

**KDI SCHOOL OF PUBLIC POLICY AND MANAGEMENT**  
**PH.D. ECONOMETRICS III – APPLIED MICROECONOMETRICS**

**Semester: Fall 2023**

**Time: TBD**

**Lecture Room: TBD**

**Professor: Josh Merfeld**

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**Office Hours: By appointment**

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**COURSE DESCRIPTION**

This Ph.D.-level course has two goals. First, you will better understand the tools used by applied microeconomists today. There have been many advancements in microeconometrics in the last few years, and the main goal of this course is for you to understand how these advancements affect what we do. A second – but just as important – goal is to have you all ready to code and write in R. R is becoming more and more popular in applied micro and is one of the most popular statistics package in some other disciplines (like statistics and data science). After this course, you will be able to write papers and create presentations in R, in addition to knowing how to use R for applied microeconometrics.

**Keywords**

Microeconometrics, R

**Text Books**

Scott Cunningham (2021). *Causal Inference*. (Referred to as *CI* in the weeks below.

This is a helpful reference because it includes R code!)

Angrist, J. D., & Pischke, J. S. (2009). *Mostly Harmless Econometrics*. Princeton University Press. (**This is a good reference for a bit more in-depth treatment of microeconometrics than CI above.**)

**Helpful references:**

R for Data Science (Wickham and Grolemund). This is available for free [here](#). Please note that this guide does not introduce most of the topics we will discuss in class.

However, it is incredibly helpful for getting started in R.

R Markdown: The definitive guide (Xie, Allaire, and Golemund). This is available for free [here](#). This guide will help you learn about using R Markdown, which is a very handy way to write using R.

Adams, C. P. (2020). *Learning microeconometrics with R*. CRC Press. (This is not required but it is a very handy reference.)

### **Readings**

From the required books above as well as articles, to be posted online.

### **References**

N/A

### **Course Requirements (Pre-requisites)**

Graduate-level econometrics I and II.

### **EVALUATION**

Students will be evaluated on the basis of three course requirements:

**1. Homework – coding tasks (55%)**: Throughout the semester, I will assign four to five coding tasks related to the material we cover in tasks. You will be required to do these tasks in R, turning in a write-up using R Markdown.

**2. Final exam (35%)**: The exam will be a take-home exam, due during finals week. It will include questions on content as well as some coding tasks.

**3. Participation (10%)**: I expect you all to come prepared to class. This includes having read the assigned material. Participation will be graded based on your participation in each class. *You will be required to bring a laptop to class.*

This course includes Korean development experience (**\*please check Yes or No**)

☐ YES

☒ NO

This course utilizes resources from KSP(Knowledge Sharing Program), K-Developedia, or Modularization report (**\*please check Yes or No**)

☐ YES

☒ NO

## COURSE OUTLINE

### Week 1

#### Introduction

- Introduction to the course and material
  - Expectations
- Introduction to R, R Markdown

#### Notes

- **Please come with R and RStudio already installed on your computer.** You can find instructions on getting started with R [here](#) and [here](#).

### Week 2

#### Linear regression

- Review of the nuts and bolts of linear regression
- Inference
  - Confidence intervals and hypothesis testing
  - Homoskedasticity and heteroskedasticity
  - Clustering
- Bootstrapping

#### Readings

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### Week 3

#### Likelihood methods

- Discrete choice
  - Binary discrete choice
  - Multiple discrete choice
- GLM
- Hazard models

#### Readings

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### Week 4

#### Introduction to causality

- Potential outcomes framework
- Problems with simple regression

- Why randomization works
- Propensity scores

#### Readings

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### **Week 5**

#### Differences-in-differences I

- Canonical differences-in-differences
- Fixed effects vs. random effects
- Two-way fixed effects
  - Bias in two-way fixed effects
- Event studies
- Synthetic control (time dependent)

#### Readings

- *CI* pages 315-384
- Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*.
- Roth, J., Sant'Anna, P. H., Bilinski, A., & Poe, J. (2022). What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature. *arXiv preprint arXiv:2201.01194*.
- Karthik Muralidharan and Nishith Prakash. 2017. "Cycling to School: Increasing Secondary School Enrollment for Girls in India." *American Economic Journal: Applied Economics* 9(3), pp. 321–350.

#### Optional

- *CI* pages 241-313

### **Week 6**

#### Differences-in-differences II

- Finishing up previous week
- Synthetic control methods

#### Readings

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### **Week 7**

#### Instrumental variables I

- IV requirements

- IVs in RCTs
- Some examples

Readings

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## **Week 8**

Instrumental variables II

- What to do with weak instruments?
- Bartik instruments

Readings

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## **Week 9**

Regression discontinuity

- Canonical regression discontinuity
- Parametric vs. non-parametric

Readings

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## **Week 10**

Machine learning in economics

- Machine learning for prediction
  - LASSO, ridge, elastic net
- Cross validation
- Heterogeneous treatment effects
- Brief introduction to other supervised ML (time dependent)
  - Trees
  - Neural networks

Readings

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## **Week 11**

Reading week

## **Week 12**

Take-home final exam due