GMS5221: Introduction to Econometrics

Meeting time: Weekly from 6:00-9:00pm SGT
Meeting Location: Zoom

Instructors: Soye Shin PhD, Nick Stacey PhD

Synopsis of Course Content
This course aims to equip students with fundamental knowledge in econometric methods commonly applied in health economics and outcomes research (HEOR) and how to apply those methods using the Stata programming language. These methods can be used to quantify disease burden along multiple domains (e.g., health outcomes, health expenditures, productivity losses), to evaluate effectiveness of health technologies, as inputs into cost-effectiveness and budget impact analyses, and to provide real-world evidence for use in clinical guidelines and policy recommendations. The course begins with basic statistical theory review and econometric analysis with the simple linear regression model in order to develop a foundational understanding of data analysis, model building, and hypothesis testing. We then extend the analyses to include multivariate controls and binary outcomes. All examples will be based on real world applications.

Prerequisites
None.

Textbooks
Gujarati, Basic Econometrics, 4th edition, McGraw Hill
Other readings and material will be provided for some lectures.

Software
Stata

Performance Assessment
Performance will be assessed on i) short in-class quizzes at the beginning of each lecture; ii) group projects; iii) a group presentation; and iv) a final assessment.

Group projects overview
Students will be provided with a data set in the first week of the course. Working in small groups, they will use the data to answer a research question of their choosing that addresses an important health issue. The group project consists of the following progressive assignments with deadlines throughout the course: Assignment 1) to identify a research question that each group wants to pursue, and to present the research question, proposed hypotheses, and a review of the econometric methods and data used in recent prior studies on the topic. For example, the topic might be to quantify the per capita increase in costs resulting from obesity or the total value among full time employees of days missed from work due to diabetes or a related health condition. Note: it is possible to use a different data set than the one offered for the group project, but it should be discussed with and approved by the lecturer in advance; Assignment 2) to write a data analysis plan for how they will use the data to address the select research question ***using econometrics techniques covered in this course as outlined in the syllabus below***; Assignment 3) to conduct the analyses and generate results using Stata. The final formal presentation of the group project will be presented in class in Week 12, which should cover

motivation, hypotheses, methodology, results, implications, limitations of their research including their chosen econometrics models, and areas for future research.

Grade Breakdown

Component	Weightage (%)	Assessment Due Date
1. Weekly in-class quizzes	30% (Excluding the two lowest scores)	N/A
2. Group Projects 2-1. Assignment 1 2-2. Assignment 2 2-3. Assignment 3	Total 30% 10% 10% 10%	 Week 4 Week 7 Week 10
3. Group Presentation	10%	Week 12
4. Final Assessment	30%	Week 13

Course Outline

Week	Lecture	Lead Instructor
1	Statistics Review (1)	Soye Shin
2	Statistics Review (2)	Nick Stacey
3	Simple Linear Regression (1)	Nick Stacey
4	Simple Linear Regression (2)	Soye Shin
5	Multiple Linear Regression (1)	Soye Shin
6	Multiple Linear Regression (2)	Nick Stacey
7	Topics in Regression Analysis (1)	Nick Stacey
8	Topics in Regression Analysis (2)	Nick Stacey
9	Topics in Regression Analysis (3)	Nick Stacey
10	Non-linear Regression Models	Soye Shin
11	Beyond estimating statistical association: causality inferences	Soye Shin
12	Group project presentation	All
13	Final Assessment	N/A

Week 1: Statistics Review (1)

Class Outline:

I. Lecture
- Probability theory & distributions

Reading List:

- Gujarati Appendix A

Week 2: Statistics Review (2)

Class Outline:

I. Lecture
- Common probability distributions

- Estimation
- Hypothesis testing
- Confidence intervals
- Intro to Stata

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata

Reading List:
- Gujarati Appendix A

Week 3: Simple Linear Regression (1)
Class Outline:

I. Lecture
- Population vs sample regression functions
- Ordinary Least Square (OLS) & error terms
- Classical Linear Regression model

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata

Reading List:
- Gujarati Ch.2, Ch.3.2-3.4, Ch.4.1-4.3.

Assignment:
- Assignment 1: Presentation slides due in Week 4

Week 4: Simple Linear Regression (2)
Class Outline:

I. Lecture
- Measure of Goodness of Fit: R-square

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata
IV. Group presentation/discussion of Assignment 1

Reading List:
- Gujarati Ch.3.5, Ch.5.1-5.8, 5.10, Ch.6, Ch.9

Week 5: Multiple Linear Regression (1)
Class Outline:

I. Lecture
- Multiple Linear Regression
- Adjusted R-square
- Hypothesis testing in Multiple Linear Regression (1)

II. Demonstration/Illustrative examples with Stata

III. Group exercise with Stata

Reading List:
- Gujarati Ch.7.1-7.8, Ch.8.1-8.7

Week 6: Multiple Linear Regression (2)
Class Outline:
I. Lecture
   - Hypothesis testing in Multiple Linear Regression (2)
   - Multicollinearity
II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata

Reading List:
- Gujarati Ch.8.1-8.7, Ch.10

Assignment:
- Assignment 2: Presentation slides due in Week 7

Week 7: Topics in Regression Analysis (1)
Class Outline:
I. Lecture
   - Functional form and interpretation (2): Polynomials
   - Interactions
II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata
IV. Group presentation/discussion of Assignment 2 (1)

Reading List:
- Gujarati, Ch.6, Ch.7.10, Ch.9

Week 8: Topics in Regression Analysis (2)
Class Outline:
I. Lecture
   - Heteroskedasticity
   - Residual analysis
II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata
IV. Group presentation/discussion of Assignment 2 (2)

Reading List:
- Material provided, Gujarati Ch.11

Week 9: Topics in Regression Analysis (3)
Class Outline:
I. Lecture

- Misspecification problems
- Maximum likelihood estimation (MLE)

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata

Reading List:
- Gujarati Ch.4.4, Ch. 4-Appendix 4A, Ch. 13

Assignment:
- Assignment 3: Presentation slides due in Week 10

Week 10: Non-linear regression models
Class Outline:

I. Lecture
   - Linear Probability Model
   - Probit/Logit models estimation

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata
IV. Group presentation/discussion of Assignment 3 (1)

Reading List:
- Gujarati Ch.14, Ch.15

Week 11: Beyond estimating statistical associations: introduction to causal inference
Class Outline:

I. Lecture
   - Difference between causality and correlation
   - Threats to estimating causal relationships
     (1) omitted variable biases
     (2) measurement errors
     (3) simultaneity
     (4) selection biases

II. Demonstration/Illustrative examples with Stata
III. Group exercise with Stata
IV. Group presentation/discussion of Assignment 3 (2)

Reading List:
- Material provided, Gujarati. Ch.1.4-1.5, Ch. 18

Week 12: Group project Presentation
- Students will present their group projects.

Week 13: Final Assessment
- There will be an invigilated online exam that assesses students' understanding of the course material.