Antitrust Regulation

November 8, 2022

> People of the same trade seldom meet together, even for merriment or diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices. It is impossible indeed to prevent such meetings, by any law which either could be executed, or would be consistent with liberty and justice. But though the law cannot hinder people of the same trade from sometimes assembling together, it ought to do nothing to facilitate such assemblies; much less to render them necessary. - Adam Smith, Wealth of Nations, Book I, Chapter X

The quote from Adam Smith gets at the driving force behind antitrust regulation. When individuals get together, the conversation is likely to turn to business at some point, and those conversations about business could lead to some discussions about how to increase profit. He goes on to write that the government should not prohibit these types of meetings because that would be a restriction of individual liberty, but the government should not encourage practices that facilitate those meetings. He is silent on how and when the government should regulate business practices.[1]

We have already discussed how a monopolist, by following profit-maximizing behavior, chooses a level of output less than the efficient level of output and charges a price above the minimum of average total cost. While that is an economic argument against monopolies, there is no legal statute that prohibits a firm from being a monopoly. There are, however, legal statutes prohibiting anticompetitive practices. The Sherman Antitrust Act was the earliest antitrust act in the U.S. and prohibits "every contract, combination, or conspiracy in restraint of trade" and any "monopolization, attempted monopolization, or conspiracy or combination to monopolize."[2] That does not mean that every restraint of trade is a violation of the law otherwise firms would be unable to enter into any contract, just unreasonable restraints of trade. The Clayton Act and its amendments cover provisions that are not clearly prohibited by the Sherman Act, such as mergers. The Federal Trade Commission Act bans "unfair methods of competition" and "unfair or deceptive acts or practices." For recent discussion of antitrust law, the American Bar Association publishes the Antitrust Law Journal.[3]

The Federal Trade Commission (FTC) and Department of Justice (DOJ) both file suits against firms for using anticompetitive practices in the U.S.[4] The mission of the FTC is specifically to protect consumers and competition. The DOJ has a broader scope, but its Antitrust Division does file antitrust suits under the Sherman Act.[5] Antitrust concerns are not unique to the U.S. and other countries have counterparts to the FTC and DOJ. The FTC and DOJ have a list of similar agencies available.[6]

[1] A 2016 issue brief from the Council of Economic Advisers provides a recent discussion on the state of competition in the U.S.
https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160414_cea_competition_issue_brief.pdf

[2] https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/antitrust-laws

[3] https://www.americanbar.org/groups/antitrust_law/publications/antitrust_law_journal/

[4] https://www.ftc.gov/
https://www.justice.gov/

[5] On 11/2/2021 the DOJ sued to block Penguin Random House from acquiring Simon & Schuster:
https://www.justice.gov/opa/pr/justice-department-sues-block-penguin-random-house-s-acquisition-rival-publisher-simon
A list of DOJ antitrust cases is here:
https://www.justice.gov/atr/antitrust-case-filings-alpha

[6] https://www.ftc.gov/policy/international/competition-consumer-protection-authorities-worldwide
https://www.justice.gov/atr/antitrust-sites-worldwide

1 Legal Standards

There are three primary legal standards used in determining whether antitrust cases occurred. The DOJ and FTC issued some guidelines in April 2000 that discuss the standards and analysis in detail.[7] While we will not discuss specific case law, note that there are a number of antitrust casebooks that detail important antitrust cases that have led to evolving interpretation of the legal statutes and the type of analysis required.

Per Se Rule Under the per se rule, the effects of a particular practice are so inherently anticompetitive that no market analysis is required. Examples of this type of case would include firms explicitly conspiring to raise prices (price fixing), bidders in auctions colluding to keep prices low (bid rigging), firms dividing up geographic areas and restricting service only to those defined areas (market division), etc.[8] Cases under the per se rule tend to be deliberate acts by the conspirators with easily observable economic effects.[9]

Rule of Reason Recall that the Clayton Act has been interpreted as restraints of trade that are unreasonable. The rule of reason standard uses economic analysis to determine whether a restraint of trade is reasonable. What is the intention of the restraint of trade? What are the industry conditions before and after the restraint, and what was the effect of the restraint on trade? What is the structure and competitive conditions in the relevant market? Are there barriers to entry? Is there an objective justification for the restraint of trade? Economic analysis of the market is heavily used under the rule of reason and this standard will be the focus of our discussion.

Quick Look The quick look standard is an abbreviated rule of reason. This standard might be applied in cases where a practice is not per se illegal, but where the actions lead to anticompetitive effects that are so obvious that they do not require rigorous analysis. Many cases are heard under the traditional rule of reason standard as defendants may argue that the quick look is not appropriate.[10] Quick look may also be used in the merger review process in order to narrow the review process to relevant markets.[11]

2 Monopoly

As mentioned earlier, simply being a monopolist is not a reason to bring forward an antitrust lawsuit. However, a monopolist is likely under more scrutiny by antitrust authorities simply by virtue of being a monopolist. Krattenmaker, Lande, and Salop (1987)[12] provide a review of the distinction between market power and monopoly power. They distinguish between two types of market power, one in which the monopolist raises its own price to maximize profits by producing the quantity where marginal revenue equals marginal cost. The other is an exclusionary type of market power, in which a firm or group of firms acting like a monopolist, takes action outside of their own market to increase the price of their own product. One possibility is that they could purchase companies that produce a substitute product and then limit that production of the substitute product to reduce competition from the substitute good.

Klotz (2008)[13] reviews how monopolists may violate Section 2 of the Sherman Act through actions that may not be viewed as anticompetitive in competitive markets. Market power, which we will discuss in more detail later, is difficult enough to define, but is generally considered to mean that a firm can price above

[7] https://www.ftc.gov/sites/default/files/documents/public_events/joint-venture-hearings-antitrust-guidelines-collaboration-among-competitors/ftcdojguidelines-2.pdf
Section 3.2 discusses the per se rule and 3.3 discusses the rule of reason.

[8] The DOJ has a primer on these types of illegal activities: https://www.justice.gov/atr/file/810261/download

[9] The imagery of corporate executives in a back room discussing plans to increase profits comes to mind for per se rule violations.

[10] Here are some recent cases involving the quick look standard:
https://www.wlf.org/2021/06/11/communicating/in-victory-for-wlf-second-circuit-vacates-ftc-order-misapplying-quick-look-antitrust-standard/
https://www.supremecourt.gov/DocketPDF/21/21-406/196530/20211015135115143_AAM%20Amicus%20Brief_Impax%20v.%20FTC.pdf

[11] https://www.ftc.gov/system/files/attachments/merger-review/best_practices_for_merger_investigations_august_2015.pdf

[12] https://www.justice.gov/atr/monopoly-power-and-market-power-antitrust-law

[13] https://www.ftc.gov/system/files/documents/public_events/section-2-sherman-act-hearings-single-firm-conduct-related-competition/section2monopolypower.pdf

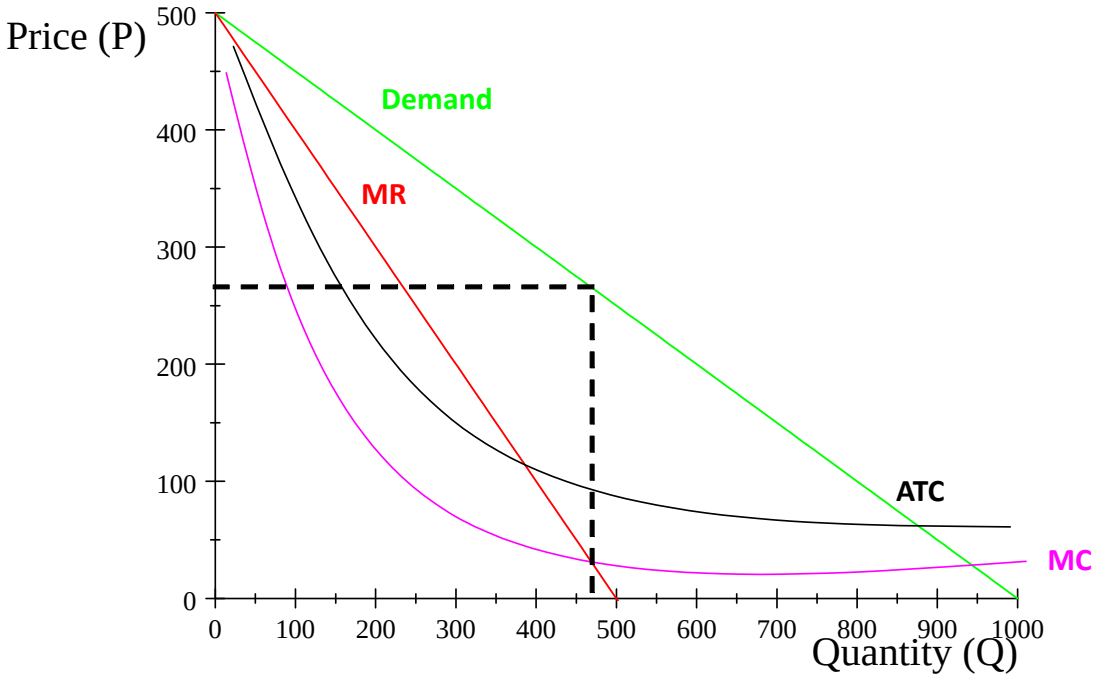

Figure 1: A natural monopoly with its profit-maximizing price and quantity illustrated by the dashed lines.

marginal cost. A small amount of market power is generally not a concern to antitrust authorities – a local restaurant that has an established customer base should have some small market power, but that does not make them a monopolist. Monopoly power is more difficult to define and differs from market power in that it must be "substantial," though there is no agreed upon definition of substantial. It must also be durable in that the firm must be able to maintain price over time.

One potential notion of monopoly power is whether the firm can raise price even higher than it currently is and increase profits. From our earlier analysis of monopoly we saw that even a monopolist faces constraints on how high price can be to maximize profit. An alternative is to consider whether the price in the market would be the prevailing price except for the conduct of the alleged monopolist, which is a hypothetical monopolist test. Market shares are also used as evidence of market power, but they may be misleading. One example is that a firm may have a large market share but if entry barriers are low the threat of potential entry may be keeping prices close to the competitive level. Another is that if the market is dynamic, a firm may have a large market share today but the introduction of new products either by existing competitors or new entrants could reduce the firm's market share substantially.

2.1 Natural Monopoly

A natural monopoly is a specific type of monopoly and is typically regulated by the government. In a natural monopoly, average costs are declining throughout the relevant range of production. Electricity is the standard example used for a natural monopoly – when you move to a new location, there is typically only a single choice of provider for electric services. Due to the cost structure, the belief is that a single large supplier could provide the good at lower cost than multiple smaller providers.

Figure 1 provides an example of a natural monopoly. The average total cost curve is declining throughout the relevant range of production as is the marginal cost curve.[14] A natural monopolist maximizes profit by finding the quantity where $MR = MC$ and then chooses the corresponding price from the demand curve,

[14] Recall that the marginal cost intersects the average total cost at the minimum of averaget total cost, so the marginal cost will always lie below the average total cost when the average total cost is declining.

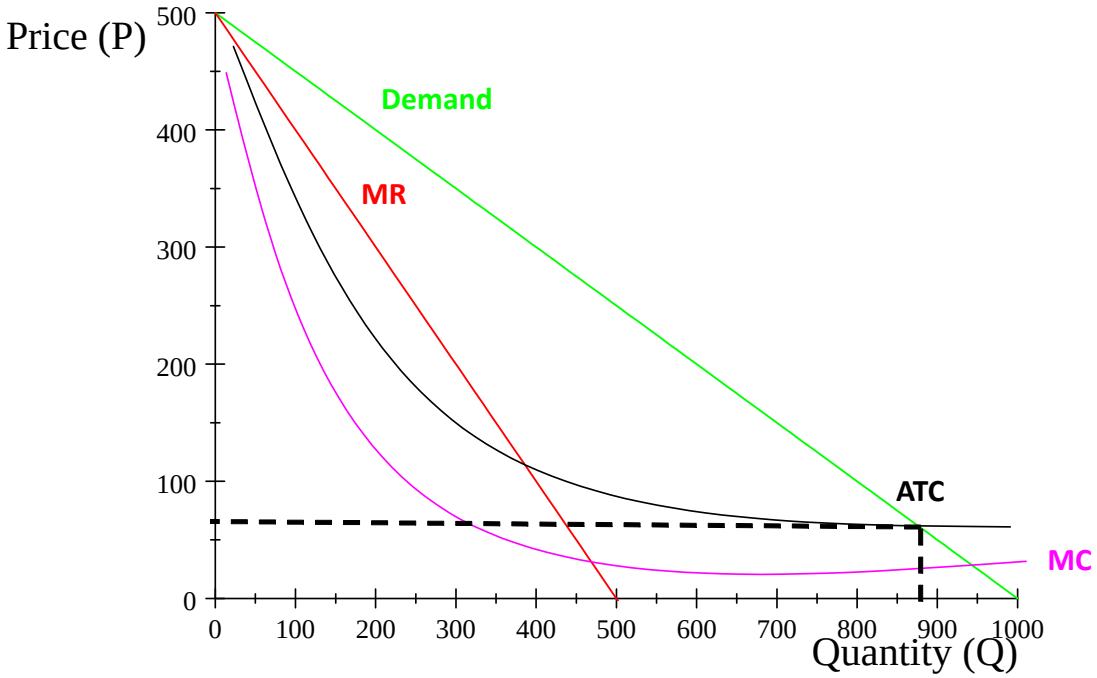

Figure 2: The price and quantity choices for a natural monopolist under average cost pricing.

which is the same process any profit-maximizing monopolist would follow to determine output and price. However, note that the monopolist could reduce per unit average cost by producing even more units of the good.

As natural monopolists tend to provide basic need goods (electricity and water), the industries tend to be regulated. There are two common types of pricing regulation, average cost pricing and marginal cost pricing.

Average cost pricing Under average cost pricing, a regulated natural monopolist will produce the quantity where average total cost intersects the demand curve. Figure 2 shows an example of the price and quantity under average cost pricing. We know that a profit-maximizing monopolist will produce an inefficient quantity that leads to deadweight loss in the market. However, if the natural monopolist is regulated to price at average total cost then there is no ability to raise price above average total cost so the natural monopolist would produce until average total cost intersects with the demand curve. If the natural monopolist prices at average cost then it will earn zero economic profit. If they produce beyond the point where ATC intersects demand then they will begin to lose money (economic profit will be negative) as consumers are not willing to pay a price equal to ATC for the additional units.

Marginal cost pricing Another possible pricing rule for a regulated natural monopolist is marginal cost pricing. Figure 3 shows an example of a natural monopolist under a marginal cost pricing rule. Marginal cost pricing is similar to average cost pricing, except the quantity is determined by the intersection of marginal cost and demand and the price is determined by the marginal cost of the last unit produced. The rationale for pricing at marginal cost is economic – there is no deadweight loss in the market because supply (given by marginal cost) intersects demand at that quantity. The marginal benefit of that last unit of production is equal to the marginal cost, so that is the optimal production level from society's perspective. However, there is a problem from the perspective of the firm. The price being charged is less than the ATC, so the natural monopolist is making negative economic profit. The reason is that the fixed costs, which are

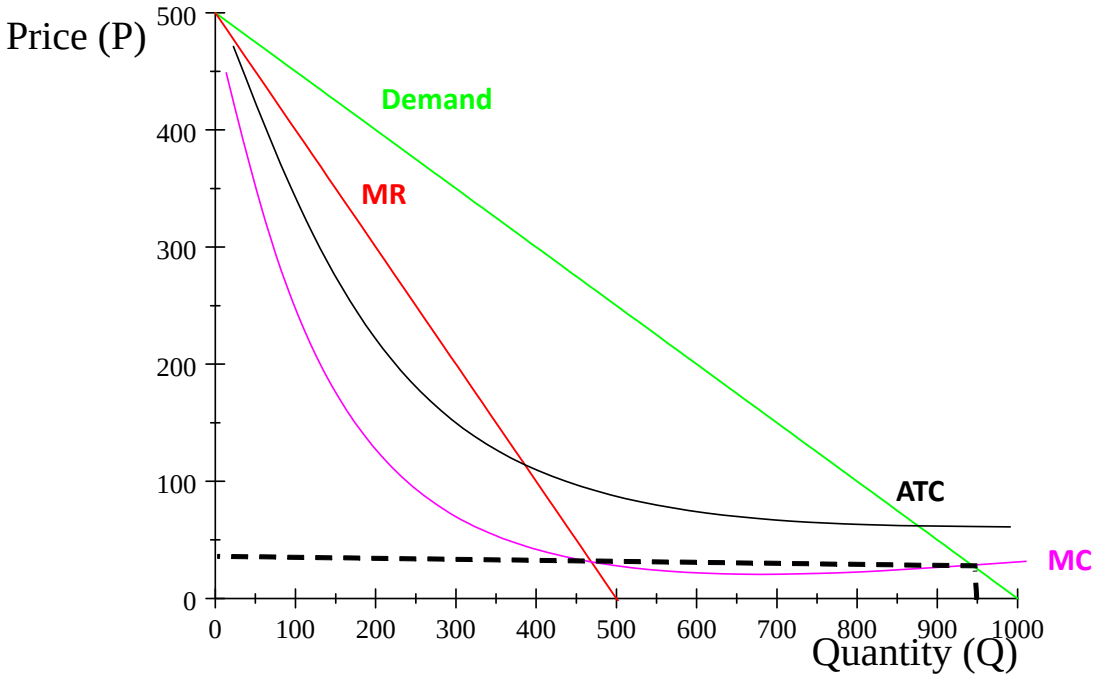

Figure 3: The price and output for a natural monopolist under marginal cost pricing.

likely substantial, are not included in marginal cost and are ignored in the pricing decision. If the natural monopolist is forced to price at this level, it will need a subsidy.[15]

Challenges In order to use average cost or marginal cost pricing, the regulator needs to know the cost structure of the natural monopolist. And that is a major challenge. Those pricing strategies are most useful as guides for regulators in thinking about how natural monopolists should price their goods. Typically, at least for electricity, there is a negotiation process between the provider of the service and a regulatory agency in order to determine the price of the good.[16]

3 Oligopoly

In our earlier discussion of market structures we focused on perfect competition and monopoly as two benchmarks on opposite ends of the market structure spectrum. In perfect competition, firms have many competitors and no market power; in monopoly, the firm has no competitors and complete market power. However, neither benchmark model represents most markets. Some markets (restaurants) are represented by many slightly differentiated sellers and the perfectly competitive model is a reasonable representation of those markets. While the firms in a monopolistically competitive market have some market power and ability to change price without losing all sales, their profits still tend towards zero economic profit.[17] The model is very similar to that of a monopolist, only the demand curve is more elastic (there are more substitutes) and entry barriers are low which is why economic profit tends towards zero. What one firm in the industry does may affect what some other firm in the industry does, but likely only on a small scale and a local level.

[15] From a broader perspective that may be desirable if the lower rates enable low-income households to afford electricity.

[16] For NC, the North Carolina Utilities Commission regulates most utilities (electricity, gas, water) service, including rates and charges.
https://www.ncuc.net/Consumer/whatwedo.html

[17] Restaurant owners and managers will talk about razor thin profit margins; that is an indication that economic profits are close to zero.

An oligopoly market, however, is characterized by a few large sellers who have market power and are protected by some entry barrier. A standard example would be the automobile industry. There is mutual interdependence among the sellers, meaning that the actions taken by one seller affect not only the other sellers but the market. The models we have discussed thus far do not have much strategic interaction. A perfectly competitive firm takes a price as given and chooses a quantity level to maximize profit; a monopolist has no competitors; even in the consumer choice model the consumer took the prices as given and any change in purchasing behavior by the consumer did not have additional effects in the market for those goods. Game theory is introduced in order to gain a better understanding of oligopoly models.

3.1 Game Theory – Overview

While used in more than just models of oligopoly, our focus here is on its relevance to oligopoly behavior.[18] While there are earlier game theoretic models in the literature, the publication of von Neumann and Morgenstern's *Theory of Games and Economic Behavior* in 1944 is typically noted as the foundational introduction of game theory into economics.

A *game* consists of four components: players, rules, outcomes, and payoffs. Chess is used as an illustrative example.

1. Players – All games must have players, who undertake the actions in the game. Generally speaking, a game should have two or more players, otherwise it turns into a decision. However, what should we do about "games" like Solitaire or Minesweeper? In one sense they are decisions, as the player simply makes (hopefully optimal) choices. In another sense, we could model "Nature" as the second player, which acts somewhat randomly. In Chess there are two players, one who controls the White pieces (White) and one who controls the Black pieces (Black).

2. Rules – Who makes what decisions or moves? When do they make the moves? What are they allowed to do at each move? What information do they know? In a standard Chess game, White moves first and there are 20 opening moves that White can make (8 pawns that can move either one or two spaces ahead, and 2 knights that can move to one of 2 different spots on the board). Players alternate turns, so that Black also has 20 moves that can be made on his first turn. Furthermore, there are restrictions on how the pieces can move, how pieces are removed and returned to the board, how a winner is determined, how long a player has to make a move – in short, there are a lot of rules to Chess.

3. Outcomes – What occurs as a result of the rules and the decisions players make? At the end of a Chess match one of three things occurs – White wins (and Black loses), Black wins (and White loses), or there is a draw. Those are the end results of the game. Much simpler than the rules.

4. Payoffs – What utility is assigned to each of the outcomes? Essentially each player has a utility function over outcomes and acts in a manner to best maximize utility, taking into consideration that the other player is doing the same. It does not have to be the case that "winning" has a higher utility than "losing". It may be that one's payoff is tied to who the other players are. If the Chess match is a professional or amateur match and you can win money (or fame) by winning the match, then typically winning will have a higher payoff than losing. However, if you are playing a game with your child or sibling and you are attempting to build their self-esteem then perhaps losing has a higher payoff. Basically, there is a utility function over the outcomes that is a function of all the relevant variables and this utility function determines the players payoffs. At times outcomes and payoffs are used interchangeably, but they are two distinct parts of a game.

A standard assumption we will make is *common knowledge* – all players know what all other players know (not that everyone knows the same information, just which information is known), and all players know that all other players know what all players know, etc. There are also two different definitions of information commonly used. With *perfect information* all players know exactly which decisions have been made by the players who move before them – Chess is a game of perfect information because all players know exactly

[18] When we discuss mechanism design approaches to policy we will return to the concepts of game theory.

which decisions have been made. With *incomplete information*, there is some uncertainty over the other player's payoff or utility function. A classic example is an auction. In a fairly standard auction setting each bidder knows his own private value but not the value of the other bidders. All bidders have the same payoff function, which is their value minus the price they pay for the object (which is just consumer surplus), but because bidders only know their own value they have incomplete information about the other bidder's actual payoff. There is still common knowledge, in that all bidders know what other bidders know (and don't know).

3.1.1 Solving Games

The ultimate goal will be to "solve" a game. In our earlier benchmark market structures, our "solution" was a quantity choice by the firm that led to a price and ultimately a profit level for the firm. Those quantity choices are decisions made by those firms. The difference between decision-making and the solution concept for a game, which will involve strategies, is that in the decision-making task there is no consideration of how others might respond to the decisions made, whereas in the game there is consideration of how others might respond.

Strategies form the basis for the solution concepts in game theory. A *strategy* is a complete, contingent plan of action for a player in a game. While it sounds simple, consider a strategy for Black in Chess. We know that White has 20 potential opening moves – as a small part of the strategy, Black must specify what move would be made if any of those 20 opening moves by White occurs. And then what move would be made for any configuration of the Chess board on Black's second move. And then for any configuration of the Chess board on Black's third move. And so on as long as there are moves to be made (the game has not ended). A complete strategy for Black in Chess is incomprehensible. Our games will not be so involved and strategies will be much simpler to specify.

The primary solution concept that we will use is Nash equilibrium. A *Nash equilibrium* is a set of strategies such that no player can unilaterally deviate from the chosen strategy and receive a strictly higher payoff. There is a lot in that sentence so we decompose it. A *set of strategies* means each player has a strategy. *No player can unilaterally deviate from the chosen strategy* means that we hold strategies for all other players fixed and focus on one player changing strategy. A *strictly higher payoff* means a payoff that is greater than the payoff the player is currently receiving from the chosen strategy; if the player switches strategies and receives a payoff of the same amount that payoff of the same amount is not "strictly higher" because it is equal to the old payoff. At its core, a Nash equilibrium occurs if, given what the other players are doing, no player wants to change strategies. If there are 100 players, and 99 of them want to use their current strategies but the 100^{th} wants to change given what the others are doing, then that set of strategies is NOT a Nash equilibrium. There are games that have multiple Nash equilibria, and so there are refinements that specify additional criteria. We will only use those refinements if needed, but at their core they all have the same basic definition.

3.1.2 Simple Pricing Game Example

Suppose there are two firms in the market, Firm 1 and Firm 2. These firms compete by choosing prices. Each firm can choose to either price low at \$20 (P_L) or to price high at \$50 (P_H). So a firm's strategy in this game will be a price choice – either P_L or P_H. If both firms choose to price low then they split the market and each will earn \$100. If both firms choose to price high then they split the market and each will earn \$200. But if one firm prices low and the other prices high, then the one that chooses to price low will capture more of the market and will earn \$300 while the one that prices high will capture less of the market and earn \$75.

We could work through all the logic to determine who should take which action given the action the other firm takes, but there is a fairly straightforward way to examine these games. We can construct a payoff matrix.[19] Begin with making a table with the number of rows equal to the number of strategies player 1 has and the number of columns equal to the number of strategies player 2 has. So if both have 2 strategies,

[19] The payoff matrix goes by different names: the strategic form or the normal form or bi-matrix being the most common other names. While I will use the term payoff matrix, I feel the strategic form is the best description because all the strategies for each player are listed.

it will be a 2x2 "table" (we will call it a 2x2 matrix). Then for each row list one of player 1's strategies and for each column list one of player 2's strategies. So the initial construction for the pricing game above should look like:

		Firm 2	
		$P_L = \$20$	$P_H = \$50$
Firm 1	$P_L = \$20$		
	$P_H = \$50$		

We would call Firm 1 the row player and Firm 2 the column player. It really does not matter which one is the row player and which is the column player, or what order the strategies are in, as long as the strategies are correct for each player. Now there are 4 empty cells, one corresponding to each outcome. So far we have the players, strategies, and outcomes present in the matrix and only need to add payoffs. The key here is to look at each outcome cell and determine what the payoff for each player would be at that outcome. Then simply list the payoffs in the outcome cell. IMPORTANT: The convention is to list the row player's payoff first, and then list the column player's payoff second. This is the convention used throughout the study of game theory, much like listing quantity on the x-axis and price on the y-axis is the convention for a supply and demand graph. So the finished matrix would look like:

		Firm 2	
		$P_L = \$20$	$P_H = \$50$
Firm 1	$P_L = \$20$	\$100, \$100	\$300, \$75
	$P_H = \$50$	\$75, \$300	\$200, \$200

Note that all four components of the game are now present.

Solving the Simple Pricing Game There are multiple approaches to solving the game – all lead to the same answer. We will use a method where we identify best responses for each player to the other player's actions. A best response is the strategy for one player that leads to the highest payoff given the strategy of the other player. We will mark the best response to one player's choice of strategy by enclosing the payoff of the strategy for the other player. If Firm 2 were to choose $P_L = \$20$, Firm 1 would earn \$100 if P_L is chosen and \$75 if P_H is chosen, so P_L is the best response. We can mark that in the payoff matrix:

		Firm 2	
		$P_L = \$20$	$P_H = \$50$
Firm 1	$P_L = \$20$	\$100, \$100	\$300, \$75
	$P_H = \$50$	\$75, \$300	\$200, \$200

Now suppose Firm 2 chooses P_H. Firm 1 would be better off choosing P_L because \$300 > \$200. Now that we know what Firm 1 will do for any choice made by Firm 2, we can hold Firm 1's action constant and determine what Firm 2 would do. If Firm 1 chooses P_L, Firm 2 would choose P_L because \$100 > \$75. If Firm 1 chooses P_H, Firm 2 would choose P_L because \$300 > \$200.

Any outcome that has both payoffs marked is a Nash equilibrium outcome. If Firm 1 chooses P_L, does Firm 2 want to change strategies? If Firm 2 changes strategy then it will go from earning \$100 to earning \$75. Similarly, if Firm 2 chooses P_L, does Firm 1 want to change strategies? As with Firm 2, Firm 1 does not want to change to P_H because that would reduce Firm 1's payoff. As neither player wants to change strategies, the set of strategies Firm 1 chooses P_L, Firm 2 chooses P_L is a Nash equilibrium. Both firms earn a payoff of \$100.

Collusion Notice that both firms would be better off if they could collude and charge the higher price P_H. At the Nash equilibrium outcome of the game they both earn \$100, but they could both earn \$200 if they could collude on choosing the higher price. In this simple game it is not possible (given these payoffs) for the firms to collude, but in a different game, particularly one that was played many times, it might be possible for the firms to determine some method to collude to keep prices high.[20] Antitrust authorities are looking for this type of anticompetitive behavior. The next example illustrates the difficulty in distinguishing anticompetitive behavior from strategic behavior.

[20] If you are familiar with the Prisoner's Dilemma, this example is just a Prisoner's Dilemma repurposed for the oligopoly context. This type of game also happens to represent the free rider problem in public goods as well. Both players could be better off if they take a particular action, but one player could free ride on the other and be even better off by free riding. Ultimately both free ride, at least in this simple game.

3.1.3 Pricing Game with Three Prices

Now suppose that our two firms, Firm 1 and Firm 2, can choose three prices. In addition to P_L and P_H they can also choose a medium price, $P_M = \$35$. Writing out all the combinations of payoffs gets convoluted, so I will represent the outcomes and payoffs in the payoff matrix.

		Firm 2		
		$P_L = \$20$	$P_M = \$35$	$P_H = \$50$
Firm 1	$P_L = \$20$	\$100, \$100	\$135, \$125	\$300, \$75
	$P_M = \$35$	\$125, \$135	\$150, \$150	\$140, \$140
	$P_H = \$50$	\$75, \$300	\$140, \$140	\$200, \$200

Given these payoffs, if Firm 1 chooses P_L or P_M, Firm 2's best response is P_M; if Firm 1 chooses P_H, Firm 2's best response is P_L. Similarly, if Firm 2 chooses P_L or P_M, Firm 1's best response is P_M; if Firm 2 chooses P_H, Firm 1's best response is P_L. Using the method of identifying the best responses, we find the following:

		Firm 2		
		$P_L = \$20$	$P_M = \$35$	$P_H = \$50$
Firm 1	$P_L = \$20$	\$100, \$100	\$135, \$125	\$300, \$75
	$P_M = \$35$	\$125, \$135	\$150, \$150	\$140, \$140
	$P_H = \$50$	\$75, \$300	\$140, \$140	\$200, \$200

The Nash equilibrium to this game is now that both firms choose P_M. The payoff to each firm is \$150. The firms still cannot reach the highest joint payoff of \$200 by choosing the high price, but the medium price does provide more profit than the low price. The firms have not colluded, they have just acted optimally given their payoff structure.[21]

This outcome underlies the difficulty that regulators may have in determining whether outcomes are anticompetitive. The firms have taken no actions to collude and prices are the same. One could argue that similar prices is evidence of collusion, but in the 2x2 game firms chose the same prices and those just happened to be the lowest possible prices in the game. Further, in our perfectly competitive markets all firms take the same price as given and charge that price. Unless one has definitive evidence that firms are engaging in collusion, such as conspirators caught on a recording, it is not easy to distinguish between a competitive outcome and a collusive one.

3.2 Market and Merger Analysis

Determining whether products are substitutes or complements is an initial step in determining the relationship between products. While intuitively we have a sense of which pairs or groups of goods are substitutes or complements or not related at all, formally we can use cross-price elasticity to make this determination. The cross-price elasticity is the responsiveness of quantity of one good to a price change in another good. Formally, it is the percentage change in the quantity of one good (Good A) in relation to the percentage change in the price of another good (Good B):

$$X - price\ elasticity = \frac{\%\Delta Q_A}{\%\Delta P_B}$$

If the cross-price elasticity is positive, then the goods are substitutes. If the price of Good B increases, and the quantity of Good A increases, then people are consuming more of Good A after a price increase in Good B. So they are switching from Good B to Good A. If the cross-price elasticity is negative, then the goods are complements. If the price of Good B increases, and the quantity of Good A decreases, then people are consuming less of Good A after a price increase in Good B. So they are switching away from both Goods A and B after a price increase in Good B, which likely means that the goods are consumed together. If the cross-price elasticity is zero, then the goods are independent. If the quantity of Good A does not change when the price of Good B changes, there is no consistent purchasing relationship that consumers have with

[21] There are more formal quantity choice and pricing choice games that lead to the same outcome (prices between the competitive equilibrium price and the collusive price). Also, in these more formal set-ups it is more obvious that $MR = MC$ at the profit-maximizing level of output.

the two goods.[22]

While cross-price elasticity calculation provides some evidence of a relationship between the prices and quantities of two goods, it will only show a correlation between prices and not causality. Baker (2007) provides an overview of the concepts of market definition. Stigler and Sherwin (1985) propose a price test for market definition, in which they use parallel price shifts in goods to define the relevant market. Early work by Baker (1987), Baker and Bresnahan (1992), and Werden and Froeb (1993) detail some shortcomings of this price test approach. The primary criticism of the price test approach is that price tests may not be measuring market power.

Merger analysis was not initially considered to be a violation of the Sherman Act, but the potential anticompetitive effects of mergers are clear. To state the obvious, a merger will reduce the number of competitors in the market by one and concentrate more market power in the single merged firm. Mergers can be horizontal, meaning that two firms competing in the same product market would be merging. Mergers can also be vertical, meaning that a firm is seeking to acquire another firm that is either upstream in the market process (a supplier) or downstream (a firm that it sells to). The FTC and DOJ have guidelines on both types of mergers.[23] White (1987) provides a review and critique of earlier antitrust and merger guidelines.

Pittman (2017)[24] discusses three tools for antitrust analysis in general with a focus on mergers: critical loss analysis, upward pricing pressure, and vertical arithmetic. The first two tools focus on horizontal mergers, while the last focuses on vertical mergers. Critical loss analysis relies on the assumption of the hypothetical monopolist, mentioned earlier in the notes. The DOJ and FTC 2010 Horizontal Merger Guidelines state that:

> Specifically, the test requires that a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future seller of those products ("hypothetical monopolist") likely would impose at least a small but significant and non-transitory increase in price ("SSNIP") on at least one product in the market, including at least one product sold by one of the merging firms.

Pittman notes that a number of modeling choices need to be made in order to construct such a hypothetical monopolist. The analysis itself focuses on how much consumers will substitute away from the product if there is a price increase and whether or not that substitution could mitigate the likelihood of an anticompetitive price increase. Demand elasticities are important in this type of analysis as they reflect substitutability of the product but the focus of critical loss analysis tends to be on homogeneous products. A key concept is the diversion ratio, which examines how much of a products lost sales post-merger are recaptured by sales of its pre-merger competitor, which are now both under the control of the same firm post-merger. O'Brien and Wickelgreen (2003)[25] comment that critical loss analysis often fails to control for the cross-price elasticities of products the monopolist may control.

Upward pricing pressure focuses on the obvious result of the merger and asks if the loss of competition is outweighed by any efficiencies in the market. While the merger will likely result in a price increase, the focus of this analysis is on how much the price increase (or upward pricing pressure) affects prices of non-homogeneous products. The diversion ratio is key to this analysis, though it is not straightforward to measure. What is lacking from the upward pricing pressure analysis is consideration of how other firms react to the merger, which may exacerbate or mitigate the effect of the merger.[26]

[22] Theoretically we say that the cross-price elasticity must equal zero, but in empirical work we could use a confidence interval to determine whether the change in quantity is significantly different than zero.

[23] 2010 Horizontal Merger Guidelines:
https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf
(Superseded) 1997 Horizontal Merger Guidelines:
https://www.justice.gov/sites/default/files/atr/legacy/2007/08/14/hmg.pdf
2020 Vertical Merger Guidelines:
https://www.ftc.gov/system/files/documents/reports/us-department-justice-federal-trade-commission-vertical-merger-guidelines/vertical_merger_guidelines_6-30-20.pdf
Note that in September 2021 the FTC withdrew its support of the 2020 Vertical Merger Guidelines.
https://www.ftc.gov/news-events/press-releases/2021/09/federal-trade-commission-withdraws-vertical-merger-guidelines

[24] https://www.justice.gov/atr/page/file/925641/download

[25] https://www.ftc.gov/sites/default/files/documents/reports/critical-analysis-critical-loss-analysis/wp254_0.pdf

[26] Game theoretic analysis could be used to predict the responses of remaining firms.

The third tool is vertical arithmetic. A key question to ask is whether the vertical merger will limit competition because a key resource in the supply chain is now under control of one of the firms producing the final product. As with horizontal mergers, how much sales or profit can be recaptured by the merged firm is a key factor. If the merged firm refuses to provide the resource to a product market competitor, then the merged firm loses those revenues. However, stopping sales of the resource to the competitor might allow for an increase in the price of the final product, which could offset those lost resource sales. Once again the diversion ratio is a key factor.

Gaynor, Kleiner, and Vogt (2013) present two types of structural models for hospital markets. Structural estimation means that a theoretical model is built and then directly estimated. They present a differentiated Bertrand (pricing) oligopoly model and an option demand model. This structural analysis allows them to incorporate the reactions of other firms in the market more completely than the traditional policy tools used by antitrust authorities. However, these models are still subject to a criticism that Pittman mentioned for the critical loss analysis, that the analyst must specify the model and if the model does not accurately capture the industry then the predicted results may be misleading.

Finally, antitrust authorities are focused on human decision-making about price setting and other anti-competitive practices. However, in recent years firms have been allowing algorithms to set prices for online goods to attempt to maximize profit. While these algorithms may lead to market efficiencies, it is also possible that the algorithms learn how to collude. Thus, there is an open question as to how to handle algorithmic behavior when humans are not involved in the day-to-day price setting but are involved in setting up the algorithms. The OECD (2017) has a review of these concerns.

4 Review

That firms act to increase profits is not in and of itself necessarily bad. If a firm discovers a lower cost production technology that allows it to increase its profits, that increases economic efficiency because the new technology should free up resources that could be used elsewhere. However, if firms are acting in anticompetitive manners to increase profits then that is not increasing economic efficiency. Differentiating between these two is a difficult task, unless there happens to be clear cut evidence that firms are engaged in price fixing of some sort. The traditional analysis used by antitrust agencies does not necessarily take into account the complete responses by other firms, but model development continues to advance to better define relevant markets.

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