

Harvard University, fall 2017  
Syllabus for Economics 1126  
Quantitative Methods in Economics

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### Overview and Objectives

Econ 1126 introduces you to the field of econometrics, that is to the use of statistical methods applied to economic data. In part I and II of Econ 1126 we will focus on some theoretical and mathematical aspects of econometrics. In part I, we will develop the (minimum mean-square error) linear predictor as a way of describing relationships among random variables. The intuition of using a sample mean to estimate a population mean is applied to the estimation of linear predictors, using cross-section data. This leads to least-squares projection. We discuss functional form, and the approximation of nonlinear functions by linear functions. This leads to the conditional expectation function. The issue of omitted variables is discussed, and we derive the omitted variables formula. This part of the course concludes with applications to panel data. Part II will discuss inference. We will first consider tests and confidence intervals, and how to construct them for the expectation of a normal vector. We will then discuss asymptotic theory, that is the behavior of estimators in large samples. We will see that we can apply the inference procedures for normal expectations to very general estimation problems.

In part III of Econ 1126 we will cover methods of causal inference as they are used in various fields of applied economics such as labor economics, development economics, and public finance. We will discuss potential outcomes, randomized experiments, and various ways to find situations which are “like” randomized experiments. In this part of class you will present empirical papers using the methods discussed. Everybody will have to prepare summaries of these papers before they are presented. You will have to use the knowledge acquired in this class to replicate the empirical analysis in one of the papers.

The goal of this class is for you to get a solid understanding of regression methods, of causality, and of (quasi-)experimental methods to estimate causal effects. The class should enable you to be a critical reader of empirical research, and to begin doing your own research.

## Assignments

Your grade for Econ 1126 will be determined by the following assignments:

1. **Five problem-sets**, posted on the class webpage (6 % of grade each). Due dates are Sep 26, Oct 5, Oct 12, Nov 16, and Dec 1. You are of course welcome to submit your solutions earlier.
2. An in-class **midterm exam** on October 19 (25% of grade).
3. **Three Summaries** of the empirical papers, to be submitted online before these papers are presented (4% of grade each).
4. Your **replication** of the empirical results in one of the papers, due December 8. (25% of grade)
5. Participation in a **presentation** on one of the papers (10% of grade). Presentation dates are on Thursdays in November.
6. There will be **no final exam**.

Your paper summaries should be about two pages long. In these summaries, you should describe both methods and results, and you should make an effort to connect your discussion to the content of our lectures. You should submit one summary for each week in which you are not presenting.

Your presentations should last about 40 minutes. You can present in groups of up to 4 students. You should prepare slides for your presentation. Please sign up for presentations via Doodle; I will send out the link some time early in the semester.

The replication should consist of

1. complete Stata code to produce all your results,
2. nicely formatted figures and tables produced by your code, which correspond to those in the paper,
3. and a verbal discussion of these figures and tables.

If you would like to replicate another paper than one of those assigned, you are welcome to do so after asking for my approval for the paper you chose. Not for all empirical papers are data readily available. Part of your assignment is to find out whether the data are online, or whether you can obtain them some other way. Please share your findings with your classmates.

You are welcome, and in fact encouraged, to collaborate on any of these assignments. However, every one of you has to produce a separate write-up of your summaries / problem-set solutions / replication. Identical write-ups will receive zero points.

To help me improve the course, I will ask you to give me anonymous feedback at some point, writing what you like about the class and what you think I should change.

I encourage you to come to my office hours with any questions. I will not answer emails with questions on the material.

If you need any special accommodations for physical or medical reasons, please see me after class or send me an email.

## Course outline

We will cover the following topics in Econ 1126.

### **Part I:**

1. Linear predictors and least squares fit
2. Conditional expectation
3. Residual regression and omitted variables
4. Panel data

### **Part II:**

1. Testing and confidence intervals
2. Asymptotic foundations
3. Asymptotic behavior of estimators

### **Part III:**

1. Causality and counterfactuals
2. Randomized experiments
3. Matching and regression
4. Difference-in-differences
5. Instrumental variables
6. Regression discontinuity
7. Distributional effects
8. Statistical software: Stata, Matlab

## Readings

The main reference for this class are the lecture slides which I have posted online. For the second part of class, we will read the following **empirical papers**, also posted on the class webpage:

### 1. Randomized experiments

Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J. P., Allen, H., Baicker, K., and Group, O. H. S. (2012). The Oregon health insurance experiment: Evidence from the first year. *The Quarterly Journal of Economics*, 127(3):1057–1106

Crépon, B., Duflo, E., Gurgand, M., Rathelot, R., and Zamora, P. (2013). Do labor market policies have displacement effects? Evidence from a clustered randomized experiment. *The Quarterly Journal of Economics*, 128(2):531–580

### 2. Difference-in-differences

Qian, N. (2008). Missing women and the price of tea in China: The effect of sex-specific earnings on sex imbalance. *The Quarterly Journal of Economics*, 123(3):1251–1285

Cascio, E. U. and Washington, E. (2014). Valuing the vote: The redistribution of voting rights and state funds following the voting rights act of 1965. *The Quarterly Journal of Economics*, 129(1):379–433

### 3. Instrumental variables

Aizer, A. and Doyle, J. J. (2015). Juvenile incarceration, human capital, and future crime: Evidence from randomly assigned judges. *The Quarterly Journal of Economics*, 130(2):759–803

Jackson, C. K., Johnson, R. C., and Persico, C. (2016). The effects of school spending on educational and economic outcomes: Evidence from school finance reforms. *The Quarterly Journal of Economics*, 131(1):157–218

#### 4. Regression discontinuity

Saez, E., Matsaganis, M., and Tsakloglou, P. (2012). Earnings determination and taxes: Evidence from a cohort-based payroll tax reform in Greece. *The Quarterly Journal of Economics*, 127(1):493–533

Card, D., Dobkin, C., and Maestas, N. (2009). Does medicare save lives? *The Quarterly Journal of Economics*, 124(2):597–636

There is no required textbook. The following are some **suggested textbooks**, if you want to read more:

- Angrist, J. D. and Pischke, J. S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

This is a paperback and cheaper than most textbooks. Also, it is named after “Mostly Harmless,” which is “the fifth book in the increasingly inaccurately named Hitchhikers Trilogy” by Douglas Adams.

- Angrist, J. D. and Pischke, J.-S. (2014). *Mastering metrics: The path from cause to effect*. Princeton University Press.

This book reviews the same material as “Mostly harmless” at a more introductory level.

- Imbens, G. W. and Rubin, D. B. (2015). *Causal inference in statistics, social, and biomedical sciences*. Cambridge University Press.

This is a more advanced up-to-date book on causal inference.

- Goldberger, A. S. (1991). *A course in econometrics*. Harvard University Press.

This is an older textbook which has a nice exposition of the material for the first part of class in its initial chapters.