Agricultural and Applied Economics 637
Applied Econometric Analysis II
Spring 2017

Web page: ***www.aae.wisc.edu/aae637/***
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Class: TUTH, 9:30 am.-10:45 am. B30 Taylor Hall
Lab: W, 2:00 pm-3:00 pm, B30 Taylor Hall
Office Hours: No set hours, my door is always open. If I am busy I will let you know.

Teaching Assistant: Eduardo Cenci, 221 Taylor Hall
Email: ***ecenci@wisc.edu***
Office Hours: Mon 3:00-4:30/Thur 11:00 – 12:00

Course Objective:

The course focuses on the development and use of more advanced econometrics techniques that follow naturally from the classical regression model usually presented in an initial regression focused class. The estimators we use are more complicated than the linear least squares based estimator (i.e., the class regression model). The parameter estimation algorithms used in this class require an iterative process to generate parameter estimates. We emphasize empirical applications, illustrating the practical methods and challenges associated with analyzing finite samples of economic data. The course should be of interest to students of economics, business, public health, political science, engineering and other disciplines in need of a more in-depth understanding of applied regression methods.

To enable you to better understand econometrics, I want to get you inside the econometrics "black box". I find the easiest way to do this is to have you actually program your own estimators, regression-related statistics and undertaking hypothesis test instead of using a canned package such as STATA, SAS, etc. To do this we will use the ***MATLAB*** software system. What is learned using this software such as data management, parameter estimation and post-estimation analyses will be easily transferable to other software packages such as R, OX, GAUSS, Mathematica, etc. All assignments for this class are to be completed using ***MATLAB***.

By developing your own software, you will be able to understand how the various statistics displayed in the output of canned econometric/statistical packages you may use in the future are actually calculated. I have recently adopted ***MATLAB*** for this course after having used a similar software system, (i.e., GAUSS) for more than 20 years. This means that I am still in the learning process as to its use for econometric analysis so your understanding would be appreciated for those occasions where I am uncertain as to ***MATLAB*** syntax. Hopefully, with Mr. Cenci, myself and the internet, we will able to quickly resolve your questions. As registered graduate students at the UW you access to a free version of ***MATLAB***. A great deal. I suggest you take

advantage of this. Click here to access the free software library that is available to you as a UW student.

Recommended Texts:

I do not have any required texts for this course but I rely heavily on Cameron and Travedi's Microeconometrics: Methods and Applications, Greene's ***Econometric Analysis*** and Judge, et al.'s ***Introduction to the Theory and Practice of Econometrics***. This latter text is out of print so I have available zip files that contain PDF's of most of the chapters with links to these files contained in this syllabus. Below are some additional resources you may want to access over the course of the semester.

I have recently discovered a text that may be of help in your use of ***MATLAB*** especially if you are familiar with the ***R*** software system. I can say that I wish I had this text when I used ***R*** for a one year experiment I undertook with this class a number of years ago (as requested by the class TA). Take a look at the Hiebleler (2015) text noted below. He also made available a reference document in PDF form which is available for download.

Cameron, A. And P. Trivedi, ***Microeconometrics***, Cambridge University Press, 2006, London, Textbook website.

Elliason, S., ***Maximum Likelihood Estimation: Logic and Practice***, Sage Series in Quantitative Applications in the Social Sciences, #96, London

Hiebeler, David E., ***R and MATLAB***, Chapman and Hall/CRC Press, 2015.

Hiebeler, David E., ***MATLAB/R Reference***, University of Maine, unpublished PDF, 2014.

Judge, G.G., R.C. Hill, W.E. Griffths, H. Lutkepohl,and T.C. Lee (JHGLL), ***Introduction to the Theory and Practice of Econometrics***, 2nd ed., John Wiley and Sons, New York, 1988. This book is out of print and I have made copies of relevant chapters. I would *strongly recommend* that you consider obtaining a used version for your library. Although very dry, it has a very good summary and presentation of basic econometric methods.

Greene, W., ***Econometric Analysis***, 7th Ed., Prentice-Hall, 2012, Textbook website, Errata website

Train, K.E., ***Discrete Choice Methods with Simulation***, (click on title to download from our website) Cambridge University Press, 2003. This text will be very useful for those undertaking analyses where the dependent variable is discrete. e.g., 0,1. Prof. Train makes available an online course on discrete choice analysis [with simulation] based on this text. This course is available at: http://elsa.berkeley.edu/users/train/distant.html .

Supplementary Resources:

Gweke, J.F., J.L. Horowitz and M. Pesaran, 2006. ***Econometrics: A Birds Eye View***, IZA Discussion Paper No. 2458, November, Bonn. This is an unpublished paper that basically gives a history of econometrics. It covers much more material than we will cover. It shows where the various dimensions of econometrics intersect.

Train, K.E., ***Qualitative Choice Analysis: Theory, Econometrics and an Application to Automobile Demand*****,** 1993. This is a good text that describes the use of discrete (binary) choice analysis as it is applied to the analysis of consumer demand and welfare evaluation.

One thing I have noticed about ***MATLAB*** is the high level of user support provided not only by the software developer but also by users. We have put together a preliminary set of materials (both PDF and web-based). These are contained in the ***MATLAB Code and Support Material*** section of the class website. In spite of a majority of this supplemental material referring to an earlier software version, these documents are still applicable to the most current version (except for the significant change in the GUI front-end). Over the course of the semester if you find a particular resource not contained in this list useful, feel free to bring it to my attention so that I can add this material to the class website. Be aware that many of the PDF-based documents are **many hundreds of pages** long so making hard copies should be done judiciously.

The ***MATLAB*** system is contained within the AAE REMOTE servers. For those of you who are AAE students you have access to these servers. Also, many computer labs across campus have ***MATLAB*** as part of their standard software offerings. As noted above you can obtain a ***MATLAB*** version for use on your own computer(s) from the ***Campus Software Library*** at no charge. Note I have not tried to load ***MATLAB*** on Microsoft's Surface Pro hardware. If someone gives it a try I would appreciate letting me know the outcome.

Course Evaluation

40% Assignments
15% Journal Article Review(s)/Class Room Participation
45% Term Paper

How to Survive the Course

For those of you who are new to programming this course may appear very challenging at the start. In reality, everything you do throughout the semester builds upon previously developed material. That is, a considerable amount of code you developed can be recycled to undertake common tasks such as reading in data sets, manipulating your data, generating printed output, etc. Recognizing this, the amount of ***original*** programming done weekly is limited.

To be successful in this course I encourage you to interact with a few of your peers to exchange ideas, concepts and to validate the accuracy of the software you develop to complete course assignments. That said, in completing course assignments I expect that everyone will develop and hand in their ***own original code***. Plagiarism is a serious offense and using someone else's code without their knowledge is unacceptable and will not be tolerated. Feel free to use your peers, myself and Mr. Cenci as sounding boards with respect

code development. As a security measure, don't save any of your work on publically available network drives. Again, hand in your ***own work***!!

A Few Standard Operating Procedures (SOPs)

Sometimes developing code can be challenge. Grabbing material/help of the net is often very useful. When developing your code for this class I suggest that you adopt the following SOPs:

i. Get into the habit of writing clean code
   a. Provide lots of comments explaining what you are doing in a particular section of the code
   b. Use a consistent and logical indenting system
   c. Use descriptive file names
   d. Use descriptive created variable names
   e. When developing some code that will be useful in other applications, develop functions that undertake the activities associates with that code instead of putting that code directly into the software you are creating.

ii. Do not develop code from the ground up when undertaking an assignment or other class related activity. Recycle code that you have previously written. Create an archive of use bits of code (e.g., the few lines of code where you can read a raw dataset via the use of a variable name instead of the variable's physical location in the dataset.

iii. Program your code so that it is applicable to any size problem. That is, do not put hard dimensions to matrices and vectors. Let the software determine the appropriate object size.

iv. If you are undertaking a particular activity that concerns a very large piece of data or is relatively complicated
   a. For large datasets develop prototype software that uses a few observations that have the same structure as the full dataset. That way, whatever you create as a result of running that code will be relatively small and you can see the entire matrix, vector, etc. Extending to the full dataset should just be a matter a changing of the dimension of data used, number iterations, etc.
   b. For complicated code, create a new command window where you can develop code outside the code of concern but mimics the full code but you get rid of any non-essential but complicating factors and you have reduced the size of the task.

v. Use MATLAB's debugging system to help in debugging your code

vi. Know ahead of time the size of matrices, vectors, etc. you are developing. A

vii. Finally, if you trying to develop code and you have a feeling it is taking too long, it probably is.
   a. **Don't** spin your wheels for hours at a time;
   b. Contact myself, Eduardo, or your fellow classmates so as to use another set of eyes when examining your software; and
   c. Finally, try to simplify the task you are trying to undertake.

viii. In terms of getting the most out of lecture, I would recommend that you obtain a hard copy of the PPT file forming the basis of class lectures. Print if off in such a way that you can add comments as I review the material. Do this **in advance of the class**. Since I am constantly changing my PPT's I would just print off about 30 slides per lecture. If possible take a look at these lecture slides.

Course Outline

Review of the Classical Regression Model (*Undertake on your own if needed as this is my assumption as to the level of your current knowledge*).

a. Properties of Parameter Estimates Under the Classical Regression Model
b. Hypothesis Testing Under the Classical Regression Model (CRM)
c. Regression Model with General Error Variance Structure: Heteroscedasticity and Autocorrelation

Readings: Cameron and Trivedi, Ch 4: 65-112
Greene, Ch. 2: 11-25, Ch. 3: 26-51, Ch. 4: 51-87, Ch. 5: 108-137, Ch. 9: 257-289, Ch. 20: 903-920,922-929, 644-652
JHGLL, Ch. 3: 58-111, Ch. 5: 157-211, Ch. 6: 221-273, Ch. 8: 327-347 Ch. 9: 351-409

I. Nonlinear Regression Models

a. Nonlinear Least Squares (NLS)
b. NLS Estimation of the General Variance Model
c. Hypothesis Testing and Parametric Restrictions

Readings: Cameron and Trivedi, Ch 5: 116-124, 150 - 159
Greene, Ch. 7: 181-201
JHGLL, Ch. 12: 497-530,532-535
Wilson, B.: 1-22
Amemiya, T., 1983. *Non-linear Regression Models*, Ch. 6, Handbook of Econometrics, Vol. 1, Elsevier Pub. Co.
Gallant, A.R., 1975. *Nonlinear Regression*, The American Statistician, 29(2):73-81
McCullough, B. and H. Vinod, 1999. *The Numerical Reliability of Econometric Software*, Journal of Economic Literature, 37(2):633-665.
Mizon, G.E., 1977. *Inferential Procedures in Nonlinear Models: An Application to UK Industrial Cross Section Study of Factor Substitution and Returns to Scale*, Econometrica, 45(5):1221-1242.
Motulsky, H. and L. Ransnas, 1987. *Fitting Curves to Data Using Nonlinear Regression: A Practical and Non-Mathematical Review*, FASEB Journal, 1:365-374.
Wilson, Bruce, 2014. Nonlinear Regression Analysis, Lecture Notes, Biosystems and Agricultural Engineering, University of Minnesota.

II. An Introduction to Maximum Likelihood Methods

a. Overview of Maximum Likelihood Techniques
b. Maximum Likelihood Estimation and Hypothesis Testing
c. Application of Maximum Likelihood Techniques Applied to the Classical Regression
d. Application of Maximum Likelihood Techniques to the General Variance and Nonlinear Regression Models

Readings: Cameron and Trivedi: Ch. 5: 139-146
Greene, Ch. 12: 432-439, 447-454; Ch. 14:509-534

Eliason, pp.1-45
JHGLL, Ch. 3: 62-66; Ch 6: 221-230; Ch. 12: 524-534,529-530,536-541
Buse, A., 1982. *The Likelihood Ratio, Wald and Lagrange Multiplier Tests: An Expository Note*, The American Statistician, 36(3):153-157.
Myung, I.J., 2003. *Tutorial on Maximum Likelihood Estimation, Journal of Mathematical Psychology*, 47:90-100.
Ward, M.D., 2007. *Maximum Likelihood for Social Sciences: Strategies for Analysis*, working paper, University of Washington.

III. Models of Discrete Choice (DC)

a. Models for Binary Choice
b. Estimation/Inference in Binary Choice Models
c. Discrete Choice Modeling With More Than Two Choices
d. Ordered Probability Models

Readings: Cameron and Trivedi, Ch. 14: 463-479, 486-487
Ch. 15: 490-507, 512-527
Greene, Ch 17: 681-706, 711-715, 738-744, 752-755
Ch. 18: 760-768, 770-781, 784-792
Eliason, p. 51-62
JHGLL, Ch 19: 785-795
Train(2003), Ch. 1: 1-11, Ch. 2: 15-37, Ch. 3: 38-79, Ch. 4: 80-97, Ch. 5: 101-118, Ch. 8: 189-205
Ai, C. and E. Norton, 2003. *Interaction Terms in Logit and Probit Models*, Economics Letters, 80:123-129.
Burnett, N.J., 1997. *Gender Economics Courses in Liberal Arts Colleges*, Journal of Economic Education, 28(4):369-376.
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Christofides, L., T. Stengos, and R. Swidinsky, 1997. *On the Calculation of Marginal Effects in the Bivariate Probit Model*, Economics Letters, 54(3):203-208, 1997.
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Daykin, A. and P. Moffatt, 2002. *Analyzing Ordered Responses: A Review of the Ordered Probit Model*, Understanding Statistics, 3:157-166.
Greene, W., 1996. *Marginal Effects in the Bivariate Probit Model*, Working Paper No. 97-02, Department of Economics, Stern School of Business, New York University
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McFadden, D., 1973. *Conditional Logit Analysis of Qualitative Choice Behavior*, in P.Zarembka (ed.), Ch. 4, Frontiers of Econometrics: 105-142, Academic Press, New York.
McFadden, D., 1975. *On the Computation of Willingness to Pay in Random Utility Models*, Department of Economics, University of California-Berkeley.

McFadden, D. 1981. *Econometric Models of Probabilistic Choice*, in *Structural Analysis of Discrete Data with Econometric Applications*, C.F. Manski and D. McFadden (eds), Cambridge MA, MIT, p.198-272.

McKelvey, R. and W. Zavoina, 1975. *A Statistical Model for the Analysis of Ordinal Level Dependent Variables*, Journal of Mathematical Sociology, 40(4):103-120.

Nagubadi, V., K. McNamara, W. Hoover and W. Mills, 1996. *Program Participation Behavior of Nonindustrial Forest Landowners: A Probit Analysis*, Journal of Agricultural and Applied Economics, 28(2):323-336.

Scarpa, R., M. Thiene and K. Train, 2008. *Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps,* American Journal of Agricultural Economics, 90(4):994-1010, November.

Scarpa, R., M. Thiene and K. Train, 2008. *Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps,* American Journal of Agricultural Economics, Appendix, January.

Sonnier, G., A. Ainslie and T. Otter, 2007. *Heterogeneity Distributions of Willingness to Pay in Choice Models*, Quantitative Marketing Economics, 5(3):313-331.

Train, K. and M. Weeks, 2005. *Discrete Choice Models in Preference Space and Willingness to Pay Space*, in R. Scarpa and A. Alberini, eds., *Application of Simulation Methods in Environmental and Resource Economics*, Springer Publisher, Dordrecht, Ch. 1: 1-16.

Veal, M., and K. Zimmermann, 1996. *Pseudo-R^2 Measures for Some Common Limited Dependent Variable Models*, Sonderforschungsbereich 386, Paper 18, University of Munich

IV. Limited Dependent Variable (LDV) and Two-Part Models

a. Truncated Regression
b. Censored Regression
c. Sample Selection Model
d. Two-Part Models

Readings: Camaron and Trivedi: Ch. 16: 529-557, 566-569
Greene: Ch. 18: 802-807, 810-815, 821-826
Ch. 19: 833-839, 845-860, 861-883
Eliason, p.62-66

Adesina, A.A. and M.M. Zinnah, 1993. *Technology Characteristics, Farmers' Perceptions and Adoption Decisions: A Tobit Model Application in Sierra Leone*, Agricultural Economics, 9:297-311.

Berk, R.A., 1983. *An Introduction to Sample Selection Bias in Sociological Data*, American Sociological Review, 48(3):386-398.

Blundell, R. and C. Meghir, 1987. *Bivariate Alternatives to the Tobit Model*, Journal of Econometrics,34:179-200.

Brown, C. and R. Moffitt, 1983. *The Effect of Ignoring Heteroscedasticity on Estimates of the Tobit Model*, NBER Technical Paper No. 27, January

Cuddeback, G., E. Wilson, J. Orme, and T. Combs-Orme, 2004., *Detecting and Statistically Correcting Sample Selection Bias*, Journal of Social Service Research, 30(3):19-33

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Greene, W., 1999. *Marginal Effects in the Censored Regression Model*, Economics Letters, 64:43-49.

Greene, W., 1981. *Sample Selection Bias as a Specification Error: Comment*, Econometrica, 49:795-798

Hausman, J.A. and D. A. Wise, 1977. *Social Experimentation, Truncated Distributions and Efficient Estimation*, Econometrica, 45(4):919-938.

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Huang, C.L., R. Rauniker and H. Tyan, 1986. *Heteroscedasticity in Broiler Meat Expenditure Pattern Estimation*, Western Journal of Agricultural Economics, 11(2):195-203.

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Stolzenberg, R.M., and D.A. Relles, 1997. *Tools for Intuition about Sample Selection Bias and Its Correction*, American Sociological Review, 62(3): 494-507.

Wang, Q., C. Halbrendt, J. Kolodinsky and F. Schmidt, 1997. *Willingness to Pay for rBST-Free Milk: A Two-Limit Tobit Model Analysis*, Applied Economics Letters, 4(10):619-621

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