(GMS5223): Advanced Health Econometrics

Meeting time: Monday, 6:00-9:00 pm
Meeting Location: Zoom

Instructors: Nicholas Stacey PhD, Soye Shin PhD

Synopsis of Course Content
Conventional ordinary least squares (OLS) regression modelling is not well-suited to the analysis of many outcomes (including disease prevalence, costs and expenditures, and care utilization) that are relevant to the economic analysis of health policy. Moreover, drawing causal inferences about the effects of interventions from simple OLS regressions is not generally possible. This course aims to provide students with an understanding of the theory and implementation of econometric methods commonly used in health economics, and will expand students' econometric knowledge and Stata programming abilities in four key areas: (1) modelling non-normally distributed outcomes with a mass at zero, such as medical expenditures, (2) modelling count outcomes, such as number of admissions and lengths of stay, (3) modelling categorical responses, such as Likert patient satisfaction measures, and (4) techniques for causal inference. Specific topics covered in this course will include generalized linear models, two-part models, count models, ordered and multinomial logit, propensity score matching, difference-in-differences, and regression discontinuity designs.

Prerequisites
Introduction to Econometrics or equivalent

Textbooks
- Deb, P., Norton, E., Manning, W., Health Econometrics using Stata (HES), Stata Press.
- Angrist, J. D., & Pischke, J.-S. (2008). Mostly Harmless Econometrics (MHE). Princeton University Press.
- Other ad hoc readings and material to be provided ahead of lectures.

Software
Stata

Performance Assessment
Performance in this course will be assessed on i) short in-class quizzes at the beginning of each lecture; ii) group project assignments; iii) final group project presentation; and iv) a final assessment. Quizzes will test knowledge and comprehension of previous week's lecture material. The final assessment will be an invigilated online exam, evaluating knowledge and comprehension of all lectures and will include a Stata coding component.

Component	Weighting (%)	Assessment Due Date
Weekly in-class quizzes (two lowest scores will be dropped)	30%	Every week, Week 2 - 12
3 group project assignments	30% (10% each)	Week 3, 6, and 9

Final group project presentation	10%	Week 12
Final Assessment	30%	Week 13

Group project overview

Students will be provided with a data set or identify an external dataset of interest in the first week of the course. Working in small groups, they will use the data and advanced health econometric methods 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 (10 minute presentation): Make a presentation to the class laying out the research question(s) and hypotheses, why it is important, and how others have addressed it, including data and methods employed and top-line results. *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 lecturers in advance.*
- Assignment 2 (10 minute presentation): Write and present a data analysis plan for how the team plans to address the selected research question(s) and why they chose this approach over alternatives.
- Assignment 3 (10 minute presentation): Execute the data analysis plan using Stata and present results.
- Final group project presentation (15 minute presentation): Present the entire study to the class, including motivation, hypotheses, approach, results, implications, and limitations. The final presentation will be presented in Week 10.

Each of the group project assignments will graded and assigned a maximum grade out of 10 according to the following rubric. All group members receive the same grade.

Criteria	**Grade**		
	Below Expectations	*Meets Expectations*	*Exceeds Expectations*
Content Content clearly addresses assignment objective: • 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 • Assignment 2: to present a data analysis plan for how they will use the data to address the selected research question using econometrics techniques covered in this course. • Assignment 3: Conduct the planned analysis and present approach and preliminary findings. • Final presentation: to present summary of project -- including research question and motivation, hypotheses, econometric approach, results, and discuss implications and any limitations.	0-1	2-3	4

Structure • Presentation is clearly structured. • Slides are used to clearly present key points. • Presentation is delivered within time limit.	0-1	2	3
Questions & Answers • Able to adequately respond to classmates' and instructors' questions.	0-1	2	3

Course Outline

Week	Lecture	Lead Instructor	Assignments
1	Review of the linear regression model and its shortcomings	Nicholas Stacey	
2	Generalized linear models	Nicholas Stacey	
3	Models for continuous outcomes with mass at zero	Nicholas Stacey	Assignment 1
4	Count models	Nicholas Stacey	
5	Multinomial logit and categorical data models	Nicholas Stacey	
6	Causal inference, the potential outcomes framework & randomized experiments	Nicholas Stacey	Assignment 2
7	Propensity Score Matching	Nicholas Stacey	
8	Regression Discontinuity	Soye Shin	
9	Panel data techniques	Soye Shin	Assignment 3
10	Difference-in-Differences	Soye Shin	
11	Hackathon	Nicholas Stacey	
12	Final project presentation	Nicholas Stacey	Final project presentation
13	Final Assessment	Nicholas Stacey	

Week 1: Review of the classical linear regression model and its shortcomings

Class Outline:

I. Lecture:
   a. Introduction to course
   b. Review of the classical linear regression model (CLRM) and assumptions
   c. Limitations of CLRM for health data

II. Stata review and In-class group exercise

Week 2: Generalized Linear Models (GLM)

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - GLM assumptions & predictions
   - Choice of link function
IV. Group exercise with Stata

Reading List:

- HES Ch.5, Ch. 6

Week 3: Models for continuous outcomes with mass at zero

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Issues with dependent outcomes with mass at zero
   - Two-part models
IV. Group exercise with Stata

Reading List:

- HES Ch.7

Week 4: Count models

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Poisson regression
   - Negative binomial regression
   - zero inflated models
IV. Group exercise with Stata

Reading List:

- HES Ch.8

Week 5: Multinomial logit and categorical data models

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Binary logit review
   - Ordinal and multinomial logit
IV. Group exercise with Stata
V. Group presentation/Group discussion of Assignment 3

Reading List:

- Material provided

Week 6: Causal inference, the potential outcomes framework & randomized experiments

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Causal inference & the potential outcomes framework
   - Randomized experiments
   - Linear regression & causal inference
IV. Group exercise with Stata

Reading List:

- MHE Ch.6.2.

Week 7: Propensity Score Matching

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Propensity score matching
IV. Group exercise with Stata

Reading List:

- HES, Ch. 2.1-2.4
- https://pubmed.ncbi.nlm.nih.gov/21818162/

Week 8: Regression Discontinuity

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Regression Discontinuity (RD)
IV. Group exercise with Stata

Reading List:

- MHE Ch.6.1.

Week 9: Difference-in-Differences

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
   - Difference-in-Differences (DID)
IV. Group exercise with Stata

Reading List:

- MHE Ch. 5.2.

Week 10: Panel data techniques

Class Outline:

I. Quiz
II. Quiz review
III. Lecture
    - Fixed effects models
    - Random effects models
IV. Group exercise with Stata

Reading List:

- MHE Ch. 5.1.

Week 11: Hackathon

Class Outline:

During class, students will work in groups to complete an econometrics exercise including model specification and estimation based on their learning in the course.

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.