Econ 201: Introduction to Economic Analysis

October 12 Lecture: Oligopoly and Models of Strategic Interaction

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Daily dose of The Far Side

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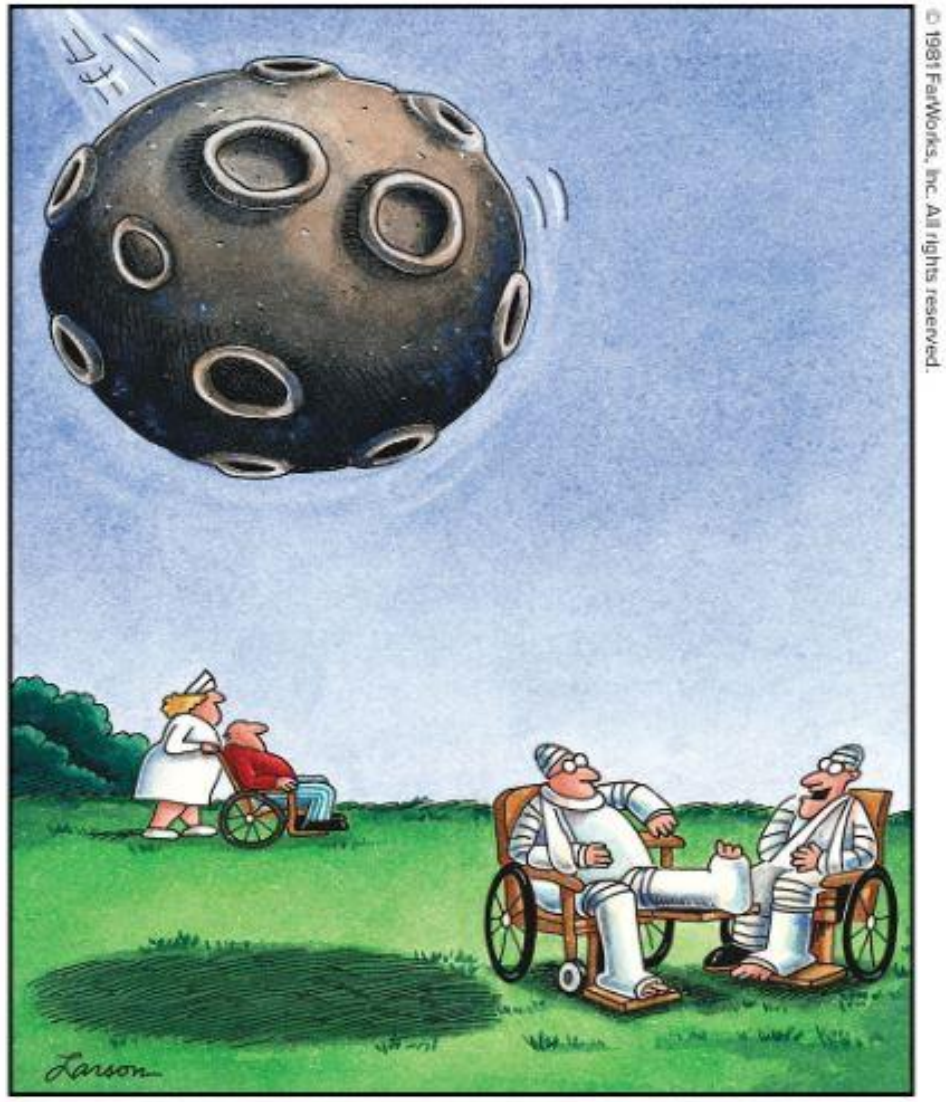


"You're kidding! I was struck twice by lightning too!"

Preview of this class session

- **Oligopoly**: few firms with strategic interaction
- **Game theory** and Nash equilibrium
- **Collusion** and cartels
- Some important models of strategic interaction
  - Cournot model
  - Stackelberg model
  - Bertrand model

Nature of oligopoly

- Few firms; some large enough to affect market price
- Barriers to entry allow some economic profits in long run
- Product can be homogeneous or differentiated
- Key feature: **strategic interaction**
  - Doesn't happen in perfect competition because no firm affects others
  - Doesn't happen in pure monopoly because no other firms
- Higher-education market: Harvard, Princeton, Stanford, Yale?
  - Is Reed oligopolistic? Are Oregon, Oregon State, and Portland State?
- Duopoly: two firms for simplicity
- **Game theory**: Analysis of strategic interaction

Nash equilibrium in duopoly

- Each agent forms strategy to respond to other's decision
- **Reaction function**:

$$X_1 = f_1(X_2), \quad X_2 = f_2(X_1)$$

- Can graph these reactions functions in (X_1, X_2)
- **Nash equilibrium**: Values of X_1 and X_2 where each is making optimal decision given the other's decision:

$$X_1^* = f_1(X_2^*), \quad X_2^* = f_2(X_1^*)$$

- On graph, this is intersection of two reaction functions
- Nash equilibrium is most basic model of game theory
- May not exist or be unique; may not be optimal for players

Collusion and cartels

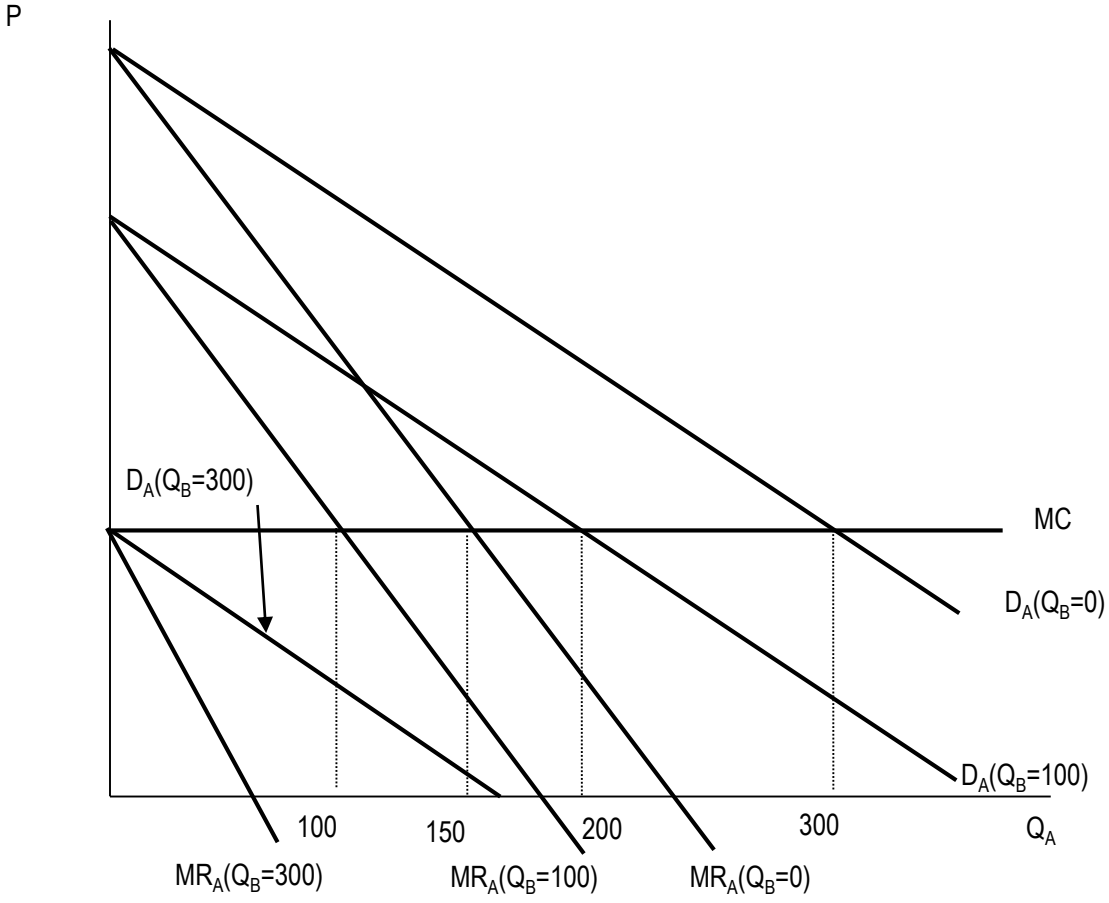
- Optimal collective behavior for oligopolists: act together and joint monopoly to maximize joint profits
  - Set industry output where industry MC = MR
- How to divide up the shares of output?
- Cartels are naturally unstable:
  - Each firm's MR acting alone exceeds its MC
  - Each member of cartel increases profit by cheating and producing more
- Cartels are illegal in United States and many other countries
  - This makes it hard to enforce agreements on production shares
- What helped ADM to enforce quotas in lysine case?
- Saudi Arabia as enforcer in OPEC?

Cournot duopoly: Quantity interaction

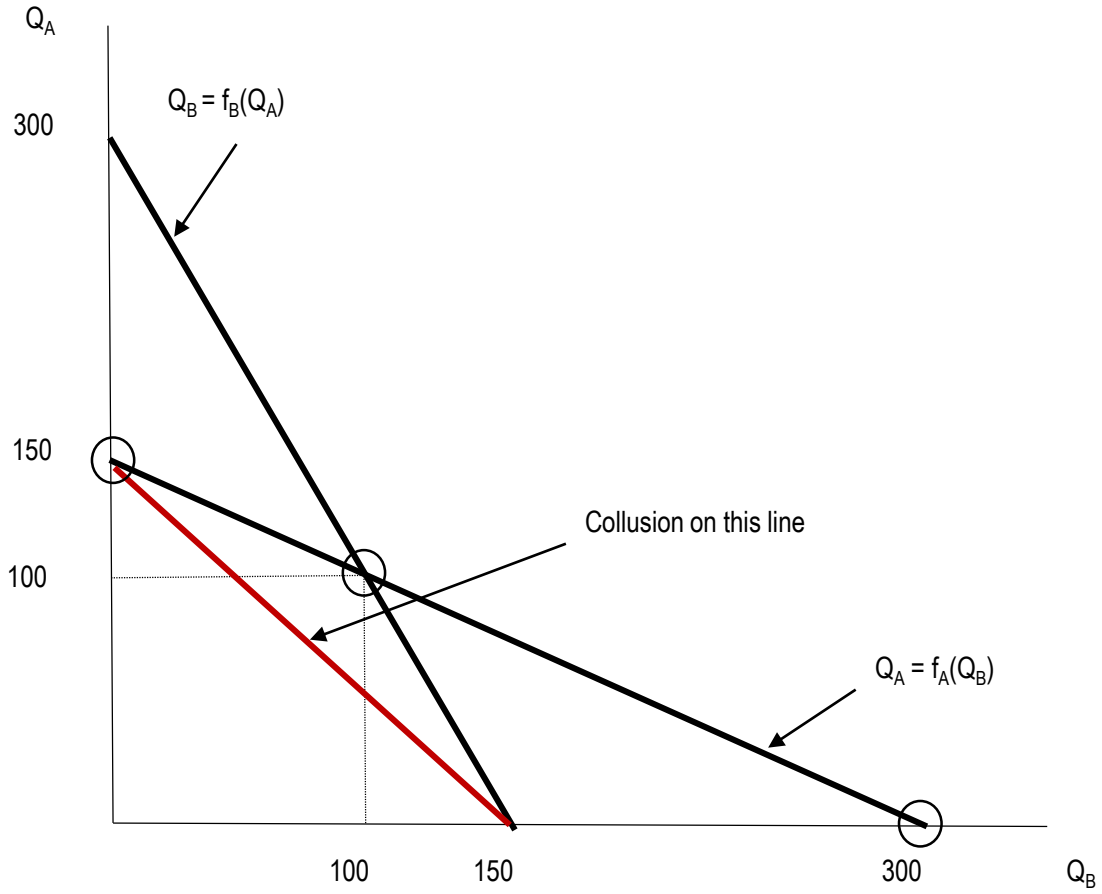
- Two firms (A and B) produce homogeneous product
- May differ in scale and in cost curves, but neither is too small for the other to ignore
- Decision-making process for Firm A:
  - Take quantity produced by B (Q_B) as given
  - Find Q_A that maximizes profit when A's demand is the market demand minus Q_B
- Firm B follows similar decision process based on Q_A
- Nash equilibrium is where both are maximizing profit given the other's output decision

Cournot duopoly in graphs

- A's Demand and MR are shown for $Q_B = 0, 100, 300$
- If $Q_B = 0$, then $MR_A = MC$ at $Q_A = 150$
- If $Q_B = 100$, then $MR_A = MC$ at $Q_A = 100$
- If $Q_B = 300$, then A is knocked out of market and $Q_A = 0$; no units can be sold $\leq$ MC
- Three points on A's reaction function: $(Q_A, Q_B) =$ (150, 0), **(100, 100)**, (0, 300)



Cournot reaction functions



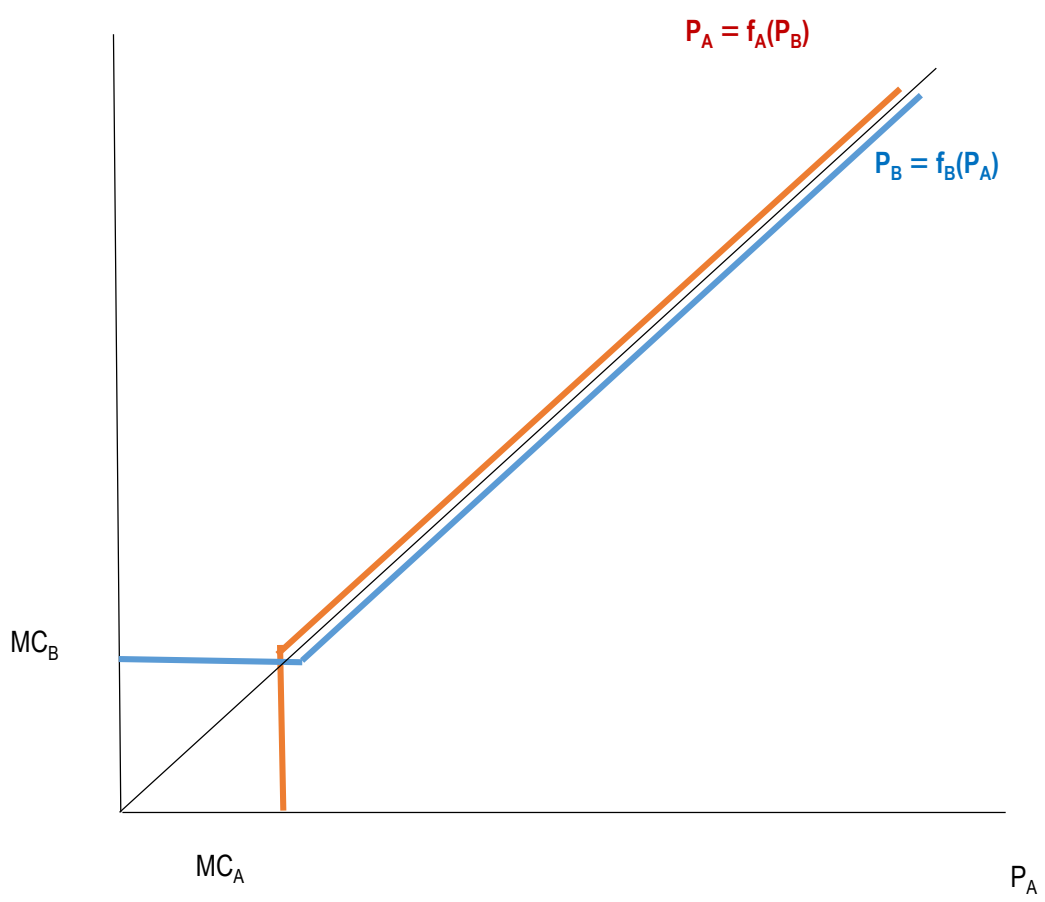
- Circled points on A's reaction function are from previous slide
- B's reaction function is mirror image of A's
- Intersection is at (100, 100), which is Nash equilibrium (total $Q = 200$)
- Competitive output = 300
- Monopoly output would be 150: Red line is where $Q_A + Q_B = 150$
- A would like to be at top, B at bottom. Can they agree?
  - Probably not!

Stackelberg oligopoly: Industry leader

- One **dominant firm** in industry
- Other firms are too small to affect dominant firm (competitive fringe)
- Small firms have reaction functions to dominant firm
  - Dominant firm maximizes its profit knowing how the small firms' will respond based on their reaction functions
  - Announces its decision and waits for small firms to react
- Large firm gets "**first-mover advantage**" and can maximize profit at the expense of consumers *and* small rivals

Bertrand price-setting model

- Firms set *price* (rather than quantity) taking other's *price* as given
- Seems like ~Cournot, but it isn't
- Identical, constant MC and homogeneous good:
  - Optimal strategy is to charge just less than rival if > MC
  - Price war drives price down to MC
  - Fully efficient!
- With differentiated good, interaction is complex and not fully efficient



Review

- Oligopoly is few firms interacting strategically
- Game theory and Nash equilibrium are used to describe interaction
- Each firm optimizes its decision given its rival's decision
- Collusion would maximize joint profits, but each has incentive to cheat
- Cournot, Stackelberg, Bertrand models are three ways of interacting

Daily diversion

Following up on my wonderful bedside clock that makes words when the numbers are read upside down…

In 2014, Reed held a "strategic-planning retreat" for faculty and trustees at Sunriver Resort in Central Oregon. Many of us were dismayed that it was scheduled right in the middle of the 2014 World Cup.

I was assigned to cabin #706. Of course, upside down on my clock, 706 reads gOL or, to quote everyone's favorite Latin American announcer, gOOOOOOOOOOOOOOOOL! The president's assistant rolled her eyes when I pointed out the appropriateness of this assignment. Some people just don't get it!

What comes next?

- Wednesday's class continues with game theory, discussing some famous games such as prisoners' dilemma and battle of the sexes
- Following that we spend three class sessions on markets for labor, capital, and other inputs
- Problem Set #5 is due on Wednesday