to learn to implement the techniques discussed in class. The professor will review the homework assignment each week. Students will grade their homework during this time and, after class, submit a memo to the professor indicating how they did on each problem and whether they understood the professor's explanation of a problem. These memos are graded for completion.

Replication Paper: Students will write a research paper replicating a published study using the quantitative methods learned in this class. The replication should use some, but not necessarily all, of the original study's data. The topic area of the paper should be related to the student's research agenda. The paper may be one written for another class, given that the student has permission from other instructor(s) the student is currently taking classes with. This paper cannot be coauthored with another student in the class. Ideally, students should produce a paper that can either be used in their dissertation or be submitted to a peer-reviewed journal.

Final Exam: Students will have an in-person, open-book final exam administered through eLC and the Lockdown Browser.

Academic Integrity

UGA Student Honor Code: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others."

In this course, academic dishonesty could include plagiarism and unauthorized assistance. A Culture of Honesty, the University's policy and procedures for handling cases of suspected dishonesty, can be found at www.uga.edu/ovpi .

UGA Well Being Resources

UGA Well-being Resources promote student success by cultivating a culture that supports a more active, healthy, and engaged student community.

Anyone needing assistance is encouraged to contact Student Care & Outreach (SCO) in the Division of Student Affairs at 706-542-8479 or visit sco.uga.edu. Student Care & Outreach helps students navigate difficult circumstances by connecting them with the most appropriate resources or services. They also administer the Embark@UGA program which supports students experiencing, or who have experienced, homelessness, foster care, or housing insecurity.

UGA provides both clinical and non-clinical options to support student well-being and mental health, any time, any place. Whether on campus, or studying from home or abroad, UGA Well-being Resources are here to help.

- *Well-being Resources: well-being.uga.edu*
- *Student Care and Outreach: sco.uga.edu*
- *University Health Center: healthcenter.uga.edu*
- *Counseling and Psychiatric Services: caps.uga.edu or CAPS 24/7 crisis support at 706-542-2273*
- *Health Promotion/ Fontaine Center: healthpromotion.uga.edu*
- *Accessibility and Testing: accessibility.uga.edu*

- *Additional information, including free digital well-being resources, can be accessed through the UGA app or by visiting https://well-being.uga.edu.*

Syllabus as a Contract

This syllabus is a contract between the professor and the individual student. Every student in this class receives an identical syllabus; therefore, every student in this class will be taught and evaluated in the same manner. This syllabus is unique to this class; therefore, the students in this class may not be taught and evaluated as students in other sections of this class, past or present, even if taught by the same professor.

A Word of Thanks

I appreciate the help of my peers who contributed to the creation of this syllabus: Clayton Webb, Joseph Ornstein, Mollie Cohen, Michael Lynch.

That being said, this syllabus and the course materials referenced in it is the intellectual property of the instructor and subject to copyright law. Do not reproduce any course materials without explicit written permission.

Expected Course Calendar

The syllabus is a general plan for the course; deviations announced to the class by the instructor may be required.

I want to estimate a regression model, but…

Non-Linear Models Using Ordinary Least Squares

Week 1: I do not know how to use it for causal inference.

Long, Chapters 1 and 2
Fox, Chapter 26 (Available Online)
Long and Freese, Chapter 4.1 and 4.2
Arel-Bundock, Chapters 2 and 3

Methods Articles:

Keller, Bryan, and Zach Branson. 2024. "Defining, identifying, and estimating causal effects with the potential outcomes framework: a review for education research." *Asia Pacific Education Review* 25(3): 575-594.

Wasserstein, Ronald L. & Nicole A. Lazar. 2016. "The ASA's Statement on p-Values: Context, Process, and Purpose." *The American Statistician* 70(2): 129-133.

Hoekstra, Rink, Richard D. Morey, Jeffrey N. Rouder and Eric-Jan Wagenmakers. 2014. "Robust misinterpretation of confidence intervals." *Psychonomic bulletin & review* 21(5): 1157-1164.

Advanced Reading:

Cinelli, Carlos, Andrew Forney, and Judea Pearl. 2024. "A crash course in good and bad controls." *Sociological Methods & Research* 53(3): 1071-1104.

Acharya, Avidit, Matthew Blackwell, and Maya Sen. 2016. "Explaining causal findings without bias: Detecting and assessing direct effects." *American Political Science Review* 110(3): 512-529.

Imbens, Guido W. 2024. "Causal inference in the social sciences." *Annual Review of Statistics and Its Application* 11:123-152.

Week 2: I have a dependent variable that is strictly positive.

Long, Chapter 2.4
Fox, Chapter 17.3
Long and Freese, Chapter 4.7
Arel-Bundock, Chapter 4

Methods Articles:

Manning, Willard G. 1998. "The logged dependent variable, heteroscedasticity, and the retransformation problem." *Journal of health economics* 17(3): 283-295.

Advanced Reading:

Chen, Jiafeng, and Jonathan Roth. 2024. "Logs with zeros? Some problems and solutions." *The Quarterly Journal of Economics* 139(2): 891-936.

Shang, Shengwu, Erik Nesson, and Maoyong Fan. 2018. "Interaction terms in Poisson and log linear regression models." *Bulletin of Economic Research* 70(1): E89-E96.

Substantive Article:

Bandyopadhyay, Subhayu, Todd Sandler, and Javed Younas. 2018. "Trade and terrorism: A disaggregated approach." *Journal of Peace Research* 55(5): 656-670.

Week 3: I have a dependent variable that is a proportion.

Long and Freese, Chapter 4.3-4.4
Arel-Bundock, Chapter 5

Methods Articles:

***Tomz, Michael, Joshua A. Tucker, and Jason Wittenberg. "An easy and accurate regression model for multiparty electoral data." *Political Analysis* 10.1 (2002): 66-83.

Advanced Readings:

Ferrari, Silvia, and Francisco Cribari-Neto. 2004. "Beta regression for modelling rates and proportions." *Journal of applied statistics* 31(7): 799-815.

Britt, Chester L., Michael Rocque, and Gregory M. Zimmerman. 2018. "The analysis of bounded count data in criminology." *Journal of Quantitative Criminology* 34(2): 591-607.

Substantive Article:
Moreira, Thiago MQ. 2025. "Is It Still the Economy? Economic Voting in Polarized Politics." *British Journal of Political Science* 55(e45): 1-24.

Week 4: I do not know what estimator to use.
Long, Chapters 2.6 and 4 — Long and Freese, Chapter 3
Ward and Ahlquist, Chapters 1, 2 — Arel-Bundock, Chapters 6 and 7
Fox, Chapter 15.1

Methods Articles:
Neuhaus, J. and McCulloch, C., 2011. "Generalized linear models." *Wiley Interdisciplinary Reviews*: Computational Statistics 3(5): 407-413.

Week 5: Midterm

Discrete Dependent Variables

Week 6: I have a dependent variable that is a duration.
Long, Chapter 7 — Arel-Bundock, Chapter 32

Methods Articles:
***Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event history modeling: A guide for social scientists*. Cambridge University Press. Chapters 2 and 3 (Provided on eLC).

Advanced Readings:
Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. Cambridge: Cambridge University Press. Everything else.

Substantive Article:
Regan, Patrick M. 2002. "Third-party interventions and the duration of intrastate conflicts." *Journal of Conflict Resolution* 46(1): 55-73.

Week 7: I have a dependent variable that is binary, Part 1
Long, Chapter 3 — Long and Freese, Chapters 5 and 6
Ward and Ahlquist, Chapter 3 — Arel-Bundock, Chapter 27

Methods Articles:
Herron, Michael C. 1999. "Postestimation uncertainty in limited dependent variable models." *Political Analysis* 8(1): 83-98.

Advanced Articles:
Greenhill, Brian, Michael D. Ward, and Audrey Sacks. 2011. "The separation plot: A new visual method for evaluating the fit of binary models." *American Journal of Political Science* 55(4): 991-1002.

Substantive Article:
Uscinski, Joseph and Casey Klofstad. 2013. "Determinants of Representatives' Votes on the Flake Amendment to End National Science Foundation Funding of Political Science Research" *PS: Political Science and Politics* 46 (3): 557-561.

Week 8: I have a dependent variable that is binary, Part 2
Long, Chapter 3 — Long and Freese, Chapters 5 and 6
Ward and Ahlquist, Chapter 3 — Arel-Bundock, Chapter 27

Methods Articles:

***Hanmer, Michael J., and Kerem Ozan Kalkan. 2013. "Behind the curve: Clarifying the best approach to calculating predicted probabilities and marginal effects from limited dependent variable models." *American Journal of Political Science* 57(1): 263-277.

Advanced Articles:
Nagler, Jonathan. 1994. "Scobit: An alternative estimator to logit and probit." *American Journal of Political Science* (1994): 38(1): 230-255.

Substantive Article:
Uscinski, Joseph and Casey Klofstad. 2013. "Determinants of Representatives' Votes on the Flake Amendment to End National Science Foundation Funding of Political Science Research" *PS: Political Science and Politics* 46 (3): 557-561.

Week 9: I have a dependent variable that is a count.
Long, Chapter 8 Long and Freese, Chapter 9
Ward and Ahlquist, Chapter 10

Methods Articles:
King, Gary. 1988. "Statistical models for political science event counts: Bias in conventional procedures and evidence for the exponential Poisson regression model." *American Journal of Political Science* 32(3): 838-863.
Bagozzi, Benjamin E. 2015. "Forecasting civil conflict with zero-inflated count models." *Civil Wars* 17(1): 1-24.

Advanced Readings:
Cameron, A. Colin and Pravin K. Trivedi. 2013. *Regression Analysis of Count Data, Second Edition.* Cambridge: Cambridge University Press.

Substantive Article:
Williamson, Vanessa, Kris-Stella Trump, and Katherine Levine Einstein. 2018. "Black lives matter: Evidence that police-caused deaths predict protest activity." *Perspectives on Politics* 16(2): 400-415.

Week 10: I have a dependent variable that is ordinal.
Long, Chapter 5 Long and Freese, Chapter 7
Ward and Ahlquist, Chapter 8 Arel-Bundock, Chapter 11

Methods Articles:
***Jacoby, William G. 1999. "Levels of measurement and political research: An optimistic view." *American Journal of Political Science* 43(1): 271-301.

Substantive Article:
Egan, Patrick J., and Megan Mullin. 2012. "Turning personal experience into political attitudes: The effect of local weather on Americans' perceptions about global warming." *The Journal of Politics* 74(3): 796-809.

Week 11: I have a dependent variable that is nominal.
Long, Chapter 6 Long and Freese, Chapter 8
Ward and Ahlquist, Chapter 9. Arel-Bundock, Chapter 29

Methods Articles:
Di Francesco, Riccardo, and Giovanni Mellace. "Causal Inference for Qualitative Outcomes." *arXiv preprint arXiv:2502.11691* (2025).

Substantive Article:
Hood III, M. V., and Seth C. McKee. 2023. "How Much Is a Trump Endorsement Worth?." *State Politics & Policy Quarterly* 23(4): 380-395.

Week 12: Final
Your final exam will be early in the semester and will only cover core course topics.

Advanced Topics
(Covered as Desired if Time Permits)

Week ??: I don't know how to communicate the results in a paper.
Methods Articles:
***Zigerell, L. J. 2013. "Rookie mistakes: Preemptive comments on graduate student empirical research manuscripts." *PS: Political Science & Politics* 46(1): 142-146.
Keele, Luke, Randolph T. Stevenson, and Felix Elwert. 2020. "The causal interpretation of estimated associations in regression models." *Political Science Research and Methods* 8(1): 1-13.
Grosz, Michael P., Julia M. Rohrer, and Felix Thoemmes. 2020. "The taboo against explicit causal inference in nonexperimental psychology." *Perspectives on Psychological Science* 15(5): 1243-1255.
Zigerell, L. J. 2011. "Of publishable quality: Ideas for political science seminar papers." *PS: Political Science & Politics* 44(3): 629-633.

Substantive Articles:
***Vande Kamp, Garrett N. 2021. "The Conditioning Role of Judicial Independence in the Exercise of Judicial Review." *Journal of Law and Courts* 9(2): 261-282.
***Vande Kamp, Garrett N. 2019. "The Conditioning Role of Judicial Independence in the Exercise of Judicial Review." Chapter 2 in *Essays on Judicial Review,* 6-45. College Station, Texas: Texas A&M University Press.

Week ??: I have data that are heteroskedastic

Methods Articles:
***Braumoeller, Bear. 2006. "Explaining Variance; Or, Stuck in a Moment We Can't Get Out Of." *Political Analysis* 14(3): 268-290.
*** Santos Silva, Joao MC, and Silvana Tenreyro. 2006. "The log of gravity." *The Review of Economics and statistics* 88(4): 641-658.
Papke, Leslie E., and Jeffrey M. Wooldridge. 1996. "Econometric methods for fractional response variables with an application to 401 (k) plan participation rates." *Journal of applied econometrics* 11(6): 619-632.

Advanced Readings:
Zhang, Dabao. 2017. A coefficient of determination for generalized linear models. *The American Statistician* 71(4): 310-316.
Santos Silva, Joao MC, and Silvana Tenreyro. 2022. "The log of gravity at 15." *Portuguese Economic Journal* 21(3): 423-437.
Santos Silva, Joao MC, and Rainer Winkelmann. 2024. "Misspecified exponential regressions: Estimation, interpretation, and average marginal effects." *Review of Economics and Statistics*: 1-25.
Ginker, Tim, and Offer Lieberman. 2017. "Robustness of binary choice models to conditional heteroscedasticity." *Economics Letters* 150: 130-134.
Chang, Yoosoon, Joon Y. Park, and Guo Yan. 2025. "Slope Consistency of Quasi-Maximum Likelihood Estimator for Binary Choice Models." *arXiv preprint arXiv:2505.02327*

Substantive Articles:
***Kriner, Douglas, and Liam Schwartz. 2009. "Partisan dynamics and the volatility of presidential approval." *British Journal of Political Science* 39(3): 609-631.
Alvarez, R. Michael, and John Brehm. 1995. "American ambivalence towards abortion policy: Development of a heteroskedastic probit model of competing values." *American Journal of Political Science* 39(4): 1055-1082.

Week ??: I have TSCS data.

Fox, Chapter 23

Methods Articles:
Clark, Tom S., and Linzer, Drew A., 2015. “Should I use fixed or random effects?” *Political Science Research and Methods* 3(2):399-408.
***Bell, Andrew, and Jones, Kelvyn. 2015. “Explaining fixed effects: Random effects modeling of time-series cross sectional and panel data.” *Political Science Research and Methods* 3(1):133-153.

Week ??: I have a small dataset.
Ward and Ahlquist, Chapter 4.5

Methods Articles:
*** Belloni, Alexandre, Victor Chernozhukov, and Christian Hansen. 2014. "High-dimensional methods and inference on structural and treatment effects." *Journal of Economic Perspectives* 28(2014): 29-50.
***Zorn, Christopher. 2005. “A solution to separation in binary response models.” *Political Analysis* 13: 157–170.
McCaskey, Kelly and Carlisle Rainey. 2021 “Estimating Logit Models with Small Samples.” *Political Science Research and Methods* 9(3): 549-564.
Puhr, Rainer, Georg Heinze, Mariana Nold, Lara Lusa, and Angelika Geroldinger. 2017. "Firth's logistic regression with rare events: accurate effect estimates and predictions?." *Statistics in medicine* 36(14): 2302-2317.

Advanced Articles:
Athey, Susan, and Guido W. Imbens. 2019. "Machine learning methods that economists should know about." *Annual Review of Economics* 11(1): 685-725. (Sections 1,2,3, and 6)

Week ??: I have a conditional relationship that predicts my dependent variable.

Methods Articles:
***Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding interaction models: Improving empirical analyses." *Political analysis* 14(1): 63-82.
***Keele, Luke, and Randolph T. Stevenson. 2021. "Causal interaction and effect modification: same model, different concepts." *Political Science Research and Methods* 9(3): 641-649.
Berry, William D., Jacqueline HR DeMeritt, and Justin Esarey. 2010. "Testing for interaction in binary logit and probit models: is a product term essential?." *American Journal of Political Science* 54(1): 248-266.
Rainey, Carlisle. 2016. "Compression and conditional effects: A product term is essential when using logistic regression to test for interaction." *Political Science Research and Methods* 4(3): 621-639.

Advanced Readings
Blackwell, Matthew, and Michael P. Olson. 2022. "Reducing model misspecification and bias in the estimation of interactions." *Political Analysis* 30(4): 495-514.
Aronow, Peter M., and Cyrus Samii. 2016. "Does regression produce representative estimates of causal effects?." *American Journal of Political Science* 60(1): 250-267.
Chattopadhyay, Ambarish, and José R. Zubizarreta. 2023. "On the implied weights of linear regression for causal inference." *Biometrika* 110(3): 615-629.