Purpose and Organization

The purpose of the course is to help students learn to use econometric methods in empirical economic research. The course focuses exclusively on econometric models and methods designed for analysis of cross-sectional data. It emphasizes problems that arise in actually conducting applied econometric research on cross-sectional data, and modern methods and practices for dealing with these problems. Empirical examples – many drawn from recent literature in applied economics – are presented to illustrate the application of all econometric methods covered in the course.

Course material is presented in both scalar and matrix terms. Extensive use is made of matrix algebra in the presentation of econometric methods and results.

Learning Objectives

Upon completion of the course, students should have acquired the methodological, operational and expositional skills required to design and conduct a small-scale econometric investigation and to write an accurate, complete and coherent report of its methods and findings. They should also have developed the capacity to comprehend and critically assess applied econometric studies based on cross-sectional data.
Course Format

The course is based on two 80-minute lectures per week. In addition, hands-on tutorials are scheduled in the Department of Economics Computer Classroom (Dunning Hall 350) at times to be arranged. The tutorials are designed to familiarize students with those features of the statistical software program Stata they will need for the assignments in the course.

Course Work and Assessment

☐ Assignments: Two Research Projects

Two assignments will be given during the term. These assignments will require students to perform small econometric research projects that apply the various econometric methods and practices covered in the course.

The assignments will be goal-specific rather than task-specific in nature. That is, they will specify broad research objectives, a general empirical or econometric framework, and a dataset for each project, but will not specify in detail how the objectives are to be achieved or how the empirical framework is to be implemented. Students will therefore be responsible for formulating a specific research design for achieving the research objectives of each project, for deciding what specific empirical results are reported and how they are presented and interpreted, and for writing an accurate, complete, coherent and well-documented project report. The required format for each project report is that of a short economics journal article.

Students are permitted to work in pairs in researching, writing and submitting the two assignments. However, students have the option of doing assignments individually if they wish to do so.

☐ Mid-Term Exam

A mid-term exam will be given in class during the tenth week of the term, on a date to be arranged. The exam will test students' knowledge and understanding of the important econometric principles, methods and practices covered in the course. 
Note: There will be NO final exam in the course.

☐ Final Course Grade

Each student's final course grade will be computed using the following weights for the three course components:

| Assignment 1       | 45% |
| Assignment 2       | 45% |
| Mid-term Test      | 10% |
Textbooks: Required and Recommended

Required Textbook

The required textbook for the course is the fourth (2009) or third (2006) edition of the introductory textbook by Jeffrey Wooldridge:


This book provides excellent modern treatments of all topics included in the course. It also contains plenty of real applications of econometric methods. Copies of Wooldridge (2009) can be purchased in the Campus Bookstore, and copies of Wooldridge (2006) are on reserve in Stauffer Library Reserve Room. Note that the third (2006) edition of this textbook (ISBN 0-324-28978-2) is also completely adequate for purposes of this course.

Recommended Textbooks

The following three textbooks are recommended for supplementary reading.


A standard textbook in introductory econometrics, Gujarati (2003) provides clear expositions of many of the topics covered in the course.


The Griffiths, Hill and Judge (1993) book provides accessible, user-friendly and moderately advanced treatments of most of the topics included in the course.


Berndt (1991) is an excellent "hands-on" textbook in applied econometrics; it emphasizes the implementation of econometric techniques in real empirical applications.
Computer Software

The required econometric software package for the course is Stata. The current release of Stata for Windows is Release 11 (Stata 11), but Release 10 (Stata 10) is perfectly adequate for purposes of this course.

The Stata web site is at: www.stata.com.

Stata tutorials distributed during the term on the course web site will give students hands-on instruction in those features of Stata required to implement the econometric methods covered in the course and to do the two research assignments. In addition, scheduled computing labs in the Department of Economics Computer Classroom (Dunning Hall 350) will give students the opportunity to obtain individual assistance with both the computer tutorials and the research assignments.

Stata 10 or Stata 11 for Windows will run under Windows Vista, Windows XP and Windows 2000. Students with their own PCs may wish to acquire a PC version of Stata suitable to their hardware.

Two basic versions of Stata 11 are available:

Small Stata – Stata 11 for small computers
- Datasets are restricted to a maximum of 99 variables and 1,200 observations.
- Matrices may be up to 40 x 40.
- Maximum number of right-hand variables = 99
- String variables up to 80 characters.
- Computer should have at least 512 MB of RAM and 250 MB of disk space.

Stata/IC -- the standard professional version of Stata 11
- A maximum of 2,047 variables; the only limit on observations is the amount of RAM on your computer.
- Very fast.
- Matrices may be up to 800 x 800.
- 64-bit version available.
- Maximum number of right-hand variables = 798
- String variables up to 80 characters.
- Computer should have at least 512 MB of RAM and 250 MB of disk space.

Stata/IC is the required version of Stata 10 or Stata 11 for this course. Small Stata's restrictions on dataset size would prove to be binding for the research assignments in the course. Note that Intercooled Stata for Windows Release 9 (Intercooled Stata 9) is also perfectly adequate for this course.
Documented for Stata 11

Core hard copy documentation for Stata 11 consists of five manuals (approximate prices in US dollars):

- Getting Started with Stata for Windows ($25.00);
- User’s Guide ($45.00);
- Base Reference Manual (3 volumes, $165.00);
- Graphics Reference Manual ($55.00);
- Data Management Reference Manual ($50.00).

The first two manuals are particularly useful for relatively new Stata users.

Complete information on Stata 11 documentation is available from the Stata website at http://www.stata.com/bookstore/documentation.html.

Purchasing your own copy of the Stata 11 statistical software

The course instructor has set up a plan – called a Stata course GradPlan – whereby students can purchase their own copies of the Stata 11 statistical software and documentation at special student discount prices. Students who wish to take advantage of this GradPlan should send an e-mail message to the instructor, who will send them instructions on how to proceed.

Background Preparation for ECON 452*

It is assumed that students have successfully completed an introductory undergraduate econometrics course such as ECON 351*, and an introductory university-level calculus course such as MATH 126 or MATH 121.

Since extensive use is made of matrix algebra, a selective review of basic concepts in matrix algebra may be advisable. For a brief review of matrix algebra, see either Wooldridge (2009), Appendix D, pp. 788-797 or Wooldridge (2006), Appendix D, pp. 808-818.
Faculty of Arts and Science Statement on Academic Integrity

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1), on the Arts and Science website (see http://www.queensu.ca/calendars/artsci/pg532.html), and from the instructor of this course.

Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.
COURSE OUTLINE AND READINGS

NOTE: All readings in Wooldridge (2009, 2006) are required. In addition, lecture notes for several sections of the course are posted on the course web site in PDF format.

1. SPECIFICATION ISSUES IN LINEAR REGRESSION MODELS

A. Theoretical Specification of the Classical Linear Regression Model

NOTE 1: Formulation and Specification of the Multiple Linear Regression Model in Vector-Matrix Notation.
Wooldridge (2009). Ch. 3, Sec. 3.3, pp. 84-88; Appendix D, pp. 788-798; Appendix E, Sec. E.2, pp. 801-805.
Wooldridge (2006). Ch. 3, Sec. 3.3, pp. 89-94; Appendix D, pp. 808-818; Appendix E, Sec. E.2, pp. 822-825.

B. Selection of Regressors

NOTE 2: Specification Errors in the Selection of Regressors.
Wooldridge (2009). Ch. 3, Sec. 3.3, pp. 89-94.

1. Exclusion of Relevant Regressors: Omitted Variables Bias
2. Inclusion of Irrelevant Regressors

C. Functional Form of the Regression Function

Wooldridge (2009). Ch. 2, Sec. 2.4, pp. 41-46; Ch. 6, Sec. 6.2, pp. 189-199; Ch. 9, Sec. 9.1, pp. 300-306.
Wooldridge (2006). Ch. 2, Sec. 2.4, pp. 44-50; Ch. 6, Sec. 6.2, pp. 197-206; Ch. 9, Sec. 9.1, pp. 304-310.

1. Marginal Effects of Continuous Explanatory Variables: Constant or Variable?
   NOTE 3: Marginal Effects of Continuous Explanatory Variables: Constant or Variable?
2. Functional Form in the Variables: Linear or Logarithmic?
   NOTE 4: Functional Form in the Variables: Linear or Log?
D. Coefficient Differences and Dummy Variable Regressors


NOTE 5: Using Dummy Variable Regressors for Two-Category Categorical Variables.
NOTE 6: Using Dummy Variable Regressors for Multi-Category Categorical Variables.
NOTE 7: Dummy Variable Interaction Terms.
NOTE 8: A General Regression Model with Dummy Variable Interactions.

2. OLS ESTIMATION OF THE LINEAR REGRESSION MODEL: MATRIX FORMULATION

NOTE 9: OLS Estimation of the Classical Linear Regression Model: Matrix Notation and Derivations.
Wooldridge (2009). Ch. 3, Sec. 3.2, pp. 73-83; Appendix E, Sec. E.1, pp. 799-801.
Wooldridge (2006). Ch. 3, Sec. 3.2, pp. 78-89; Appendix E, Sec. E.1, pp. 819-822.

3. INERENCE (HYPOTHESIS TESTING) IN THE LINEAR REGRESSION MODEL: REVIEW AND EXTENSIONS

Wooldridge (2009). Ch. 3, Secs. 3.4-3.5, pp. 94-104; Ch. 4, pp. 117-159; Appendix E, Sec. E.3, pp. 805-807.
Wooldridge (2006). Ch. 3, Secs. 3.4-3.5, pp. 99-109; Ch. 4, pp. 123-167; Appendix E, Sec. E.3, pp. 826-827.

4. LINEAR REGRESSION MODELS WITH HETROSKELEDASTIC ERRORS

A. Consequences of Heteroskedastic Errors for OLS Estimation and Inference

NOTE 11: Heteroskedasticity-Robust Inference in Linear Regression Models Estimated by OLS.
Wooldridge (2009). Ch. 8, Sec. 8.1, pp. 264-265.

B. OLS With Heteroskedasticity-Robust Inference

NOTE 11: Heteroskedasticity-Robust Inference in Linear Regression Models Estimated by OLS.
C. Tests for Heteroskedastic Errors


D. GLS Estimation of Heteroskedastic Errors Models

Wooldridge (2009). Ch. 8, Sec. 8.4, pp. 276-290.

5. MAXIMUM LIKELIHOOD ESTIMATION OF LINEAR REGRESSION MODELS

A. Fundamentals of Maximum Likelihood Estimation


B. ML Estimation of the Classical Normal Linear Regression Model

NOTE 13: Maximum Likelihood Estimation of the Classical Normal Linear Regression Model.

6. BINARY DEPENDENT VARIABLES MODELS

A. OLS Estimation: The Linear Probability Model

Wooldridge (2009). Ch. 7, Sec. 7.5, pp. 246-251; Ch. 8, Sec. 8.5, pp. 290-293.
Wooldridge (2006). Ch. 7, Sec. 7.5, pp. 252-257; Ch. 8, Sec. 8.5, pp. 295-297.

B. Probit and Logit Models: Basic Features

NOTE 14: Maximum Likelihood Estimation of Binary Dependent Variables Models: Probit and Logit.

C. ML Estimation of Probit and Logit Models

NOTE 14: Maximum Likelihood Estimation of Binary Dependent Variables Models: Probit and Logit.
D. Interpreting Probit and Logit Coefficient Estimates


E. Statistical Inference in Probit and Logit Models

NOTE 16: Testing Linear Coefficient Restrictions in Probit Models.  