

Econometrics (MSc)

Version 15-9-2024, 21:29

Class Schedule

Lecture:

Mon 10:15 - 12:00 (Vesalianum, Grosser Hörsaal EO.16)

Thu 10:15 - 12:00 (Pharmazentrum, Hörsaal 1)

Exercise sessions:

During lecture time. Will be announced as we go ahead.

Your Teacher

Prof. Dr. Kurt Schmidheiny

Universität Basel

Peter Merian-Weg 6, Office 5.55

kurt.schmidheiny(at)unibas.ch

Office Hours: Tuesday afternoon by appointment per email

Teaching Assistant:

Düzgün Dilsiz

Universität Basel

d.dilsiz(at)unibas.ch

Course Homepage

There is a course homepage with slides, handouts and additional readings:

<http://www.schmidheiny.name/teaching/unibas/econometrics/>

(username: unibas; password:)

Introduction

Most widely used econometric tools:
OLS, IV, 2SLS, FE, RE, Probit

- What is it?
- How are they used?
- When can they be used?
- When can they not be used?
- What can go wrong?

Heterogenous Backgrounds

Some of you ...

- ... have taken several courses in econometrics
- ... have only taken basic statistical courses

- ... very much like mathematics
- ... very much like getting results

- ... have performed sophisticated own empirical projects
- ... have never (really) run a regression

Challenge of this course: Heterogeneity

This is a very large class with students from very different backgrounds and with very different goals.

Heterogenous Goals

Some of you ...

- ... want to do empirical research in their PhD
- ... want to a purely theoretical PhD

- ... want to use quantitative analysis in their work,
e.g. consultants, traders, financial analysts
- ... want to become deciders

- Some disappointment is inevitable.
- ⇒ I want to challenge all of you in some dimension.
- ⇒ You will be able to (partly) choose the formal level.

Outline

1. Causal effects and the logic of randomized experiments
2. Linear regression:
Estimation, small and large sample properties, hypothesis testing, omitted variable bias, model selection, functional form
3. Robust inference in the linear model:
heteroscedasticity and clustering
4. Instrumental variable estimation:
Estimation, identification, weak instruments
5. Panel data: Fixed effects, random effects
6. Binary choice: probit and logit

Companion Course

Advanced Econometrics

Thursday, 14:15-16:00 (WWZ S13/S9/S14)

by Prof. Schmidheiny

1. Elements of matrix algebra: basic operations, trace, rank, inverse, eigenvalue and spectral decomposition
2. Elements of probability theory: random variables, joint, conditional and marginal distribution, expected value and other moments, change of variables
3. Elements of statistics: point estimation, interval estimation, hypothesis testing, large sample theory

Outline

- + Data generating process and Monte Carlo
- + Sampling distribution and asymptotic properties
- + Maximum likelihood estimation

Companion Course (cont.)

4. The algebra of the multivariate linear regression: degrees of freedom, Gauss-Markov theorem, Frisch-Waugh-Lovell theorem
5. The algebra of instrumental variable estimation
6. The algebra of basic panel data methods: within and between transformation, testing for unrelated effects under non-spherical disturbances
7. Maximum Likelihood Estimation
8. Binary choice as an example of deriving estimators and their properties using maximum likelihood

This course deals (mainly) with observational data

This course deals with Data which is non-experimental, i.e. not from experiments

- Data from surveys, public records, accounting, ...
- Traditional approach of econometrics
- Prevailing in empirical literature
- Widely used in current research

But experiments become more and more important.

Level of the course

The level of this course is *between introductory and advanced* textbooks.

It is introductory concerning ...

- ... most of its topics
- ... its mathematical rigor (limited use of matrices)

It is advanced concerning ...

- ... some of its topics
- ... its mathematical rigor (we do some proofs)
- ... the applications

Level of the course (cont.)

“Econometrics”

+ “Advanced Econometrics”

= Really “Advanced Econometrics”

Prerequisites

I assume that you took an *introductory course in statistics/econometrics*.

In particular, you need to know basics of *probability*

- discrete and continuous random variables
- probability density function, cumulative distribution function
- expected value, $E(\cdot)$, variance, $V(\cdot)$, covariance
- rules about them

⇒ Read Stock/Watson, section 2.1-2.4

And basics of *statistics*

- estimation of mean
- standard error, confidence intervals
- hypothesis testing, t-test, p-value

⇒ Read Stock/Watson, section 3.1-3.7

Advanced textbooks

- ▶ Cameron, A. Colin and Pravin K. Trivedi (2005)
Microeconometrics: Methods and Applications
Cambridge University Press
- ▶ Wooldridge, Jeffrey M. (2002)
Econometric Analysis of Cross Section and Panel Data
MIT Press

Introductory textbooks

- ▶ Stock, James H. and Mark W. Watson (2020)
Introduction to Econometrics, 4th Global ed.
Pearson
- ▶ Wooldridge, Jeffrey M. (2009)
Introductory Econometrics: A Modern Approach, 4th ed.
Cengage Learning
- ▶ Wooldridge, Jeffrey M. (2014)
Introduction to Econometrics, 5th ed.
Cengage Learning EMEA
(Identical content as 2009 but no appendices)

Companion textbooks

- ▶ Angrist, Joshua D. and Jörn-Steffen Pischke (2009)
Mostly Harmless Econometrics: An Empiricist's Companion
Princeton University Press
- ▶ Kennedy, Peter (2008)
A Guide to Econometrics, 6th ed.
Blackwell Publishing

Handouts

There are handouts for all topics of the course.

These handouts are ...

- ... very brief
- ... not self-contained
- ... intended to be a useful companion for your life after this course
- ⇒ You will *absolutely need* to work with one or more textbooks
- ... most handouts will come in two versions:
with use of matrices and without

Handouts

Short Guides to Microeconomics
Fall 2024

Kurt Schmidheiny
University of Basel

The Multiple Linear Regression Model

1 Introduction

The multiple linear regression model and its estimation using ordinary least squares (OLS) is doubtless the most widely used tool in econometrics. It allows to estimate the relation between a dependent variable and a set of explanatory variables. Prototypical examples in econometrics are:

- Wage of an employee as a function of her education and her work

Handouts

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The Multiple Linear Regression Model

matrix-free

1 Introduction

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Matrices or NO matrices?

How should you choose the formal level of this course?

- You can pass the exam with or without matrices. You may not reach to maximum number of points. But almost.
- ⇒ Choose your level based on your background and/or ambition
- Only choose matrices if you feel comfortable with them. Spend your time on the *econometrics* and not on the *mathematics*.
- Choose *matrix-free* if you just want to pass this exam.
- Choose matrices if you want to continue with Time Series Analysis I/II or Microeconomics I/II.

Statistical Software

- We will use *R*
- Handouts provide *R* and *STATA* code
- We assume you are familiar with some statistical software

Alternative:

- Use another statistical package.
For example, *STATA*
- Please check with me if it covers all methods we use.

Online Tests

There will be an online test for each problem set.

- They have to be completed before the discussion in class
- They will be graded on a pass / fail basis
- You must pass at least 5 out of the 8 online tests in order to be allowed to the final exam

Note:

- The questions in the online test are different from the questions in the problem set.
- The online test is a good preparation for the problem set.
- The questions in the online tests are generally easier than the exam questions.

Problem Sets

There will be 8 problem sets.

- They will *not* be graded
- You don't have to hand them in
- They will be discussed by the teaching assistant in dedicated lectures during the usual time slots.

Note:

- It is in your own interest to do the problem sets seriously
- The problem sets are *key* for your understanding
- They are very important for the exam
- Doing the problem sets in groups can considerably increase their value added

Exam

There will be a final exam in January

- Part with Multiple Choice questions
- Part with open question based on output from statistical software
- No proofs.