Strategic Behavior

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Outline

1. Strategic Behavior
   - Strategic Behavior Defined
   - Noncooperative Strategic Behavior
     - Predatory Pricing
     - Limit Pricing
     - Investment in R&D
     - Learning by Doing
     - Raising Rival's Costs
     - Raising All Firms' Costs
   - Cooperative Strategic Behavior

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Strategic Behavior Defined

- **Strategic behavior** is a set of actions a firm takes to influence the market environment so as to increase its profits
- The **market environmen**t comprises all factors that influence the market outcome (prices, quantities, profits, welfare), including
  - the beliefs of customers and of rivals
  - the number of actual and potential rivals
  - the production technology of each firm
  - the costs or speed withwhich a rival can enter the market
- By manipulating the market environment, a firm may be able to increase its profits
- Two types of strategic behavior:
  - **Noncooperative strategic behavior**
    - encompasses the actions of a firm that is trying to maximize its prof- its by improving its position relative to its rivals
  - **Cooperative strategic behavior**
    - comprises those actions that make it easier for firms in a market to coordinate their actions and to limit their competitive responses

Noncooperative Strategic Behavior

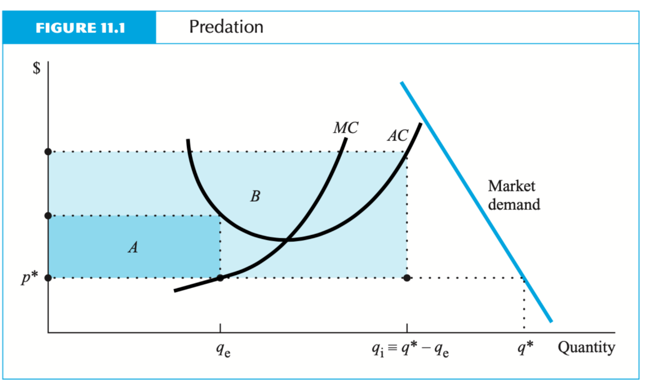
- Two conditions must be met for a non-cooperative strategy to be successful:
  - **Advantage**: The firm must typically have an advantage over the rivals.
  - **Commitment**: The firm must demonstrate that it will follow its strategy regardless of the actions of its rival.
- If two firms are identical, both firms are in an equal position to threaten each other
- For a strategy to work, one firm must have an advantage that allows it to harm the other firm before that firm can retaliate
- For the incumbent firm's claim to be a credible threat, its rivals must believe that its strategy is rational in the sense that it is in the firm's best interest to continue to employ it

Predatory Pricing

- A firm engages in **predatory pricing** by first lowering its price in order to drive rivals out of business and scare off potential entrants, and then raising its price when its rivals exit the market
  - i.e. incurs short-run losses to obtain long-run gains
- This strategy is successful only if the firm can survive low prices longer than its rivals can
- If the firm succeeds in driving out its current rivals and then raises its price, new rivals may enter the market, and the incumbent must again lower its price to drive out those firms
  - For the predation to be successful, potential entrants must believe that it does not pay to enter this business because of the incumbent's pricing behavior
  - Only then can the incumbent raise its price to the monopoly level with no fear of inducing entry

Predation with Identical Firms[1]

- Suppose that there are only two firms, an incumbent and a recent entrant, in the market with identical cost functions



- The incumbent firm lowers the market price to p^*so as to inflict losses on its rival and drive it out of business
  - At p^*, q^* units of output must be sold

Predation with Identical Firms[2]

- If the rival does not exit the market, it produces $q_e$units, where p^* equals its marginal cost, and suffers a loss equal to area A
- To keep the price at p*, the incumbent must produce $q_i = q^* - q_e$ units so that total market output is q^*
  - Thus, the incumbent produces at a higher marginal and average cost than its rival
  - It suffers losses equal to area A plus area B
  - The incumbent's loss is greater than that of its rival
- Consumers gain during the period of predation because they are able to purchase the product at price p^*
  - If the predation is successful, consumers lose after the rival is driven out of business because the price rises to the monopoly level
- For predation to work, the rival must believe that a firm will keep price low for as long as it takes to drive the rival out of business

Predation with Identical Firms[3]

- If an entrant did fear that its entry would precipitate a price war and drive prices below cost, it could avoid this problem in several ways
  1. **Try to talk the in-cumbent into merging**: enabling itself to charge a high price immediately and avoid the costly period of predation
     - ★ U.S. antitrust laws prohibit mergers to monopolize as well as predatory pricing
  2. **The entrant obtain contracts with buyers to set the price in advance of entry**: A drop in the incumbent's price would not hurt it because its sales would be at the prespecified price
     - ★ Buyers should be willing to sign fixed-price contracts at prices below the monopoly price that the incumbent initially charges
  3. **The rival reduces its output during periods of predation to minimize the harm**
     - ★ In some markets, a rival can exit a market costlessly and redeploy its assets to another market during a period of predation

Predation Where One Firm Has an Advantage[1]

- Differences in firms' beliefs about their rivals can result in successful predation
  - e.g., suppose that a firm can be either a high-cost firm or a low-cost firm and that only the firm knows its own costs with certainty. In response to entry, an incumbent firm may lower its price for one of two reasons:
    1. If the incumbent is a low-cost firm, the price decline might simply represent vigorous price competition
    2. If the incumbent is a high-cost firm, it may engage in predatory pricing
  - The other firm infers whether the incumbent firm is likely to have low or high costs
    - The lower its cost, the more likely the incumbent firm is to meet entry with very low prices

Predation Where One Firm Has an Advantage[2]

- An incumbent can acquire a reputation of being a low-cost firm by responding to entry with very low prices
  - Its pricing history is used by other potential entrants as an indicator as to whether the incumbent firm has low or high costs
  - Pricing histories can be used as an indicator of a firm's costs only if high-cost firms use low prices less frequently than do low-cost firms
  - An entrant with no associated pricing history cannot influence the incumbent's beliefs about its costs, so there is a natural asymmetry between the firms
  - Pricing below cost for a high-cost firm turns out to be a rational strategy if it is able to create the illusion that it is a low-cost firm, and thereby deter entry
- An entrant may have a reputation
  - e.g., a firm's reputation in one market may carry over to any new market it enters

Legal Standards of Predation[1]

- Many courts have adopted a rule proposed by Areeda and Turner (1975): A firm's pricing is predatory if its price is less than its short-run marginal cost
  - The logic behind: no firm ever profitably chooses to operate where price is less than short-run marginal cost unless it is motivated by strategic concerns
  - Suggested using average variable cost as a proxy for short- run marginal cost if data limitations prevent the determination of short-run marginal costs
  - A strength of the Areeda-Turner rule is that it explicitly recognizes that pricing below average total cost is not proof of predatory behavior

- Most of the suggested tests for predation can be difficult to implement for two reasons:
  1. The data needed to determine short-run marginal production costs or even average variable production costs are often difficult to obtain
  2. Other factors having nothing to do with price predation may explain violations of the tests

Legal Standards of Predation[2]

- It is common for a firm, upon entering a market, to attract consumer attention by running price promotions.
  - During the start-up phase of a business, many firms give away their products as samples to
    - build business for the future, and
    - reflect rational, profit-maximizing behavior
  - This behavior appears to violate the Areeda and Turner rule and other predation tests
- For most firms, a price of zero is lower than short-run marginal cost
  - A reasonable alternative view is that the price of zero is a short-run promotional activity and is an investment designed to attract future customers
  - It makes such calculations difficult

Legal Standards of Predation[3]

- Price can appear lower than short-run marginal cost when there is **learning by doing**
  - A firm's cost of production decreases as it produces more because it learns how to produce the product more efficiently
    - Costs are initially high but decline over time
  - By setting a very low price initially, the firm makes many sales and thereby accumulates experience that will enable it to lower its costs in the future
  - Even if the current price is lower than its current production costs, the prospect of reducing costs in the future by accumulating knowledge today justifies the lower price as an important investment for the firm
- Most lawsuits alleging predatory pricing are brought by a firm against its rival
  - Predatory pricing suits could be a strategy by a less efficient firm to protect its market position.
  - If vigorous enforcement of predatory pricing laws prevents efficient firms from lowering their prices out of fear of a predatory pricing suit, it harms rather than helps consumers

Evidence on Predatory Pricing

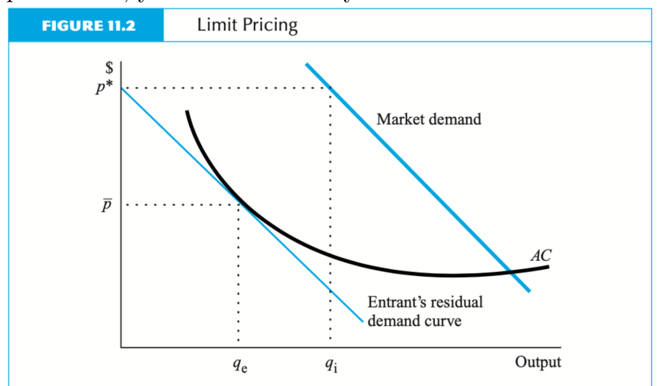
- Although predation is frequently alleged in lawsuits, careful examination of these cases indicates that predation in the sense of pricing below cost usually did not occur
    - e.g., Creation of Standard Oil
        - Supposedly, Rockefeller bought small, independent oil refineries after having lowered price to drive them out of business. McGee (1958), in his careful examination of this historical period, rejects that view and concludes that Rockefeller's rivals were bought out on rather favorable terms.
    - e.g. Koller (1971) reviews the available records in predatory pricing cases since 1890
        - Of the 26 cases for which adequate data existed, there were below-cost pricing in 7 cases
        - Of these, only 4 represented successful predation, in that the rival vanished
        - Of these, 3 involved mergers
- Evidence for predation in most cases is very weak and that defendants win over 90 percent of the time

Limit Pricing[1]

- A firm is **limit pricing** if it sets its price and output so that there is not enough demand left for another firm to enter the market profitably
  - Suppose that both the incumbent and a potential entrant have the same average cost
  - If the incumbent firm produces q_i units, can compute the residual demand for the entrant
  - If the entrant believes that the incumbnt will continue to produce q_i units , it believes its residual demand curve is the total demand curve minus $q_i$units

Limit Pricing[2]

- If q_i is chosen so that the residual demand curve facing the potential entrant is just below its average cost curve, then the entrant cannot produce a quantity such that it earns a positive profit in this market
  - The incumbent can sell q_i at p^*, which is above its average cost of production, yet not induce entry



Limit Pricing with Identical Firms

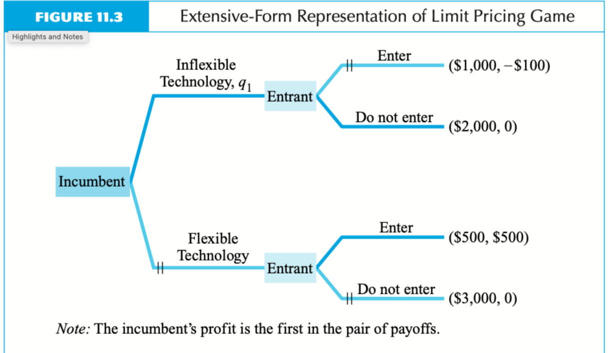
- If incumbent and the potential entrant have identical costs, it is unclear how one firm could scare another based on assumed behavior after entry
  - It is not profit maximizing for the incumbent to continue to produce q_i in the event of entry therefore the threat is not credible with identical firms
  - A potential entrant can threat incumbent into exiting by threatening to enter and produce q_i

Limit Pricing Where One Firm Has an Advantage[1]

- To make limit pricing believable and effective, an incumbent firm must pursue a strategy in which it is optimal for it to produce the q_i units at the limit price $\bar{p}$ after entry
  - If the two firms have identical average cost curves, it is not believable that an incumbent would keep its output unchanged after entry
  - The key to making limit pricing believable: The incumbent firm somehow manipulates the market environment when entry occurs so that the incumbent has the incentive to produce q_i units
    - e.g., incumbent can construct its manufacturing facility so that it only can produce exactly $q_i$units so that the potential entrant has no doubt that the incumbent will produce q_i units of output whether or not entry occurs
- The incumbent chooses its investment first so that it can commit to produce q_i units of output whether or not entry occurs, whereas the entrant is not able to precommit to an output level before the incumbent acts

Limit Pricing Where One Firm Has an Advantage[2]

- Figure 11.3 illustrates this example of limit pricing using an extensive-form representation of the game



Limit Pricing Where One Firm Has an Advantage[3]

- Choosing the inflexible technology is more profitable:
  - If the incumbent chooses the inflexible technology, the entrant does not enter, so the incumbent earns a profit of $2,000
  - If the incumbent chooses the flexible technology, the potential entrant enters, so that the incumbent earns a profit of only $500.

- The solution of choosing the inflexible technology is subgame perfect because the threat to produce q_i is credible

Dynamic Limit Pricing

- If a firm sets prices or quantities over time so as to reduce or eliminate the incentives of rivals to enter a market, it is practicing **dynamic limit pricing**
  - Although a dominant firm may be able to set an extremely high price and maintain it in the short run, it may choose not to do so
  - A very high price attracts additional fringe firms, causing the market price to fall
- A dominant firm that faces the threat of entry must trade off high profits in the short run against the entry of more competition and lower profits in the future
  - It is often in the dominant firm's best interest to set a high price at first and then slowly to lower the price as entry occurs
  - Although the high price increases the rate of entry, profits today are worth more to the dominant firm than are profits in the future (given positive interest rates)

Investments to Lower Production Costs[1]

TABLE 11.1 Strategic R&D Investment: Monopoly in Period 1, Cournot Competition in Period 2

	Period 1	Period 2	Total Profit in Periods 1 and 2
Entry			
No R&D investment	Profit of incumbent = \$8	Profit of incumbent = \$3	\$11
		Profit of entrant = 3	3
	Price = 9	Price = 8	
R&D investment	Profit of incumbent = 8 − 7.01 = 0.99	Profit of incumbent = 10.11	11.10
		Profit of entrant = 0.77	0.77
	Price = 9	Price = 7.33	
No Entry			
No R&D investment	Profit of incumbent = 8	Profit of incumbent = 8	16
	Price = 9	Price = 9	
R&D investment	Profit of incumbent = 8 − 7.01 = 0.99	Profit of incumbent = 15	15.99
	Price = 9	Price = 8	

- Investing in R&D
  - Suppose that there are two time periods and two firms with identical initial cost functions
    - In Period 1, the incumbent firm is a monopoly and can invest in research and development (R&D) that will lower its costs in Period 2
    - In Period 2, the second firm may enter
    - Only the incumbent firm can invest in R&D to lower its costs

Investments to Lower Production Costs[2]

- Investing in R&D (cont'd)
  - Given entry in Period 2, the incumbent earns more by investing in R&D because its reduced earnings in Period 1 are more than offset by the increased earnings in Period 2
    - Moreover, consumers are better off when Firm 1 invests in R&D because the price in Period 2 is lower when R&D occurs
    - Without the threat of entry, the incumbent would not invest in R&D

Learning by Doing

- If the incumbent can reduce its costs in Period 2 through learning by doing in Period 1, it can gain an advantage over its rival that enters in Period 2
  - The incumbent has an incentive to sell more to gain experience and lower its cost relative to that of its rival in Period 2
    - ★ Learning by doing = an investment that enables the firm to earn more in subsequent periods
  - In a learning-by-doing model, the advantage of being able to go first depends on
    1. How much a firm can lower its cost relative to that of its rival
    2. How long it takes to learn
       • If learning is either extremely rapid or extremely slow, the advantage of having a head start is not very great
       - When learning is very rapid, late entrants can quickly catch up with the incumbent
       - Conversely, when learning is very slow, the head start a firm gets does not matter very much
       • If learning is neither very rapid nor very slow, the strategic importance of learning by doing is greatest for increasing profits

Raising Rivals' Costs

- Raising Rivals' Costs
  - **Direct Methods:** A firm may directly raise its rivals' costs if it can interfere with its rivals' production or selling methods
    - e.g., an unethical firm could blow up a rival's plant or sabotage a rival's machines
      - Both actions would raise its rival's costs, reduce competition, and raise the profit of the unethical firm practicing this strategic behavior
    - e.g. Make it difficult for a rival to gather information
      - If an entrant conducts a marketing experiment to see whether its product is liked in certain locations, the incumbent can counteract the experiment by offering huge promotional discounts in those locations, making it more difficult for the entrant to judge consumer acceptance of its product relative to the incumbent's product
  - **Interference Through Government Regulation:** A firm may raise its rivals' costs through government regulation
    - Many government regulations "grandfather" (exempt from regulation) existing firms and make it more onerous for new firms to operate in a market
      - e.g., some environmental regulations impose more stringent requirements on new equipment than on old equipment

Raising Rivals' Costs

- Raising Rivals' Costs (cont'd)
  - **Tie-ins of Other Products:** Sometimes an incumbent produces two products that must be used together, whereas the entrant produces only one of these products
    - Where products must be used together, the incumbent can disadvantage the entrant either through a contractual tie that makes the entrant's product incompatible or difficult to use with the incumbent's other product
      - e.g., a computer manufacturer could use a nonstandard plug to connect a printer.
  - **Raise Switching Costs:** An incumbent can make it difficult for consumers of its product to switch to an entrant's product in the future
    - incumbent may be able to raise the entrant's marketing costs to attract customers
      - e.g., appropriate design may make it impossible to use computer programs written for one computer on another computer

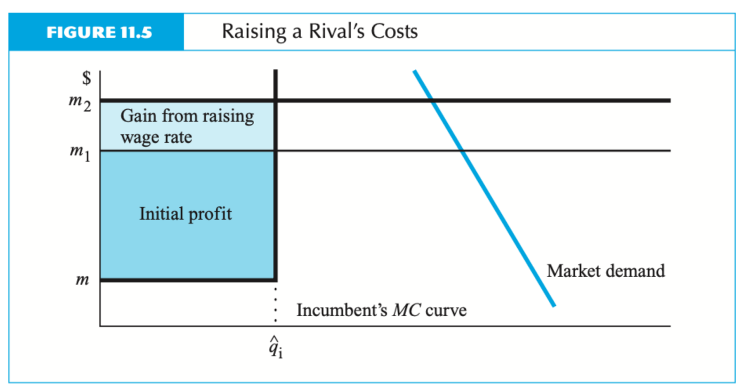
Raising Rivals' Costs

- Raising Rivals' Costs (cont'd)
  - **Raising Wages or Other Input Prices:** An incumbent firm that uses a different production technology than its rivals may be able to raise their costs disproportionately by raising the cost of an input to all firms in the market
    - An incumbent may be able to increase wages by supporting union activities
      - e.g. all the U.S. automobile manufacturers face a single union. Each time the union contract comes up for renewal, the union negotiates with (and strikes if necessary) one of these firms, and the others accept the outcome of these negotiations. A single firm could negotiate an unusually high wage rate
    - If the incumbent can purchase enough of the labor in a market to drive up the market wage, it has monopsony power
      - It can strategically use that market power to increase the costs of other firms more than its own if the other firms are more labor intensive

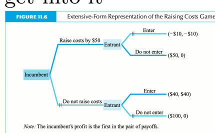
Raising Rivals' Costs

- Raising Rivals' Costs (cont'd)
  - Suppose that the incumbent has a constant marginal and average cost of m until its capacity $\hat{q}_i$ is reached. Suppose now that the incumbent can raise the market wage rate
    - Consider an extreme example in which the marginal cost of the incumbent firm does not change, and the marginal cost of rivals increases from m_1 to m_2
    - The equilibrium price rises from m_1 to m_2, the incumbent's optimal level of production is $\hat{q}_i$, and its profit increases to $(m_2 - m)\hat{q}_i$
  - Even if the wage increase raises the incumbent's costs, it may still be profitable for the incumbent to raise wages as long as the cost increase is smaller than the gain

[Illustration]Raising Rivals' Costs



Raising All Firms' Costs

- Raising All Firms' Costs
  - A natural asymmetry often exists between an incumbent and potential entrants, in that the incumbent has already made expenditures that make it unlikely that it would exit the market
    - This strategic advantage creates incentives for the incumbent to spend more money to keep entrants out of a market than they are willing to spend to get into it
    - 

Investments to Lower Production Costs

- Advantage of Entrants
  - A large firm that has more to lose than a smaller firm if price falls may prefer to let an entrant develop a small foothold rather than engage in a price war
    - Thus, a firm that enters and remains at a small scale can compete without fear of retaliation
- If a large firm has stores at many locations that all charge the same price, and another firm enters in just one of these locations, the large firm may abandon that location rather than lower its prices everywhere
- If the large firm decides to fight, one alternative to reducing its uniform price is to introduce a new brand, sometimes called a **fighting brand**
  - whose price is low and whose availability is limited to those areas where a small rival is successful
  - thus, the large firm can engage in competition without lowering price to all its customers

Welfare Implications and the Role of the Courts

- The welfare implications of strategic behavior need to be considered case by case
  - Some strategic behavior lessens competition and harms consumers
    - e.g., successful predatory pricing that leads to market power in the long run has no socially redeeming virtues
  - Other types of strategic behavior can produce socially desirable results
    - Even if R&D investments are a strategic action, consumers may ultimately benefit from lower prices. Even when strategic behavior leads to monopoly, consumers may benefit
    - Indeed, patents are designed to create monopolies because the incentive of monopoly profits encourages firms to develop new knowledge
  - U.S. antitrust laws allow the government to intervene if it believes that firms are taking actions that lessen competition
    - The antitrust laws also give private plaintiffs who are the victims of such behavior the right to sue
    - Too little enforcement: leads to bad behavior and monopoly power,
    - Too vigorous enforcement: may deter firms from pursuing desirable forms of competition for fear that this competition will be misinterpreted

Practices That Facilitate Collusion[1]

1. **Uniform Prices**
   - If all of a firm's customers are charged exactly the same price, then it is costly for the firm to try to steal a rival's customers by offering them a slightly lower price
     - The slightly lower price must also be offered to all of the firm's existing customers

2. Penalty for Price Discounts
   - A more dramatic way of reducing a firm's incentive to steal another firm's customers by lowering price is for each firm to adopt a policy whereby any lower price is passed on not just to the firm's current customers, but to all of its past customers over some time period
     - e.g., if a firm signs a contract with buyers that entitles them to receive any price discount that occurs in the next year, then the firm has a great disincentive to lower price

Practices That Facilitate Collusion[2]

3. Advance Notice of Price Change

- Suppose that it is clear that the prices in an oligopoly that is not a cartel should rise
  - The first firm to raise price is at a serious disadvantage because it loses sales from its relatively high price
  - If rivals eventually match the higher price, all firms are better off with the higher prices
- One way around this problem is to use **advance notice of price increases**
  - A tactic that allows other firms in the market to decide whether to go along with the price increase before it becomes effective
  - If rivals decide not to go along, the firm that announced the price increase can rescind it
  - In such a circumstance, firms need never find themselves selling at different prices in the market, and the disincentive to raise price is eliminated
- At times of decreased demand, the firm initiating the price decline gains relative to its rivals who take time to respond to the price cut
  - Thus, each firm has an incentive to cut its price first
  - Advance notice of price decreases mitigates this incentive by ensuring that no firm gains an advantage from taking the lead in cutting price

Practices That Facilitate Collusion[3]

4. **Information Exchanges**
   - Information exchanges between firms can facilitate cartels or promote efficiency
     - One way a firm can convince rivals that it is not trying to steal customers through a price discount is to announce the identity of its new customers and the price and quantity terms offered
     - Another method of conveying information: disseminating publicly what the firm's strategy is so that rivals will not misinterpret the firm's actions and can coordinate with the firm's strategy
5. **Delivered Pricing**
   - A **delivered pricing** system specifies the total delivered price that a buyer must pay as a function of the buyer's distance from a specified location (a basing point), but not of the location of the seller
     - e.g., steel used to be sold with Pittsburgh as the basing point. If an Ohio steel mill shipped steel to Chicago, the price the buyer paid equaled the going price of steel in Pittsburgh plus freight from Pittsburgh to Chicago. The freight charges were calculated from standard published rate schedules
     - It facilitates collusion because it prevents competing firms from secretly granting discounts disguised as low freight charges

Practices That Facilitate Collusion[4]

5. Delivered Pricing (cont'd)
   - **FOB pricing**: The buyer pays a free-on-board (FOB) price, where the seller loads the good onto the transport carrier at no cost to the buyer, plus the actual freight
     - Under such a system, the freight charge varies with a buyer's location, and sellers can cut price by undercharging for freight
     - A great disadvantage to collusion through the use of delivered pricing is that it fails to allocate the market to sellers
   - Figure 11.7 illustrates that FOB pricing creates a clean market division precisely because firms charge most buyers different prices

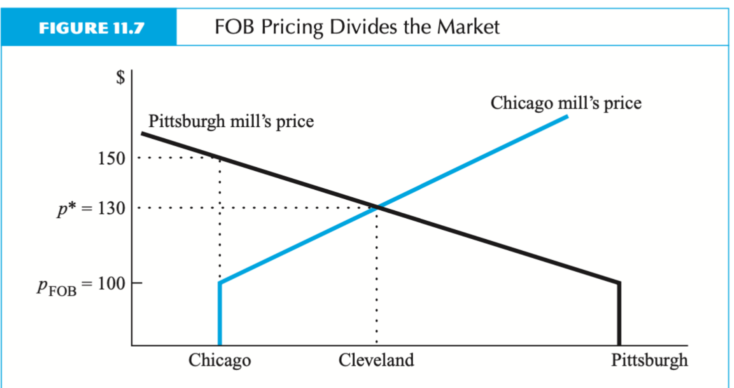


FIGURE 11.7
FOB Pricing Divides the Market
$
Pittsburgh mill's price
Chicago mill's price
150
p* = 130
pFOB = 100
Chicago
Cleveland
Pittsburgh

Practices That Facilitate Collusion[5]

5. Delivered Pricing (cont'd)
   - Suppose that each firm agrees to charge the same FOB price at its plant and to charge actual transportation charges
     - The price lines rise as one moves away from the location of each firm to show that transportation costs rise with distance.
     - Under delivered pricing, the Chicago firm could be selling in Pittsburgh and the Pittsburgh firm could be selling in Chicago so that there is a lot of inefficient cross-hauling of the product
       - The greater the distance between the firms and the more important the transportation charges, the better FOB pricing is as a means of market allocation and collusion compared to delivered pricing
   - There is an important difference between delivered pricing and FOB pricing
     - In an equilibrium with FOB pricing, all firms must charge the marginal buyer the same price ($130 at Cleveland)
     - At points other than Cleveland, however, the firms located at Pittsburgh and Chicago charge different prices under FOB pricing but not under delivered pricing
     - Despite this difference between delivered and FOB pricing, it is sometimes possible for the two pricing systems to look alike

Practices That Facilitate Collusion[6]

5. Delivered Pricing (cont'd)
   - Although using delivered pricing can facilitate collusion, it does not always do so
     - In some settings, delivered pricing can lead to greater competition than FOB pricing
     - Moveover, delivered pricing can be more efficient (reduced transaction costs) than FOB pricing, and therefore can appear in competitive industries

Practices That Facilitate Collusion[7]

6. Swaps and Exchanges

- Firm C, located in Chicago, has a customer in Boston, and Firm B, located in Boston, has a customer in Chicago
  - To minimize shipping costs and service their customers, Firm C "swaps" or "exchanges" one unit of its output in Chicago for one unit of Firm B's output in Boston
- Swaps have often been attacked as a facilitating device in antitrust cases. The theory is that
  - swaps are a mechanism to divide the market, allow rivals to communicate, and prevent competition from occurring, yet still allow firms to service distant clients
  - swaps also can make it difficult for a small entrant to service distant customers because the new entrant has few locations that it can use to engage in swaps
- Swaps can be an enforcement mechanism to guarantee timely delivery in industries where supply availability is key

Cooperative Strategic Behavior and the Role of the Courts

- Cooperative strategic behavior requires that firms all choose similar actions, seems superficially easier to identify and condemn than other types of strategic behavior
- After all, any agreement or practice that tends to reduce competition is likely to harm society
  - e.g., dvance notice of price changes might benefit consumers even though it could also facilitate collusion
  - e.g., A policy that condemns practices reached through agreement to limit competition seems correct. A policy that condemns business practices that conceivably could affect collusion is probably too broad and would leave firms in a quandary as to which of their policies would be subject to antitrust scrutiny

For Further Reading I

- Carlton, Dennis W., and Jeffrey M. Perloff. Modern Industrial Organization. Fourth edition. Harlow, Essex, England: Pearson, 2015. Print.
- Belleflamme, Paul., and Martin. Peitz. Industrial Organization : Markets and Strategies. Cambridge, UK ;: Cambridge University Press, 2010. Print.