

# Lecture 1: Introduction to IO and computational methods

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ECON 4620

Cornell University

Adam Harris

As you arrive:

1. Make a name card.
2. Connect to Poll Everywhere:  
[PollEv.com/econ4620](https://PollEv.com/econ4620)

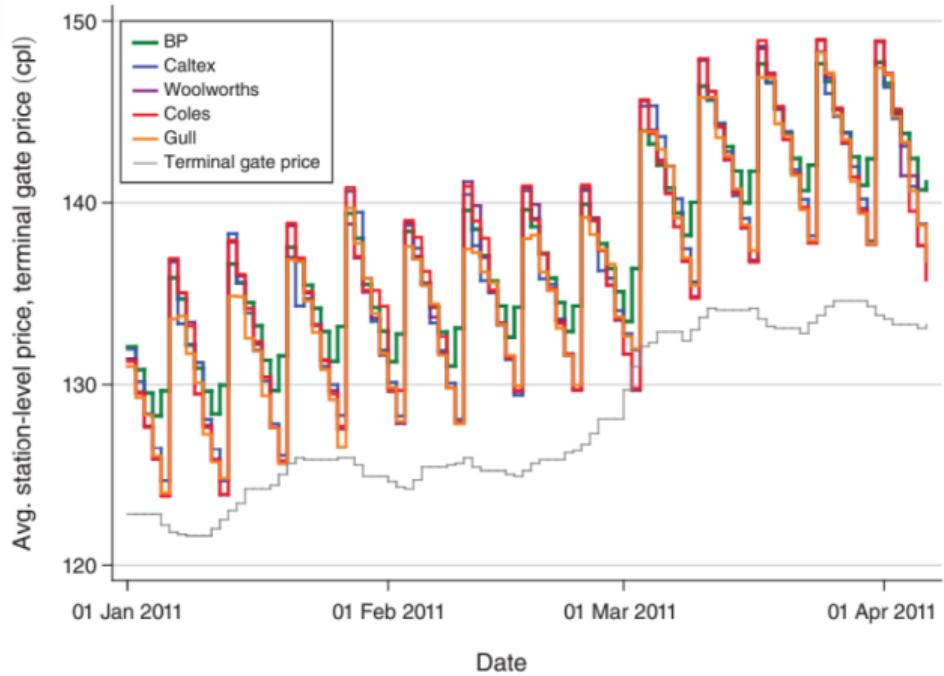
# What is industrial organization?

Respond on Poll Everywhere

# Which type of gasoline does Shell want you to buy?



# Retail gasoline prices in Perth, Australia



Byrne and de Roos (2019)

Real-world markets are **imperfectly competitive**.

# Another example

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19 VIDEOS



Roll over image to zoom in



## Crayola Ultimate Crayon Box Collection (152ct), Bulk Kids Crayon Caddy, Classic & Glitter Colors, Coloring Book Supplies, Gift for Kids

[Visit the Crayola Store](#)

4.8 18,080 ratings | [Search this page](#)

Amazon's Choice Overall Pick

3K+ bought in past month

-6% \$16<sup>97</sup>

List Price: \$17.99

[Two-Day](#)

[FREE Returns](#)

Pay \$16.97 \$0.00 after using available Amazon Visa rewards points.

Pattern: [Coloring Set](#)

**Brand** Crayola

**Writing Instrument** Crayon

**Form**

**Color** Multicolor

**Ink Color** Multicolor

**Age Range (Description)** Kid

One-time purchase:

\$16<sup>97</sup>

[Two-Day](#)

[FREE Returns](#)

FREE delivery **Wednesday, January 22**. Order within **13 hrs 37 mins**

[Shorter shipping distance](#)

[Deliver to Adam - Spencer 14883](#)

In Stock

Quantity: 1

Add to Cart

Buy Now

Ships from Amazon.com  
Sold by Amazon.com  
Returns 30-day refund/replacement  
[See more](#)

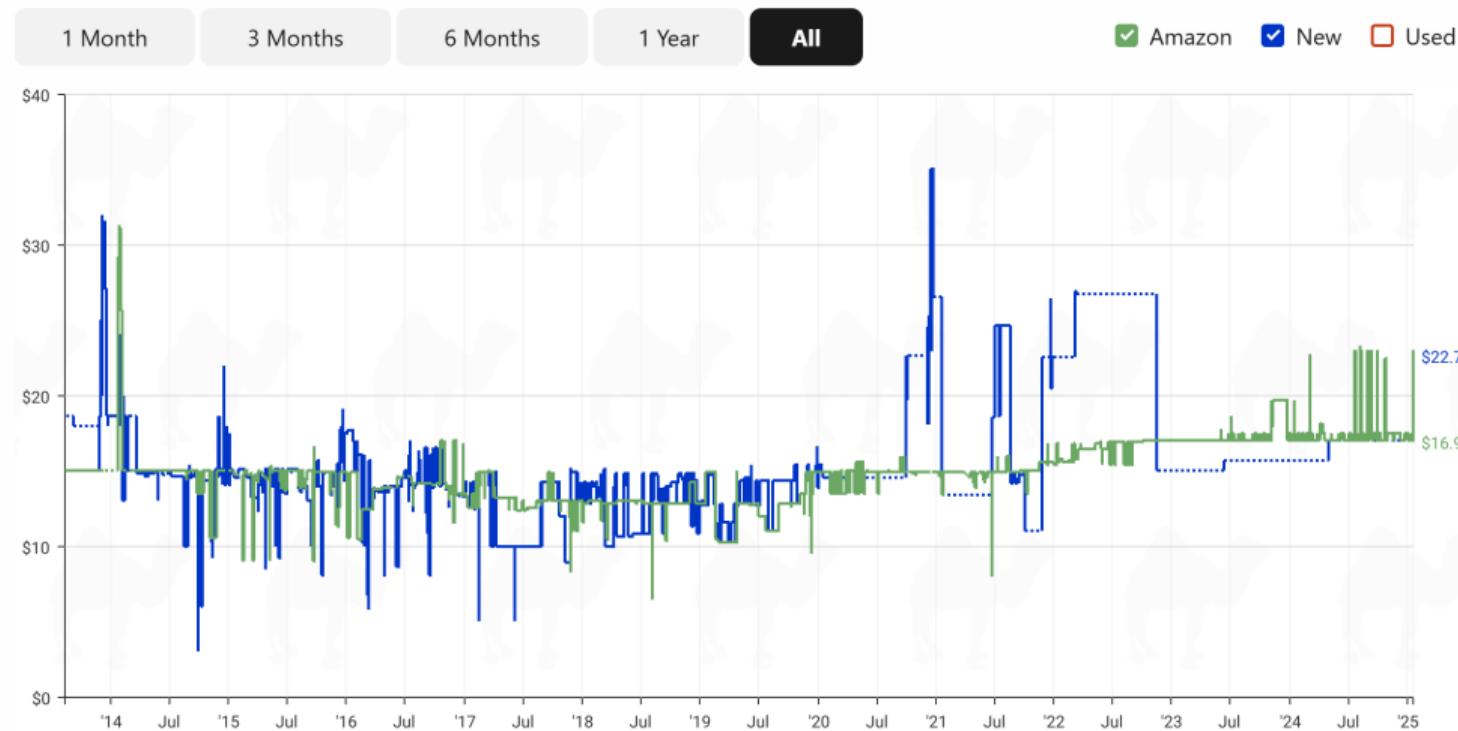
Customer service Amazon.com

Add a gift receipt for easy returns

# Another example

## Amazon Price History

This is our record of Amazon price changes for Crayola Ultimate Crayon Box Collection (152ct), Bulk Kids Crayon Caddy, Classic & Glitter Colors, Coloring Book Supplies, Gift for Kids (B00CI6J3HA) since we began monitoring it on Aug 14, 2013.



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# Industrial Organization

The study of **imperfect competition** between firms.

IO theory can help us understand

- how firms make strategic pricing and product choices;
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All of this can help inform

- antitrust policy;
- environmental policy;
- innovation policy; and more....

# Another example

## *OpenAI Is Growing Fast and Burning Through Piles of Money*

As the company looks for more outside investors, documents reviewed by The New York Times show consumer fascination with ChatGPT and a serious need for more cash.



The chief executive of OpenAI, Sam Altman, center, is pitching an investment round that could value the start-up at \$150 billion. Bryan R. Smith/Agence France-Presse — Getty Images

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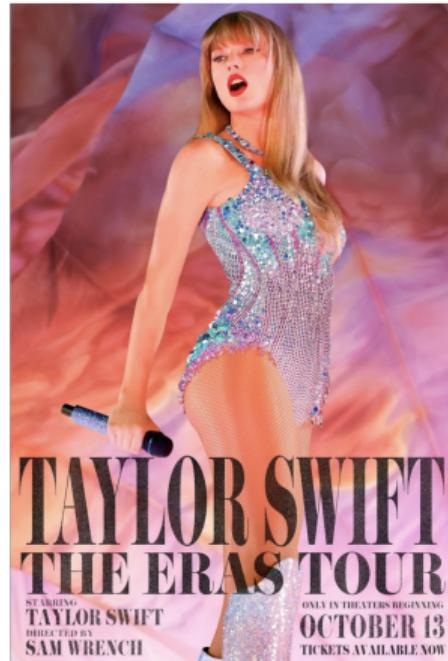
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Real-world markets are **dynamic**. Other examples: Reputation, durable goods, entry deterrence....

## Another example: Why were Eras Tour tickets so cheap?



### TAYLOR SWIFT THE ERAS TOUR

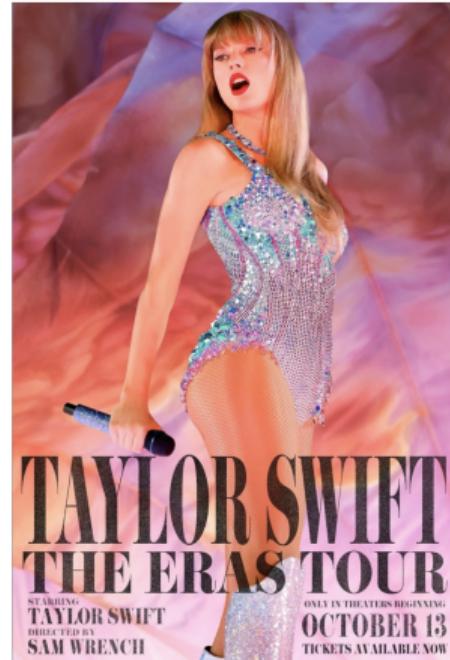
STARRING  
TAYLOR SWIFT  
DIRECTED BY  
SAM WRENCH

ONLY IN THEATERS BEGINNING  
OCTOBER 13  
TICKETS AVAILABLE NOW

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- November 2022: Ticketmaster crashed, tickets being sold in secondary market for \$10,000+.



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THE ERAS TOUR**

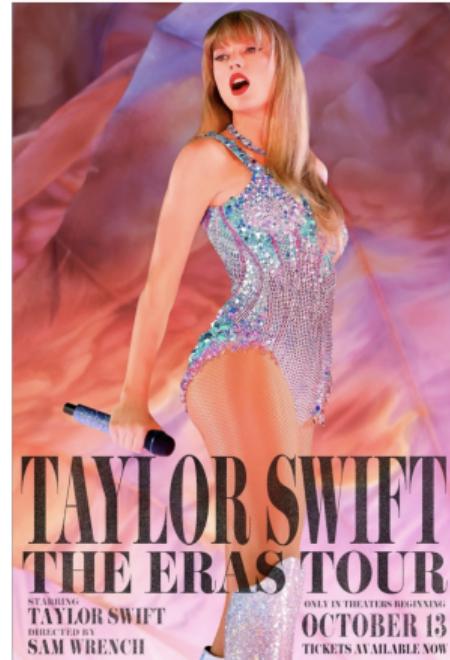
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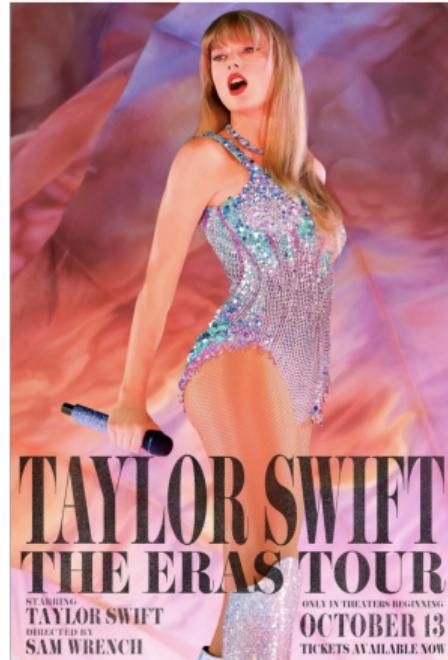
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  - **Rationing** is not a typical feature of markets.
- Why weren't prices set higher?



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# The tools of Industrial Organization

1. Game theory → Explicitly model competition and dynamics
2. Optimization
- 3.

## Yet another example: Airline pricing

Dynamic pricing algorithms respond in real time to:

- Time before departure
- Seats available
- Competitor pricing
- Demand spikes:
  - Holidays or weather disruptions, etc
  - Real-time search data (tens of millions of flight searcher per day)
- Price discrimination: Targeting leisure vs. business travelers.

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  - Simulation of **counterfactuals**. For example, antitrust authorities do *merger simulations*.
  - In this course, we’ll be working in Python.

# Outline of course topics and tools

1. **Monopoly pricing**—Numerical optimization
2. **Dynamic choices**—Dynamic programming
3. **Competition**—Basics of computational game theory

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In all three cases, we'll be using tools that are useful outside of IO and outside of economics.

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- Setting expectations

## Review of pre-semester assignment

## Monopolist's pricing problem

### Linear demand curve

A firm sells a monthly software subscription. The demand curve describing the number of subscriptions sold as a function of the monthly price  $p$  is

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## Monopolist's pricing problem

### Network effects

Now suppose the software has **network effects**. The more users the software has, the more utility each consumer gets from using it. The demand curve describing the number of subscriptions sold as a function of the monthly price  $p$  is

$$Q = 100000 - 5000p + 1000 \log(Q + 1)$$

The firm's marginal cost is zero. What is the firm's profit-maximizing choice of  $p$ ?

Next time

Theory of monopoly pricing