

Course Syllabus

Eco 6352
Applied Econometric Analysis
Spring 2017

Prof. Tom Fomby
TTH 5:00 – 6:20 PM
110 Dedman Life Sciences Building

Purpose of Course: This course is a follow-up to the introductory econometrics course ECO 5350. (Eco 5350 is a prerequisite for this course or you may be allowed to take this class by instructor permission if you have had substantial training in statistics including regression analysis.) The major purpose of this course is to extend the student's econometric toolkit to regression models that have qualitative, limited, count or duration dependent variables. We will also study spatial linear regression models, and, time permitting, Panel Data Methods. Many of the examples used in the course will be taken from the fields of micro-econometrics and marketing research.

The student will learn the essentials of and demonstrate proficiency in

- **The Maximum Likelihood Method including numerical optimization techniques and methods of statistical inference (Wald, Score, and Likelihood Ratio tests)**
- **Quasi (Robust) Maximum Likelihood Estimation and Inference**
- **Logit/Probit models**
- **Unordered and Ordered Multinomial Logit/Probit Models**
- **Truncated and Censored Regression Models**
- **Duration Models**
- **Count Models**
- **Spatial Econometrics**
- **Proficiency in using the STATA computer software package**
- **Time Permitting, Static Panel Data Models including Fixed and Random Effects Models along with the Hausman Specification test**

Textbook for Course: Analysis of Microdata (2nd ed.) by Rainer Winkelmann and Stefan Boes (Springer, 2009). Data sets used in this textbook can be found at www.sts.uzh.ch under the tab labeled "data" both in ASCII and Stata format. For students who, in addition, want to replicate some of the work we do in STATA using R, you might purchase the **Supplementary textbook** Applied Econometrics with R by Christian Kleiber and Achim Zeileis (Springer, 2008). The primary R package used in the Kleiber and Zeileis book is called **AER**. It contains R code and data sets used in their book. Also if you are interested in the application of R to specifically categorical data analysis you might want to consult the book Analysis of Categorical Data with R

by Chris Bilder and Thomas Longhin, CRC Press, 2014. Their website www.chrisbilder.com/categorical contains R programs involving the analysis of the categorical data discussed in their book.

Computer Usage: We will primarily be using the STATA software package in this course. It can be found on SMU's Apps.smu link that provides virtual access to STATA and other software program including SAS and SPSS. To use STATA on the Apps.smu system you will first need to download the **Citrix Receiver**. You can go to the website <http://www.smu.edu/BusinessFinance/OIT/Services/AppsSMU> and then, being a first time user, you will be prompted to download Citrix Receiver to your PC or laptop. Citrix Receiver provides you with "virtual" access to the STATA software in that Citrix makes it appear that you have STATA installed on your own computer when, in fact, it is being accessed from an SMU server on campus. After you install the Citrix Receiver on your computer, you can then logon to the Citrix Receiver by entering your student ID and personal password. Thereafter you can work on your homework assignments, etc.

The R package is what is called "freeware" or "shareware." To download R to your PC or laptop, go to the website <http://CRAN.R-project.org/> and download the "base" R package. For an introduction to the R language see chapters 1 and 2 of the Kleiber/Zeileis book or download introductory discussions of R contained on the above R website.

Evaluation of Student:

The evaluation of the student consists of four parts:

- Quick Quizzes on (20%)
- Homework Exercises (20%)
- Mid-term Exam (30%)
- Final Exam (30%)

Additional Information on QQs and Homework Exercises:

The **Quick Quizzes** (QQs) will consist of occasional short answer and/or multiple-choice quizzes that will be administered in the first five minutes of the class. They are meant to reinforce the concepts presented in the previous lecture. In addition to keeping the students current in the class and providing review material for the mid-term and final exams, the QQs allow me to keep track of student attendance. It has been my experience that the more Quick Quizzes missed by students, the lower their scores on the mid-term and final exams. **The bottom line is that it pays to come to class!** I will be dropping your lowest QQ grade before calculating the QQ average.

The purpose of **homework exercises** is to reinforce the concepts discussed in class. They invariably will be based on computer-oriented empirical problems using XLMINER, SPSS Modeler, and R. In completing the homework exercises students can confer with each other with respect to programming advice and discussion of basic ideas but in the final analysis each student is expected to write up his/her own homework answers and not make copies of others' homework. **Copying someone else's homework to hand in as one's own work is a violation of the SMU Honor Code and will be dealt with according to the rules of the SMU Honor Code.** You should know that the homework assignments are very important in that the basic ideas covered by them invariably show up on the mid-term and final exams. If you know you are

going to be missing a class on the day a homework exercise is due, hand in your homework **in advance** to receive full credit for your work. Any homework that is handed in late will be given a one letter grade reduction for each day of tardiness. I will be dropping the lowest homework exercise score before calculating the exercise average. Additionally, I want all homework handed in in **hardcopy form** – no pdf files sent to my e-mail address or the address of my teaching assistant. If you must send in your finished homework by e-mail, a point deduction (out of 10 points) will be applied to the student’s exercise. **Also, I am expecting the homework to be typed as compared to handwritten. Handwritten homework will be given a one grade point deduction for not being typed.**

The **mid-term exam** will cover the topics in the first half of the course. The **final exam** will cover only the topics covered following the mid-term exam.

Note: After 4 unexcused class absences, I reserve the right to administratively drop students from the class.

My grading scale in this course is as follows:

92-100	A
90-91	A-
88-89	B+
82-87	B
80-81	B-
78-79	C+
72-77	C
70-71	C-
68-69	D+
62-67	D
60-61	D-
0-59	F

Classroom Website: <http://faculty.smu.edu/tfomby/>

Office: Room 301M, Umphrey Lee, 214-768-2559. E-mail address: tfomby@smu.edu.

Office Hours: 3:00-4:30 PM TTH or by appointment.

My Graduate Teaching Assistant: Yiyi Hu. Her E-mail address is: yiyih@smu.edu

If you should need extra tutorials or help outside of my office hours, contact Ms. Hu. She will be happy to go over concepts that you may not fully understand.

Important Dates to Remember:

First Day of Class: Tuesday, January 24

Spring Break: Monday – Sunday, March 13 - 19 (No Classes)

Last Day to Drop a Course: Tuesday, April 11

Last Day of Semester in this Class: Thursday, May 4

Exam Dates:

Midterm Exam – Thursday, March 23. This is the second class following spring break.

Final Exam – Tuesday, May 16, 3:00 – 6:00 in 110 Dedman Life Sciences Building.

General comments on work and class etiquette:

In order to succeed in this class, constant work is essential. Come to class. Read all assigned readings, complete all exercises on time, and prepare for the Quick Quizzes. Don't get behind. If there is something in class discussion or homework assignments that you don't understand, don't hesitate to ask me in class, after class, during office hours, or through e-mail.

Obviously, general rules of etiquette apply: cell phones are to be turned off during class and miscellaneous reading material stowed away.

Some Standard Stuff You Should Know

Excused Absences for University Extracurricular Activities:

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Disability Accommodations:

Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/ALEC/DASS> to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

Religious Observance:

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Honor Code:

All SMU students are bound by the Honor Code (see SMU Student Handbook for a complete discussion of the SMU Honor Code). The code states that "any giving or receiving of aid on academic work submitted for evaluation, without the express consent of the instructor, or the toleration of such action shall constitute a breach of the Honor Code." A violation can result in an "F" for the course and an Honor Code Violation on your transcript.

TOPICS

I. Introduction to STATA Software

- A. Apps.smu and how to use it
- B. A run through with a sample STATA program

Reference: Class presentation and Introduction to STATA pdf files

II. What are Microdata?

- A. Types of Microdata
- B. Common Elements of Microdata Models
- C. Examples

Reference: Chapter 1 in Winkelmann and Boes

III. From Regression to Probability Models

- A. Conditional Probability Models
- B. A Review of Some Probability Models

Reference: Chapter 2 in Winkelmann and Boes

IV. Maximum Likelihood Estimation - I

- A. Introduction
- B. Definition of Likelihood Function
- C. Example 1: The Bernoulli Distribution
- D. Example 2: The Normal Distribution
- E. Example 3: The Classical Normal Linear Regression Model

Reference: Chapter 3 in Winkelmann and Boes

V. Maximum Likelihood Estimation - II

- A. Score Function
- B. Hessian Matrix
- C. Information Matrix
- D. Properties of ML Estimators
 - i. Consistency
 - ii. Asymptotic Normality
 - iii. Asymptotic Efficiency
- E. Covariance Matrix of ML Estimators

Reference: Chapter 3 in Winkelmann and Boes

VI. Maximum Likelihood Estimation – III

- A. Numerical Optimization Methods
- B. Analytic Solution – Example: Least Squares in Classical Normal Linear Regression Model
- C. Non-analytic Solution – Example: Logistic Model
 - i. Newton-Raphson method
 - ii. Other methods
 - iii. Global Concavity – guaranteed convergence

Reference: Chapter 3 in Winkelmann and Boes

VII. Maximum Likelihood Estimation – IV

- A. Asymptotically Equivalent Testing Methods
- B. Wald Test
- C. Likelihood Ratio Test
- D. Score (Lagrangian Multiplier) Test

Reference: Chapter 3 in Winkelmann and Boes

VIII. Maximum Likelihood Estimation – V

- A. Quasi (Robust) Inference in Maximum Likelihood Estimation
- B. Mean Function assumed to be correctly specified
- C. Sandwich Variance-Covariance Matrix
- D. Example: White's Standard Errors

Reference: Classroom Presentation

IX. Binary Logit Model

- A. Likelihood Function
- B. Variance-Covariance Matrix
- C. Interpretation of Coefficients – Marginal Effects and Log Odds Ratios
- D. Model Selection
- E. Contingency Tables and ROC curves
- F. Applications/Target Marketing and Bond Ratings
- G. Comparison to Probit Model

Reference: Chapter 4 in Winkelmann and Boes

X. Unordered Multinomial Response Models

- A. Multinomial Logit Model
- B. Conditional Logit Model
- C. Multinomial Probit Model
- D. Model Selection
- E. Applications in Textbook

Reference: Chapter 5 in Winkelmann and Boes

XI. Ordered Multinomial Response Models

- A. Ordered Probit Model
- B. Ordered Logit Model
- C. Sequential Models
- D. Model Selection
- E. Applications in Textbook

Reference: Chapter 6 in Winkelmann and Boes

Mid-Term Exam
Approximately
Thursday, March 23
6:30 – 7:50 PM
101 Dedman Life Sciences Building

XII. Limited Dependent Variable Models

- A. Truncation versus Censoring
- B. Truncated Regression (Tobit) Model
- C. Censored Regression Model
- D. Heckman Selection Model
- E. Model Selection
- F. Applications in Textbook

Reference: Chapter 7 in Winkelmann and Boes

XIII. Duration (Survival) Dependent Variable Models

- A. Definition of Density, Survival, and Hazard Functions
- B. Exponential, Weibull, Loglogistic, and Lognormal density functions and their Corresponding Survival and Hazard functions
- C. Cox Proportional Hazard Model
- D. Nonparametric Methods
- E. Model Selection
- F. Applications in Textbook

Reference: Chapter 8 in Winkelmann and Boes

XIV. Count Models

- A. Poisson Model and the equi-dispersion assumption
- B. Negative Binomial Model
- C. Zero Inflated Models
- D. Model Selection
- E. Applications in Textbook

Reference: Chapter 8 in Winkelmann and Boes

XV. Spatial Linear Regression Models

- A. Distance Measures
- B. Spatial Error Model
- C. Spatial Lag Model
- D. Model Selection
- E. Application: Boston Housing Data

Reference: Classroom Presentation

TIME PERMITTING:

XVI. Static Panel Data Models

- A. Two Period Panel Models – Difference in Difference Approach
- B. Fixed Effects Models
- C. Random Effects Models
- D. The Hausman Test
- E. Model Selection
- F. Application: Rental prices in college towns

Reference: J.M. Wooldridge, Introductory Econometrics, 5th edition, chapters 13 and 14.

Final Exam
Tuesday, May 16
3:00 – 6:00 PM
301 Dedman Life Sciences Building
