# Mergers

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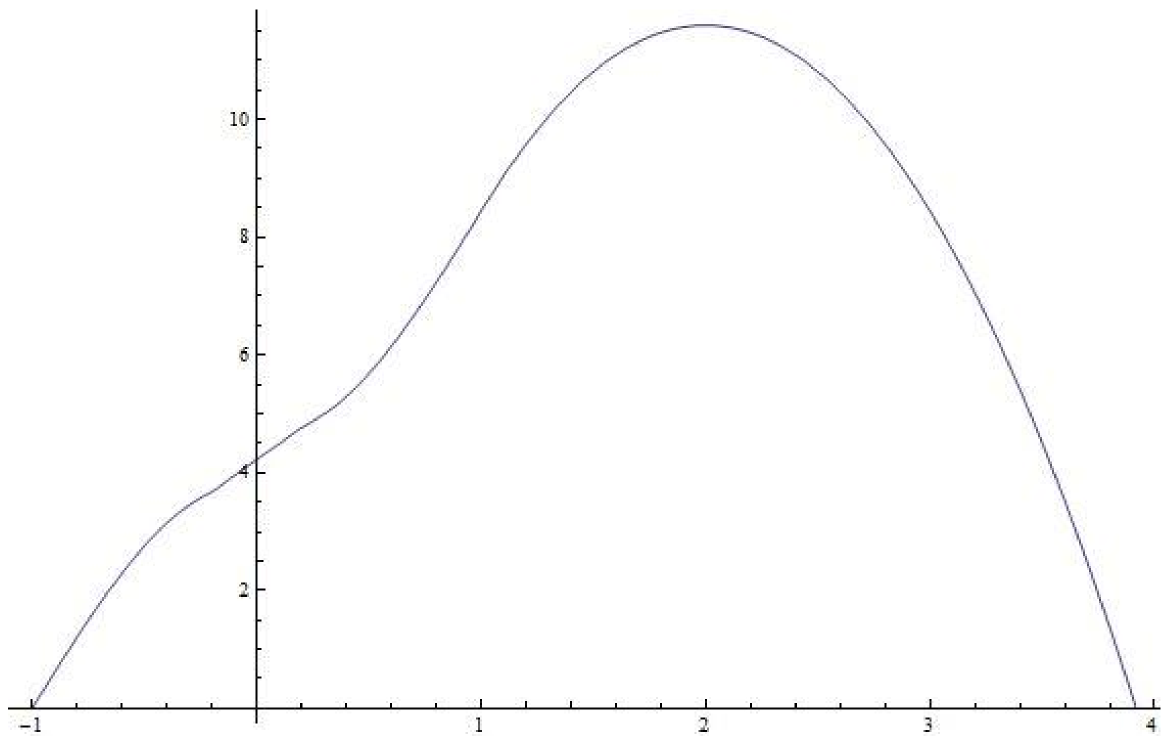


Figure 1: **Temp diagram holder**

**Choosing Price and Output to Maximize Profits**

These notes supplement the Cournot game notes, giving some extra examples.

1a. Suppose a firm's fixed cost is 100, its marginal cost is constant at 4, and the demand curve facing it is $Q = 120 - 4P$. What price should it charge?

The firm's profit as a function of Q is $\pi = PQ - 100 - 4Q$. We want to write that in terms of Q, so we rewrite the demand curve as $4P = 120 - Q$ so $P = 30 - Q/4$. Profit is then $\pi = (30 - Q/4)Q - 100 - 4Q$. That is equivalent to

$$\pi = 30Q - Q^2/4 - 100 - 4Q$$

To maximize profit with respect to Q, take the first derivative and setting it equal to zero (calculate the "first order condition"). That is

$$\frac{d\pi}{dQ} = 30 - \frac{2Q^{2-1}}{4} - 4 = 30 - \frac{Q}{2} - 4 = 0$$

Solving this, we get $Q = 52$ as the profit-maximizing Q, so $P = 30 - Q/4 = 30 - 52/4$, so the price is 17.

1b. What equation tells us marginal revenue as a function of Q?

Revenue is

$$R = PQ = (30 - Q/4)Q = 30Q - Q^2/4.$$

Marginal revenue is the derivative of revenue, so it is

$$\frac{dR}{dQ} = 30 - Q/2.$$

1c. What output maximizes revenue?

To maximize revenue, take the derivative of revenue (NOT profit) and set it equal to zero. This is also where marginal revenue equals zero, and where the MR curve cuts the Q axis— those are just different ways of saying the same thing. So set

$$\frac{dR}{dQ} = 30 - Q/2 = 0$$

which is true at Q=60. Note that that is more than the monopoly output.

1d. What output maximizes the sum of consumer and producer surplus?

The efficient output is where $P = MC$, using the P from the demand curve, since that P is the marginal benefit to consumers from consuming more Q. Thus, set

$$P = 30 - Q/4 = MC = 4.$$

That solves out to $26 = Q/4$ so $Q = 104$, more than the output where profit is maximized. It also happens to be more than the output where marginal revenue equals zero, but that isn't true for all demand functions

and cost functions, just for this situation.
1e. Drop the marginal cost from 4 to 2 and the fixed cost from 100 to 57. Will the monopolist lower its price? What is the new output and price?

The profit function is now

$$\pi = 30Q - Q^2/4 - 57 - 2Q$$

To maximize profit with respect to Q, take the first derivative and setting it equal to zero (calculate the "first order condition"). That is

$$\frac{d\pi}{dQ} = 30 - Q/2 - 2 = 0$$

Thus, output is Q=56– it rises by 4. The new price is $P = 30 - Q/4 = 30 - 56/4$,which is P = 16. The monopolist passes along a little of the cost saving to consumers, but not much. Its price only falls by 1, from 17 to 16.

Note that the fixed cost plays no role in pricing or output decisions in the short run. In the long run, if it is too high the firm would shut down— even if it was a monopoly.

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2. Suppose the firm's total cost is $TC = 4 + Q^2$ so marginal cost is rising with output. Let the demand curve be $P = 60 - 2Q$.
2a. What output maximizes profit?

The firm's profit function is

$$\pi = PQ - 4 - Q^2 = (60 - 2Q)Q - 4 - Q^2 = 60Q - 2Q^2 - 4 - Q^2$$

Take the derivative and set it to zero to get the profit-maximizing output:

$$\frac{d\pi}{dQ} = 60 - 6Q = 0$$

Thus, the profit maximizing output is $Q = 60/6 = 10$. The price is then $P = 60 - 2Q = 60 - 20 = 40$.

2b. What equations tells us marginal revenue and marginal cost as functions of Q?

Revenue is

$$R = PQ = (60 - 2Q)Q = 60Q - 2Q^2$$

Marginal revenue is the derivative of revenue, so it is

$$\frac{dR}{dQ} = 60 - 4Q.$$

Marginal cost is the derivative of total cost, so it is

$$\frac{dTC}{dQ} = \frac{d(4 + Q^2)}{dQ} = 2Q.$$

2c. What output maximizes revenue?

To maximize revenue, take the derivative of revenue (NOT profit) and set it equal to zero.

$$\frac{dR}{dQ} = 60 - 4Q = 0$$

which is true at Q=15.

2d. What output maximizes the sum of consumer and producer surplus?

The efficient output is where $P = MC$, using the P from the demand curve ($P = 60 - 2Q$), since that P is the marginal benefit to consumers from consuming more Q. Thus, set

$$P = 60 - 2Q = MC = 2Q$$

That solves out to $60 = 4Q$ so $Q = 15$, more than the output where profit is maximized. It happens to be the output where marginal revenue is zero, but that is just a coincidence.

2e. Drop the marginal cost from 2Q to Q. What is the new profit-maximizing output and price?

We could find the new profit function and take its first derivative, but this time let's just equate marginal revenue and marginal cost, to get the same answer.

$$\frac{dR}{dQ} = 60 - 2Q = MC = Q$$

This solves to $60 = 3Q$ so $Q = 20$. Price is $P = 60 - 2Q$, so price falls from 40 to 20.

Note that the old profit maximizing output was 10, so the old marginal cost was $MC = 2(10) = 20$ and the new marginal cost is $MC = 1(10) = 10$, so in this case, because the price falls by 20, the firm is passing along *more* than the decline in marginal cost (which is 10) to consumers.

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3. Three firms have have the total cost curves $TC_i = 4 + 2q_i^2$, $i = 1...3$. The demand curve facing the industry is $P = 40 - Q$, where $Q = q_1 + q_2 + q_3$.

3a. What is the profit function for firm 1?

Firm 1's profit is

$$\pi_1 = (40 - Q)q_1 - (4 + 2q_1^2)$$

which can be rewritten as

$$\pi_1 = (40 - q_1 - q_2 - q_3)q_1 - 4 - 2q_1^2 = 40q_1 - q_1^2 - q_2q_1 - q_3q_1 - 4 - 2q_1^2$$

3b. What is the profit function for firm 1? You can think of this as the demand curve facing firm 1.

Take the first derivative and set it equal to zero to get

$$\frac{d\pi_1}{dq_1} = 40 - 2q_1 - q_2 - q_3 - 4q_1 = 0.$$

Solve this for $q_1$ We can rewrite it as $40 - q_2 - q_3 = 6q_1$, so

$$q_1 = \frac{40 - q_2 - q_3}{6}.$$

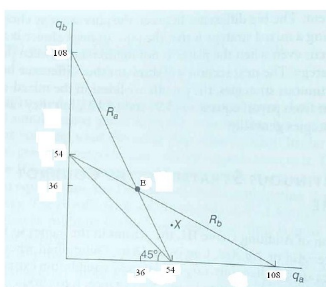
G406: Cournot Duopoly

Suppose firms Apex and Brydox, with marginal cost constant at $c = 12$, simultaneously choose quantities $q_a$ and $q_b$. Total quantity is $Q = q_a + q_b$, and we will assume demand to be linear:

$$p(Q) = 120 - q_a - q_b. \tag{1}$$

Payoffs are profits, which are given by a firm's price times its quantity minus its costs, i.e.,

$$\begin{aligned} \pi_{Apex} &= (120 - q_a - q_b)q_a - cq_a = (120 - c)q_a - q_a^2 - q_a q_b; \\ \pi_{Brydox} &= (120 - q_a - q_b)q_b - cq_b = (120 - c)q_b - q_a q_b - q_b^2. \end{aligned} \tag{2}$$




The monopoly output maximizes profit, $R - TC = pQ - cQ = (120 - Q)Q - cQ$, with respect to the total output of $Q$, resulting in the first-order condition

$$120 - c - 2Q = 0, \tag{3}$$

which implies a total output of $Q = 54$ and a price of 66

To find the "Cournot-Nash" equilibrium, we need to refer to the **best-response functions** or **reaction functions** for the two players. If Brydox produced 0, Apex would produce the monopoly output of 54. If Brydox produced $q_b = 108$ or greater, the market price would fall to 12 and Apex would choose to produce zero. The best response function is found by maximizing Apex's payoff, given in equation (2), with respect to his strategy, $q_a$. This generates the first-order condition $120 - c - 2q_a - q_b = 0$, or

$$q_a = 60 - \left(\frac{q_b + c}{2}\right) = 54 - \left(\frac{1}{2}\right) q_b. \quad (4)$$

The reaction functions of the two firms are labelled $R_a$ and $R_b$ in the figure. Where they cross, point E, is the equilibrium. It is found by solving the two reaction functions for $q_a$ and $q_b$, which generates the unique equilibrium, $q_a = q_b = 40 - c/3 = 36$. The equilibrium price is then 48 (= 120-36-36). Profit is bigger than zero, but less than the monopoly level.

Well start with the basic graph on the board of how a firm with market power equates MR and MC. Well do it with flat, rising, and falling MC.

Whats wrong with monopoly?

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Are Triangle Losses Important?

Suppose we thought the entire US economy was monopolized. Let there be a 2020

Q. .5 (.2)(.2)Q = .02Q— 2dollars. 2 percent is 280 billion dollars. BUT: Potential rentseeking loss: 201, 20(.2) (.8)Q = .16Q. 2,240 billion. How would you go about creating and using market power? Some ways increase total surplus, some ways reduce it.

TREBLE DAMAGES

# 1 4

Clayton Act, 15 U.S.C.

# 2 1

5 Suits by persons injured (a) Amount of recovery; prejudgment interest Except as provided in subsection (b) of this section, any person who shall be injured in his business or property by reason of anything forbidden in the

antitrust laws may sue therefor in any district court of the United States in the district in which the defendant resides or is found or has an agent, without respect to the amount in controversy, and shall recover threefold the damages by him sustained, and the cost of suit, including a reasonable attorney's fee.

Exemptions Labor unions (Clayton Act) Export cartels (Webb-Pomerene) Ag cooperatives ( Capper-Volstead) Regulated industries, e.g., insurance, electricity, phones Sports— Baseball (1922).

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Example: Cement in Indiana

Builders Concrete and Supply Co. of Fishers, Gus B. (Butch) Nuckols conspired with another company, IMI, which made $225 million from the conspiracy. Plea agreement. Nuckols assists govt. but received a $50,000 fine and 14 months prison. His company was fined $4 million.

4 execs of IMI pled guilty and received fines of one to two hundred thousand dollars and went to jail for 5 months.

Their company was fined $29 million.

The FBI alleged meetings at the Nuckols horse barn in Fishers to discuss price, discounts, and conditions of sale, together with phone calls and other meetings.

Summary:

Sherman Act: No price agreements. No monopolization.

Clayton Act, FTC Act: No pricing, exclusive dealing contracts mergers that 18 contracts, mergers, reduce competition. Treble damages allowed.

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Per Se vs. Rule of Reason Per se: no excuses. The practice is always illegal. Example: bid rigging. Two bidders cannot agree what each will bid, even if there are 100 other bidders and they dont matter much.

Rule of reason: excuses allowed. Example: price discrimination. You can charge different prices if costs are different, or competitors are doing it.

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Enforcers:

Antitrust Division of the Justice Dept. Federal Trade Commission Private suits for treble damages

Why have all these enforcers?

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Single-Firm Conduct

Charging high prices is legal. Why? Having a monopoly is legal. Why? 21 Robinson-Patman Act: You are not supposed to charge different prices to different customers unless the cost of serving them differs or you need to meet competition. This is a confused and confusing law.

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Multi-Firm Conduct: Collusion Here, Ill draw reaction curves to show how two firms choosing quantity independently result in prices above marginal cost (the Cournot diagram).

Ill also draw the prisoners dilemma

The prisoner s dilemma.

It is hard for firms to collude without binding contracts. Such contracts have always been unenforceable in England and America, even before the Sherman Act.

4-firm Concentration Ratios

Sheet metal: 9 Typesetting: 16 Publishing: 23 Soap and detergents: 6333 Greeting cards: 84 Cigarettes: 93 Corn farming ¡ 1 Aircraft: 79 Asphalt paving: 15 Men's slacks: 75

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1. SHERMAN ANTITRUST ACT, 15 U.S.C. sections 1-7

# 3 1

Sherman Act, 15 U.S.C.

## 4 1

Trusts, etc., in restraint of trade illegal; penalty

Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $10,000,000 if a corporation, or, if any other person, $350,000, or by imprisonment not exceeding three years, or by both said punishments, in the discretion of the court.

## 5 2

Sherman Act, 15 U.S.C.

## 6 2

Monopolizing trade a felony; penalty

Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $10,000,000 if a corporation, or, if any other person, $350,000, or by imprisonment not exceeding three years, or by both said punishments, in the discretion of the court.

## 7 2

Clayton Act, 15 U.S.C.

# 8 1

3(2)

Discrimination in price, services, or facilities

(a) Price; selection of customers

It shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities of like grade and quality, where either or any of the purchases involved in such discrimination are in commerce, where such commodities are sold for use, consumption, or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, and where the effect of such discrimination may be substantially to lessen competition or tend to create a monopoly in any line of commerce, or to injure, destroy, or prevent competition with any person who either grants or knowingly receives the benefit of such discrimination, or with customers of either of them: Provided, That nothing herein contained shall prevent differentials which make only due allowance for differences in the cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which such commodities are to such purchasers sold or delivered: Provided, however, That the Federal Trade Commission may, after due investigation and hearing to all interested parties, fix and establish quantity limits, and revise the same as it finds necessary, as to particular commodities or classes of commodities, where it finds that available purchasers in greater quantities are so few as to render differentials on account thereof unjustly discriminatory or promotive of monopoly in any line of commerce; and the foregoing shall then not be construed to permit differentials based on differences in quantities greater than those so fixed and established: And provided further, That nothing herein contained shall prevent persons engaged in selling goods, wares, or merchandise in commerce from selecting their own customers in bona fide transactions and not in restraint of trade: And provided further, That nothing herein contained shall prevent price changes from time to time where in response to changing conditions affecting the market for or the marketability of the goods concerned, such as but not limited to actual or imminent deterioration of perishable goods, obsolescence of seasonal goods, distress sales under court process, or sales in good faith in discontinuance of business in the goods concerned.

(b) Burden of rebutting prima-facie case of discrimination

Upon proof being made, at any hearing on a complaint under this section, that there has been discrimination in price or services or facilities furnished, the burden of rebutting the prima-facie case thus made by showing justification shall be upon the person charged with a violation of this section, and unless justification shall be affirmatively shown, the Commission is authorized to issue an order terminating the discrimination: Provided, however, That nothing herein contained shall prevent a seller rebutting the prima-facie case thus made by showing that his lower price or the furnishing of services or facilities to any purchaser or purchasers was made in good faith to meet an equally low price of a competitor, or the services or facilities furnished by a competitor.

(c) Payment or acceptance of commission, brokerage, or other compensation

It shall be unlawful for any person engaged in commerce, in the course of such commerce, to pay or grant, or to receive or accept, anything of value as a commission, brokerage, or other compensation, or any allowance or discount in lieu thereof, except for services rendered in connection with the sale or purchase of goods, wares, or merchandise, either to the other party to such transaction or to an agent, representative, or other intermediary therein where such intermediary is acting in fact for or in behalf, or is subject to the direct or indirect control, of any party to such transaction other than the person by whom such compensation is so granted or paid.

(d) Payment for services or facilities for processing or sale

It shall be unlawful for any person engaged in commerce to pay or contract for the payment of anything of value to or for the benefit of a customer of such person in the course of such commerce as compensation or in consideration for any services or facilities furnished by or through such customer in connection with the processing, handling, sale, or offering for sale of any products or commodities manufactured, sold, or offered for sale by such person, unless such payment or consideration is available on proportionally equal terms to all other customers competing in the distribution of such products or commodities.

(e) Furnishing services or facilities for processing, handling, etc.

It shall be unlawful for any person to discriminate in favor of one purchaser against another purchaser or purchasers of a commodity bought for resale, with or without processing, by contracting to furnish or furnishing, or by contributing to the furnishing of, any services or facilities connected with the processing, handling, sale, or offering for sale of such commodity so purchased upon terms not accorded to all purchasers on proportionally equal terms.

(f) Knowingly inducing or receiving discriminatory price

It shall be unlawful for any person engaged in commerce, in the course of such commerce, knowingly to induce or receive a discrimination in price which is prohibited by this section.

Discrimination in rebates, discounts, or advertising service charges; underselling in particular localities; penalties, 15 U.S.C.

## 9 1

3a

It shall be unlawful for any person engaged in commerce, in the course of such commerce, to be a party to, or assist in, any transaction of sale, or contract to sell, which discriminates to his knowledge against competitors of the purchaser, in that, any discount, rebate, allowance, or advertising service charge is granted to the purchaser over and above any discount, rebate, allowance, or advertising service charge available at the time of such transaction to said competitors in respect of a sale of goods of like grade, quality, and quantity; to sell, or contract to sell, goods in any part of the United States at prices lower than those exacted by said person elsewhere in the United States for the purpose of destroying competition, or eliminating a competitor in such part of the United States; or, to sell, or contract to sell, goods at unreasonably low prices for the purpose of destroying competition or eliminating a competitor.

Any person violating any of the provisions of this section shall, upon conviction thereof, be fined not more than $5,000 or imprisoned not more than one year, or both.

# 10 3

Clayton Act, 15 U.S.C.

# 11 1

4

Sale, etc., on agreement not to use goods of competitor

It shall be unlawful for any person engaged in commerce, in the course of such commerce, to lease or make a sale or contract for sale of goods, wares, merchandise, machinery, supplies, or other commodities, whether patented or unpatented, for use, consumption, or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, or fix a price charged therefor, or discount from, or rebate upon, such price, on the condition, agreement, or understanding that the lessee or purchaser thereof shall not use or deal in the goods, wares, merchandise, machinery, supplies, or other commodities of a competitor or competitors of the lessor or seller, where the effect of such lease, sale, or contract for sale or such condition, agreement, or understanding may be to substantially lessen competition or tend to create a monopoly in any line of commerce.

## 12 4

5. Unfair methods of competition unlawful; prevention by Commission

## 13 4

5. Unfair methods of competition unlawful; prevention by Commission

* (a) Declaration of unlawfulness; power to prohibit unfair practices; inapplicability to foreign trade o (1) Unfair methods of competition in or affecting commerce, and unfair or deceptive acts or practices in or affecting commerce, are hereby declared unlawful. o (1) Unfair methods of competition in or affecting commerce, and unfair or deceptive acts or practices in or affecting commerce, are hereby declared unlawful.

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## Questions You Should Be Able to Answer

## Terms to Know

## Homework Questions

HERE PUT EXAMPLES WITH DIFFERENT NUMBERS THAN IN THE TEXT