— As you arrive:

1. Make yourself a namecard with your preferred name (materials up front). (Please keep this and bring it back to for every subsequent lecture.)

2. Answer question on `PollEv.com/ECON7510`. Please no Googling or discussing—I want to know what you think. (It's anonymous.)

Lecture 1: Introduction

ECON 7510
Cornell University
Adam Harris

Slides draw upon lecture materials from Nikhil Agarwal (MIT).

Today's lecture

1. Introductions and course details
2. Industrial organization: Definition and history
3. Overview of theory of the firm

Introduction to ECON 7510

Introductions

Getting to know me:

- Research: IO methods $\rightarrow$ questions in transportation economics and the economics of AI
- Preferred name: Adam

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Getting to know you:

1. Your preferred name
2. Your program and year
3. Something about your research interests and why you wanted to take the course / what you hope to get out of the course

Introductions

What experience do you come into the course with?

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- — Have you solved dynamic programming problems numerically?

Course logistics

- Instructor office hours
  - Uris Hall 436.
  - By appointment. See syllabus for details and Calendly link.

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- Requirements
  - Assignments (30%):
    - Five problem sets with empirical exercises and conceptual questions.
    - Please turn in problem sets and code and output via Canvas.
    - Coding in python, julia, or R strongly encouraged.
    - You are encouraged to collaborate; groups can be as large as 3. Please list collaborators.
  - End-of-term assignment (in-class presentation or written) (30%): Either a review of a recent IO/structural paper or a proposal for a research project.
  - Class Participation (10%)
  - Final exam (30%): In-class November 16 and November 18.

Course guidelines and expectations

Two principles:

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   - Lectures—questions and discussion encouraged.

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   - Choice of topics on final.
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2. **"Be curious, not judgmental."**
   - Lectures—questions and discussion encouraged.
   - We want to cultivate an environment where everyone can participate, ask questions, and learn
     → Please don't hold yourself back from participating!

Overview of Topics

Theme: Fundamental tools of industrial organization

- **Part 1**: Fundamental IO theory
  1. Theory of the firm; producer theory
  2. Monopolies: Pricing; product quality/choice
  3. Price discrimination
  4. Competition: Static; dynamic
  5. Market entry
- **Part 2**: Computational building blocks
- **Part 3**: Estimating demand systems
- **Part 4**: Estimating single-agent dynamic discrete choice models

Industrial organization: Definition and history

Industrial organization

Question: What is industrial organization?

Industrial organization: Traditional definition

Industrial organization is the study of imperfectly competitive markets.

- How do firms behave, and what are the consequences for welfare?

  (What determines the incentives of the firm?)

  - Demand conditions
  - Cost conditions – Production
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- Which policies, market rules should we adopt?
  - Antitrust policies
  - Regulation of concentrated industries
  - Market Design
  - Intellectual property

History of the field

1. Prior to 1980s: Structure-conduct-performance (SCP) empirical research
2. 1980s: Developments in theoretical IO
3. 1990s-present: New Empirical IO (NEIO)

Historical Perspective: Pre 1980

Schmalensee (1986): critical overview in Handbook of IO

- SCP: Structure - Conduct - Performance (Bain 1951, 1956)

- **Structure:** Inherent characteristics of the industry
  - Product type (demand)
  - Production technology (supply)
  - Number of firms (competitive environment)
  - Concentration (market power)
  - Entry barriers (fixed costs)
- **Conduct:** Firm behavior
  - Investment, innovation, pricing, advertising ...
- **Performance:** Positive or normative outcomes
  - Profits, welfare, entry, exit, R&D

SCP Paradigm

Cross-industry regression

- Study how structure $\Longrightarrow$ conduct $\Longrightarrow$ performance
- ✓ Difficult to observe conduct: focus on structure $\Longrightarrow$ performance
- Cross-industry regression analysis:

$$
\begin{aligned}
r_i &= \beta_0 + \beta_1 H_i + \beta_2 BE_i + \beta_3 (H_i \times BE_i) + \varepsilon_i \\
\text{where} \quad & \quad i \text{ is industry (4 digit SIC)} \\
r_i &= \text{ROR on capital (closely related to profits)} \\
H_i &= \sum_j s_{ij}^2 \text{ is HHI (a measure of concentration)} \\
BE_i &= \text{Entry barriers such as fixed costs, min efficient scale}
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- Assume markets in long-run equilibrium

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- Assume markets in long-run equilibrium
- → Do you have any concerns about this regression?

Issues with SCP

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Practical issues

1. Poor data
   - Accounting profits and costs are not economic profits/costs
   - Cross-industry analysis $\implies$ use data common to all industries (worst data)
2. Is 4-digit SIC the correct level of aggregation?
   - SIC code 2024 is ice cream and frozen desserts
   - SIC Code 7372 is prepackaged software

Policy relevance?

3. How do we measure consumer welfare?
   - Typical objective of antitrust authorities
4. Little to say about mechanisms (conduct)
   - Cannot guide public policy

Econometric issues

5. Endogeneity and reverse causality
   - Conduct may affect structure
   - Omitted variables

Example

Concentrated industries have few firms and high profits

- Two equally plausible explanations
  1. Market power has led to high prices
  2. Efficient firms may have driven away inefficient firms

→ Matters for public policy

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- Nevertheless, SCP literature was useful in establishing empirical regularities that spurred the theoretical literature to follow.

Theoretical IO: 1980s

(Part 1 of the course)

Approach and broad lessons (see Tirole's book)

- Game theoretic models of firm behavior

→ Rich set of results explaining a wide range of phenomenon

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Approach and broad lessons (see Tirole's book)

- — Game theoretic models of firm behavior
- → Rich set of results explaining a wide range of phenomenon
- → **A key takeaway**: Details of the specific market matter
  - ✓ Classic example: Investment could accommodate or deter entry depending on strategic effects (Fudenberg and Tirole, 1984)
  - — Conundrum for public policy
- — Tirole's Nobel lecture consequently calls for policies that pays attention to "specificities of particular industries"
  - ✓ Underlying theme: Heterogeneity across industries

New Empirical IO: 1990s - Present

(Parts 3-4 of the course)

Tirole's Nobel citation: "theoretical advances fundamentally affected the empirical IO literature"

- Theoretical literature offered:
  - Several explanations for similar observations
  - A basis for building empirical models
  - An understanding of important mechanisms
- Empirical Revolution
  - Focus on narrowly defined industries (heterogeneous effects)
  - Close attention to theory
    1. Deriving testable hypotheses
    2. Interpreting the data (structural modeling)
  - Greater emphasis on
    1. Strategies (conduct)
    2. Quantifying welfare, economic costs, profits (performance)
    3. Counterfactual simulations (policy)

New Empirical IO Approach

- Phrase a question in terms of a counterfactual
  - ✓ What will happen if Union Pacific and Norfolk Southern merge?
  - Only data available is from a world where these are separate entities
- Approach: build the primitives of the model
  - Demand and Supply
  - Interaction between insurers and pharmacies
- Estimate a model: attention to data limitations and institutional details, e.g.
  - Prices negotiated between railroads and their customers might only be selectively observed.
- Simulate a counterfactual world and analyze outcomes of interest
  - Factual world: Competitive price setting and negotiations
  - Counterfactual: Joint price setting, considerations about pricing to competitors
  - ✓ Consumer welfare, profits, bargaining with upstream firms etc.

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Example: Use NEIO approach to study what would happen if Ford and GM merged.

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   - Consumer surplus
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   With further extensions to the model, we can also analyze longer-run effects:

   - Investment, innovation (of both merged firm and other firms)
   - Entry of new firms

New Empirical IO

Question: Am I an IO economist?

New Empirical IO $\rightarrow$ Structural empirical research

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Insight: The NEIO approach was developed to answer questions about imperfect competition, but it's actually much more widely applicable.

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Examples (all recent job market papers):

- How do out-of-district campaign contributions distort the positions of Congressional candidates? (Waldfogel 2025)
- What would be the effects of reforming the structure of real estate agent commissions? (Kim 2025)
- Why do developing economies feature so many small firms? (Ramos and Sverdlin-Lisker 2022)
- How can policymakers effectively incentivize the development of combination therapies for treating cancer (Dix and Lensman 2025)
- How can policymakers design mechanisms to incentivize conservation in a cost-effective way? (Aspelund and Russo 2025)

A Broader Definition?

- “Industrial Organization" may be too narrow to describe the modern IO field
- Perhaps “Market Organization" is better?
  - Analysis of market rules and structure
  - Behavior, incentives and payoffs of agents
  - Effects of policies and government interventions
- But even that might be too narrow. The field has become closely linked to a set of tools that are useful even in non-market contexts.
- Imperfect competition, antitrust, and regulation = “core IO”

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  - (b.) Monopolies: Pricing; product quality/choice
  - (c.) Price discrimination
  - (d.) Competition: Static; dynamic
- **Parts 2-4**: Fundamental tools of structural estimation **(Broadly applicable empirical tools)**
  2. Computational building blocks
  3. Estimating demand systems
  4. Estimating models of single-agent dynamics

What does “structural” mean?

Reduced-form approach

Reduced form: Model relationships among *observables*.

- *Example*: Suppose Y is (log) hourly earnings, X is years of education. Model relationship as

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + W'\gamma + \epsilon$$

Possible identifying assumptions:

- $\mathbb{E}[\epsilon \mid X, W] = 0$, or
- $\mathbb{E}[\epsilon \mid Z, W] = 0$ and $\text{Cov}(Z, X \mid W) \neq 0$

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- Suppose one of these sets of assumptions is satisfied and so we can estimate β, γ. What *counterfactual* questions can we answer?

Structural approach

What we might want but can't achieve using reduced-form alone

- Counterfactual analysis
- Welfare estimates
- Estimate treatment effect when good instruments/time stagger not available

Theory of the firm: A brief overview

The Neoclassical view

MWG: A black box.

- Defined by some technology $Y \subset \mathbb{R}^L$.
- Chooses $y \in Y$ so as to maximize profit.

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Question: This is a useful description, but what key questions does it sidestep?

- Wait, but actually, what *is* a firm?
- Why does the firm exist?
- What determines Y?
- What determines the firm's boundaries?

What is a firm? What determines its boundaries?

Tirole's perspective

NB: This is question that is more often tackled by organizational economics rather than IO.

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→ i.e., the firm exists because producing *within the firm* is cheaper than producing without.

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Three perspectives:

1. *Technological view*: Static synergy
2. *Contractual view*: A long-term relationship
3. *Regulatory arbitrage view*: e.g., firm is loophole for the exercise of monopoly power

What is a firm? What determines its boundaries?

Technological view

- If there are increasing returns to scale, having production concentrated in a smaller number of firms may be more efficient.
- “Economies of scale encourage the gathering of activities."
- When output is higher:
  - Workers can be more specialized.
  - More machines $\rightarrow$ lower proportional variance in output due to breakdowns.
  - Avoid duplication of fixed costs.

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Contractual view

- Key ideas: Idiosyncratic investment and asset specificity.

→ Want *ex ante* assurance that future gains from trade will be exploited and shared.

- *Example*: Specific human capital. More efficient to work on the same task / with the same team every day.

- *Example*: Site specificity. Mine-mouth power plant.

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- *Example*: Price of intermediate good set by government

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  - Monetary incentives, e.g., distorting short-term vs long-term tradeoff
  - Growth for its own sake (prestige, ego, power, etc)
  - Mislead about technology to take pressure off
- To combat this, shareholders may try to monitor manager performance or put limits on managerial discretion. But all of these approaches are imperfect.
- These are important issues. But are they ones that we as IO economists have to grapple with? Or is assuming profit maximization “good enough”?

What do firms do?

Is the assumption of profit-maximization "good enough"?

1. Yes, if internal organization issues and product-market/input-market choices are approximately "separable".

   Example: Manager chooses q, e.

   $$\Pi = P(q)q - c(e, \epsilon)q$$

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   So firm's choice of quantity is *observational equivalent* to that of a profit-maximizing firm. The fact that $\tilde{c} > c^*$ is sometimes referred to as *X-inefficiency*.

What do firms do?

Is the assumption of profit-maximization "good enough"?

2. Regardless, it is a necessary assumption.
   - — As with any modeling choice, there's a realism-versus-tractability tradeoff.
   - — If we want to make progress/derive theoretical predictions about important IO questions—e.g., antitrust policy, innovation, regulation, etc.—we can't also tackle the intra-firm incentives.
   - → Let's leave the internal principal-agent issues to the organizational economists.

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MWG (p.127): "The firm is viewed merely as a "black box", able to transform inputs into outputs."

Next time

1. Review of producer theory from ECON 6090

2. Monopoly pricing