ECON-L1350 - Empirical Industrial Organization PhD I: Static Models

Lecture 1

Otto Toivanen

Teachers

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Objectives of these lectures

By the end of these lectures, you

- understand what structural econometrics means,
- know how to model demand in differentiated goods markets using both market- and individual level data,
- know how to model supply in an imperfectly competitive market, and
- know how to conduct a merger analysis.

Schedule

- Mon Jan 15 & 22, U006: Otto Toivanen
  - Logit and nested logit, (welfare, interpretation of parameters, market & individual level data)
  - Exercise 1 (logit, nested logit), due Feb 1
- Mon Jan 29 & Feb 5, U006: Tanja Saxell
  - The BLP demand model
  - Exercise 2 (BLP), due Feb 29
- Mon Feb 12 & Feb 26, U006: Otto Toivanen
  - Reading group / paper TBA
  - Supply side
  - Exercise 3 (simulated data), due March 14

Schedule

- Mon March 4 & 11, T003: Iivo Vehviläinen
  - Market power, merger analysis, Iivo Vehviläinen
  - Exercise 4 (merger simulation), due March 28
- Mon March 18 & 25, T003: Ari Hyytinen
  - Identification, optimal instruments (Berry & Haile, market & individual level data)
  - Outside good: definition, estimation, ...
  - No exercise
- Mon April 8, T003: Otto Toivanen & April 15, T003: Tanja Saxell
  - Consideration sets (Otto)
  - Pass-through analysis (Otto)
  - Choice frictions (Tanja)
  - Other firm decisions (Tanja)
  - No exercise

About the course

- This is a PhD level course. That means the following things:
  - We take the prerequisites as given.
  - The work load of the course is substantially higher than in MSc courses.
  - The exercises will be more difficult than in the MSc courses.
  - You are expected to prepare for the lectures by reading the compulsory material in advance.
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  - 2 hours of paying attention during the lecture
  - 3 hours of post-lecture work trying to understand what it all really was about.

Materials for the course

- Lectures and lecture notes.
  - We build, with permission, on the lectures of Phil Haile (Yale) and Chris Conlon (NYU) + others.
- Reading list.
- Exercises.
- Videos: Chris Conlon (NYU), AEA / Phil Haile.

What this course is not about

- Compared to many other IO PhD courses, we do not start by
  1. talking about the development of the field (SCP, NEIO, ...).
  2. covering homogenous goods demand and supply.
- For these, see Chris Conlon's lecture materials and videos and/or refer back to Jiekai Zhang's MSc IO course at Helsinki GSE.
- For these, also check the Schmalensee and Bresnahan Handbook chapters (see reading list).

About today's lecture

- Today's lecture is a warm-up lecture. We discuss
  1. Definition of econometrics.
  2. What is structural econometrics.
  3. What is a reduced form model.
  4. Marshak's Maxim.
  5. Different approaches to modeling demand.

1. Definition of Econometrics

Econometrics: *A branch of economics in which* ***economic theory*** *and statistical methods are fused in the analysis of numerical and institutional data*", Hood, W. & Koopmans, T. (1953). Studies in econometric method. *Cowles Commission Monograph no. 14, Wiley*.

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2. Ingredients of a structural model

- A **structural (econometric) model** combines a theoretical model with a statistical structure and delivers (combinations of) **structural parameters** which have an interpretation within the model.
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- **Structure = economics & statistics.**

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- Generally:

1. Well-defined economic model.
2. Sufficient stochastic structure.
3. Adequacy of the model as a description of the data.

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5. An equilibrium concept.

2. The stochastic model

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1. What is a plausible description of reality?
2. Is the stochastic specification consistent with what is observed?
3. Is the stochastic specification consistent with the model? (who observes what when).

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1. What the researcher does not know.

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- The stochastic model must be able to rationalize all possible realizations of the endogenous variables.

2. The stochastic model & estimation & testing

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1. Functional form assumptions.
2. Distributional assumptions.
3. Estimation technique.
4. Specification / out-of-sample tests.

3. Definition of a reduced form model

- **Definition**. A **reduced form** is a functional or stochastic mapping for which the inputs are
  1. **exogenous** variables and
  2. unobservables ("structural errors"),
- The outputs of a reduced form model are **endogenous** variables. e.g., $Y = f(X, Z, U)$.

3. Definition of a reduced form model

- What does **exogenous** mean here?
- It can mean different things:
  1. For a theorist, all those things not determined within the model
  2. For an econometrician, exogenous variables need to satisfy some **independence** condition.
- These can be different!

3. Definition of a reduced form model

- A reduced form model implies that a structural model exists.
- This may or may not have implications on the functional forms used for the reduced form model (e.g. semiparametric).
- A reduced form model can be used for counterfactuals.
- **Requirement**: The mapping from exogenous variables (incl. error terms) to endogenous variables is invariant to the counterfactual.

3. Definition of a reduced form model

- Demand and supply example.

3. Definition of a reduced form model

- Lesson from the example: It is hard to think of what the unobservables in your regression equation are (what economic role, what statistical role they play) if you do not have a model in mind.
- From this point of view, it is unfortunate we call them "errors"; this does not give license not to think about their content!
- Note, model does not have to mean a mathematical model, but often that would be helpful (can be deceiving, too).

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- This may (greatly) reduce the number of assumptions needed.
- Marschak's Maxim helps bridge the gap between different approaches.

5. Different approaches to modeling differentiated goods demand

- Taxonomy of demand systems.
  1. Representative consumer vs. heterogenous agents.
  2. Discrete choice vs. continous choice.
  3. Single vs. many products.
  4. Product space vs. characteristics space.
- Note: For homogenous goods demand, see Lecture 1 of Chris Conlon (NYU) and e.g. Genesove and Mullin (1998).

5. Different approaches to modeling differentiated goods demand

- Data.
  1. Individual level data. Who bought what, where and when.
  2. Aggregate data: market shares and prices for each good in a given market in a given period.
  3. Sometimes a combination of both, e.g., aggregate data + survey data.

5. Different approaches to modeling differentiated goods demand

- Starting point: consumers value different goods available to them differently.
- How to model?
- First, let's label the goods $j = 1, ..., J$.
- **Note**: We will start with approaches using market level data, then go to individual level data, only to go back to market level data.

5.1 The product space approach

- **The product space (goods) approach**: We write down a model for each of the goods.
- Let's take the simplest model, i.e., constant elasticity of demand.
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  2. possible demand shifters $\boldsymbol{x}$;
  3. its own price p_j; and
  4. the prices of all the substitutes.

5.1 The goods approach

$$\begin{aligned} \ln q_1 &= \alpha_{10} + \alpha_{11} \ln y + \alpha_{12} \ln p_1 + ... + \alpha_{1J} \ln p_J + \boldsymbol{x'}\boldsymbol{\beta_1} + \epsilon_1 \\ &\cdot \\ &\cdot \\ &\cdot \\ \ln q_J &= \alpha_{J0} + \alpha_{J1} \ln y + \alpha_{J2} \ln p_1 ... + \alpha_{JJ} \ln p_J + \boldsymbol{x'}\boldsymbol{\beta_J} + \epsilon_J \end{aligned} \tag{1}$$

5.1 The goods approach

- What about those consumers that choose none of the products? (substitution in and out of the market).
- Number of parameters: $J(J + 2 + M)$, where M = number of demand shifters.
- Very large number of price elasticity parameters (J^2).
- Need J instruments (collinearity of them an issue...).
- Question: What if you want to study the effect of introducing a new good?
- Finally: This may be a very suitable approach, depending on the data and the research question.

5.1 The goods approach

- Ways to deal with the problems:
  1. Hicks composite commodity theorem. Not useful here as it assumes away differential price movements.
  2. Multilevel budgeting, Gorman polar forms = representative consumer, Dixit-Stiglitz (CES) preferences, Almost Ideal Demand System.
  3. See Chris Conlon's slides + video, lecture 2.

5.2 The characteristics approach

- Goods are treated as bundles of **observed** and **unobserved** characteristics.
- Note, price is a characteristic (which is potentially endogenous in a way to be specified).
- Consumers have preferences over these bundles.
- Then we apply consumer theory, i.e., discrete choice models.