ECON 120 – Regulation and Antitrust Policy
Drake University, Spring 2026
William M. Boal

Blackboard: http://drake.blackboard.com
Old exams: http://wmboal.com/antitrust
Email: william.boal@drake.edu

BOAL'S ECON 120

SLIDESHOW HANDOUTS

SPRING 2026

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TENTATIVE COURSE SYLLABUS

1. Resources | 2. Requirements | 3. Schedule

1. Resources

Description from Course Catalog: Economic foundations, history, and recent developments in antitrust policy and economic regulation of monopolies. Emphasis on U.S. policy, with occasional comparisons to the European Union and other countries.

Prerequisites: ECON 002 and a course in calculus (MATH 028 or 050). The calculus prerequisite is essential—students must know how to find derivatives.

Zimpleman Promises: "Our graduates will have the skills and experiences to thrive in a complex, diverse, and evolving world. They will be (1) Proficient in their fields, (2) Data-driven, strategic problem solvers, (3) Effective communicators, (4) Socially and ethically responsible leaders, and (5) Global and multicultural citizens." This course addresses all five Promises, but especially Promises (1) and (2).

University "Engaged Citizen" Area of Inquiry: In this course, students will learn to participate effectively in the democratic process primarily through these outcomes:

2. *Establish skills, knowledge, or dispositions that lead them to be active stewards for the common good.* Should business be regulated for the common good? If so, how? The loudest voices in democratic society often advocate only for themselves—whether businesses or consumers. This course establishes skills in looking beyond the interests of particular groups to the common good. It begins by developing a framework—economic welfare analysis—for evaluating the impact on all of society of business behavior and government regulation. Then this framework is applied throughout the course to problems of imperfect competition and monopoly and to possible government responses.

3. *Critically reflect on the social, economic, or political issues that they will face as citizens.* As citizens, we face important economic issues about whether and how business should be regulated. For example, how should the government respond if companies coordinate their pricing, if companies grow very large, if big companies try to merge, if companies "tie" or bundle their products so that consumers must buy all or none, or if companies charge different prices to different customers? Some industries, such as electric power, are now heavily regulated. Should they be deregulated and allowed to set their own prices? If not, how should government set prices for them? In this course, we reflect on these issues using economic analysis and data. Then we critically examine important legal cases and current policies followed by the Department of Justice and regulatory agencies which are intended to address these issues.

and to a lesser extent through this outcome:

1. *Learn to evaluate the mix of diverse values and interests that influence democratic decision-making.* Government policies are the outcome of democratic decision-making among people with diverse interests. Even bad policies usually benefit someone. As we study market failure and possible government responses, we use economic theory and examples to determine who wins and who loses, and use economic welfare analysis to evaluate how much they win or lose.

Who should take this course: This course counts as an elective for the following programs:
- Economics major; Quantitative Economics major; and Economics minor
- Law, Politics, and Society major.
- Business Law major; and Law and Business minor.

Class meetings: CRN 14909 meets Tuesdays and Thursdays, from 12:30 to 1:45 in Aliber 102.

How to contact instructor:
- Office: 319 Aliber Hall
- Telephone and voice mail: 271-3129
- Electronic mail: william.boal@drake.edu (preferred)

The quickest way to reach me is by email, which I check continually throughout the day. Please do *not* send messages by Blackboard, which I check infrequently.

Office hours: Office hours are a time when you can get help with homework, ask questions about course material, and discuss your grade or anything related to this course or economics in general. Bring your slideshow handouts. My office hours this semester are **TBA**. If these hours are inconvenient due to schedule conflicts, please send email to schedule a special appointment and suggest some alternate times.

Resources to purchase:
- Required: W. Kip Viscusi, Joseph E. Harrington Jr., and David E.M. Sappington, *Economics of Regulation and Antitrust,* 5th edition, Cambridge, Massachusetts: MIT Press, 2018, ISBN 9780262038065. Available for purchase at University Bookstore. Alternatively, it can be rented as an online e-textbook at https://mitpress.ublish.com/. Used copies are OK, provided they are 5th edition.
- Required: *Boal's Econ 120 Slideshow Handouts*, a course packet. Buy it at University Bookstore. Alternatively, you may download it from Blackboard and print it. Please bring it to class every day.
- Required: A simple calculator (capable of addition, subtraction, multiplication and division) for exams.
- Recommended: Your favorite introductory microeconomics textbook, for reference.
- Recommended: Your favorite calculus textbook, for reference.
- Recommended: A three-ring binder and highlighter for your course packet.

Online resources:
- Drake email. Course announcements will occasionally be sent to this account, so check it daily. Announcements often get diverted to "Junk" or "Clutter" folders, so check them as well as your inbox.
- Blackboard (http://drake.blackboard.com). Slideshow quizzes and problem sets are posted here. If you have difficulty accessing Blackboard, please call the Drake ITS HelpDesk at 271-3001.
- Course materials page (http://wmboal.com/antitrust). Old exams are posted here.

2. Requirements

Course grade: Each exam and homework exercise is graded on a scale from zero to 100. Your overall course score is calculated as a weighted average, using the following weights:

75%   **Exams.** All exams are closed-book, closed-notes. Simple calculators are permitted, *but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are not permitted.* If you do not bring a simple calculator, you must take the exam without a calculator. The final exam counts double and is required—students who do not take the final will not pass the course.

10%   **Slideshow quizzes**. These online multiple-choice quizzes cover the slideshows presented in class and are accessed from Blackboard. They consist of 5-10 multiple-choice questions and are due the day after the topic is covered in class. You can take each slideshow quiz up to three times until the due date, but the questions will change. Blackboard records your maximum score.

10%   **Problem sets.** These are posted on Blackboard in PDF format. Print them, complete them in pen or pencil (colored pencil welcome!) and submit them as hard-copy. They are due at the next class after the topic is covered in class.

5%   **Presentation.** Students will make a short presentation of a recent antitrust case. Detailed instructions will be posted on Blackboard.

An overall score of 97 or above is required for an A+, 93 for an A, 90 for an A-, 87 for a B+, 83 for a B, 80 for a B-, 77 for a C+, 73 for a C, 70 for a C-, 67 for a D+, 63 for a D, and 60 for a D-. SCORES will not be rounded before awarding letter grades. Extra credit work is not available. Exams, problem sets, and quizzes may not be redone for a better grade.

Policy on late work: Early submissions are welcome but *late submissions are not accepted*. If your computer fails, please use a computer in Cowles Library or some other device to complete assignments. Computer problems are *not* an acceptable excuse for late assignments. Students expecting to absent on an athletic trip when an assignment is due should submit that assignment before leaving.

Policy on absences: Attendance is taken at every class. Students may miss up to three classes for any reason without penalty (except when exams are given). Thereafter, one point will be deducted from the course SCORE for each absence. Athletic team trips, documented by an official schedule sheet, will not be counted as absences.

Policy on rescheduling exams: If your own medical emergency, or a serious illness or death in your family requires you to miss an exam, you may be given a makeup exam. However, you must inform me of the emergency before the exam by email, and soon afterward submit a written explanation (including date of absence and documentation if possible).

Certain other circumstances are acceptable reasons for rescheduling an exam. These include religious observance, medical appointment, interview trip, and athletic team trip. Because these circumstances can be predicted, you must send me an email request to reschedule, with an explanation, at least one week before the date of the exam. *Unacceptable* reasons include family vacation, ride leaving early for break, early plane flight, overslept, etc.

Policy on grade corrections: Accurate grading is important. If you find an error, please let me know as soon as possible. The deadline for regrading homework, problem sets, or midterm exams is the day of the final exam.

Policy on computers and phones in class: Computers, tablets, and phones must be turned off during class unless I specifically announce otherwise.

Disability accommodation: Any student who has a disability that substantially limits their ability to perform in this course under normal circumstances should contact Student Disability Services, 271-1835, to request accommodation. Any request must be received from Student Disability Services at least one week before the necessary accommodation. All relevant information will be kept strictly confidential. If your accommodation requires extra time for exams, you should contact me at least a week before each exam to schedule an alternative time and place.

How to succeed in this course:
- Read the textbook before class.
- Study with pencil and paper. Economics is inherently mathematical. Math is difficult to absorb without trying it yourself. As you study your text or notes, try to reproduce any numerical examples and mathematical derivations while covering the page. Everything will make more sense if you work it through yourself.
- Further prepare for exams by working old exams, posted at wmboal.com/antitrust. Don't look at the answer key until after you have solved each problem, or you will become overconfident.
- If you are doing all this but not doing as well as you would like, please ask me for help. Talk to me after class, send email to william.boal@drake.edu, or visit my office hours. I am eager to help!

Policy on academic integrity: The Zimpleman College of Business's Academic Integrity Policy (https://www.drake.edu/zimpleman/about/policies/) applies to this course. The consequences of violating this policy vary, depending on my evaluation of the severity of the dishonesty. A violation (such as cheating, plagiarism, or fabrication) can result in a grade of zero on the test or assignment, an F for the course grade, or even expulsion from the University. Please read the policy and ask for clarification if necessary.

3. Schedule

Textbook should be read before class, but you can skip the mathematical examples—I will present simpler ones in class. Dates below in [brackets] are tentative. If bad weather or an epidemic closes campus, most likely we will have class online using Blackboard Collaborate.

Calculus Review (to be completed before course starts)

Big ideas: Rates of change are fundamental to modern economic theory. The economic term "marginal" corresponds to the mathematical term "derivative."

Famous quote: «Quiconque connaît la notation algébrique, lit d'un clin-d'oeil dans une équation le résultat auquel on parvient péniblement par des règles de fausse position, dans l'arithmétique de Banque.» ["Anyone who understands algebraic notation, reads at a glance in an equation results reached arithmetically only with great labor and pains."] --A. A. Cournot, *Researches on Mathematical Principles of the Theory of Wealth* (1838)

- ☐ Read chapter 1 of online lecture notes, entitled "Review of Basic Calculus" (wmboal.com/imicro).
- ☐ Optionally, if your calculus is rusty, view "AP Calculus AB" videos on derivatives at https://www.khanacademy.org/math/ap-calculus-ab/ab-differentiation-1-new .
- ☐ Optionally, review chapters on techniques of differentiation in your favorite calculus textbook.
- ☐ Slideshow quiz due **Jan 27.**

Part 1: Review of Perfect Competition

Big ideas: Perfect competition is economically efficient because it ensures marginal-cost pricing.

Famous quote: "Every individual ... neither intends to promote the public interest, nor knows how much he is promoting it ...He intends only his own gain, and he is in this ... led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for society that it was no part of it. By pursuing his own interest he frequently promotes that of society more effectually than when he really intends to promote it."
--Adam Smith, *The Wealth of Nations* (1776)

A. Demand and supply [Jan 27, 29]
   ☐ Read Viscusi, Harrington, and Sappington chapter 1.
   ☐ Bring the following slideshow handouts to class: *Government regulation of business: introduction. Demand. Supply. Equilibrium. Elasticities. The price elasticity of demand. Price elasticity and revenue. The price elasticity of supply.*
   ☐ Slideshow quiz due Jan 30. (I recommend you do the quiz *after* the slideshows are covered in class.)
   ☐ Problem set due Feb 3.

B. Competitive firms [Feb 3]
   ☐ Bring the following slideshow handouts to class: *Cost curves. Profit maximization. Cost curves in the short run. Profit maximization in the short run. Short-run market equilibrium. Long-run market equilibrium.*
   ☐ Slideshow quiz due Feb 4.
   ☐ Problem set due Feb 5.

C. Welfare analysis [Feb 5, 10]
   ☐ Bring the following slideshow handouts to class: *Willingness-to-pay and consumer surplus. Marginal cost and producer surplus. Economic efficiency and welfare analysis. Perfect competition. Efficiency of perfectly competitive markets. Welfare analysis of price controls and quotas.*
   ☐ Slideshow quiz due Feb 11.
   ☐ No problem set. Instead, study for exam.

First exam [Feb 12]
   • Prepare by reviewing slideshow handouts and studying old exams posted online (wmboal.com/antitrust).
   • You may use a simple calculator, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are NOT permitted
   • Exam seating is assigned, so please check the projector screen before you sit down.

Part 2: Antitrust Theory

Big ideas: Monopoly, oligopoly and collusive markets are economically inefficient because they push price above marginal cost and reduce the quantity traded. But concentrated markets are not necessarily inefficient.

Famous quote: "People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices."
--Adam Smith, *The Wealth of Nations* (1776)

A. Monopoly theory and antitrust [Feb 17, 19]
- ☐ Read Viscusi, Harrington, and Sappington chapter 3.
- ☐ Bring the following slideshow handouts to class: *Monopoly and barriers to entry. The monopolist's marginal revenue. Monopoly pricing. Welfare analysis of monopoly. The structure-conduct-performance paradigm. Antitrust statutes and their enforcement.*
- ☐ Slideshow quiz due Feb 20.
- ☐ Problem set due Feb 24.

B. Theories of oligopoly and collusion [Feb 24, 26]
- ☐ Read Viscusi, Harrington, and Sappington chapter 4.
- ☐ Bring the following slideshow handouts to class: *Oligopoly. Basic game theory. Cournot duopoly. Cournot oligopoly. Bertrand duopoly. Joint profit maximization (collusion). Cartels in the real world. Cheating in a cartel. Antitrust law on price-fixing.*
- ☐ Slideshow quiz due Feb 27.
- ☐ Problem set due Mar 3.

C. Theories of market structure [Mar 3, 5]
- ☐ Read Viscusi, Harrington, and Sappington chapter 5.
- ☐ Bring the following slideshow handouts to class: *Measures of industry concentration. Concentration and profits. Scale economies. Entry costs and equilibrium entry. Entry barriers and contestable markets. Preventing entry.*
- ☐ Slideshow quiz due Mar 6.
- ☐ No problem set. Instead, study for exam.

Second exam [Mar 10]
- • Prepare by reviewing slideshow handouts and studying old exams posted online (wmboal.com/antitrust).
- • Bring a straightedge to this exam—a ruler or an extra pencil.
- • You may use a simple calculator, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are NOT permitted.
- • Exam seating is assigned, so please check the projector screen before you sit down.

Part 3: Antitrust Policy

> Big ideas: Horizontal and vertical mergers have very different effects on prices and economic efficiency, and so are treated differently by the courts. Whether other business practices harm economic efficiency often depends on context, so courts use the "rule of reason."
>
> Famous quote: "Consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to only so far as it may be necessary for promoting that of the consumer."
> --Adam Smith, *The Wealth of Nations* (1776).
>
> Another famous quote: "The successful competitor, having been urged to compete, must not be turned upon when he wins."
> -- Judge Learned Hand, United States v. Aluminum Co. of America, 148 F 2nd 416 (2d Cir. 1945).

A. Policy on horizontal mergers [Mar 12, 24]
- ☐ Read Viscusi, Harrington, and Sappington chapter 6.
- ☐ Skim 2010 Horizontal Merger Guidelines (at www.justice.gov/atr/public/merger-enforcement.html).
- ☐ Bring the following slideshow handouts to class: *Mergers. Motivations for horizontal mergers. Historic horizontal merger cases. Horizontal merger enforcement today. Changes in concentration. Upward pricing pressure. Other ways to evaluate mergers. Conglomerate mergers.*
- ☐ Enjoy Spring Break, March 16-20!
- ☐ Slideshow quiz due Mar 25.
- ☐ Problem set due Mar 26.

B. Policy on vertical mergers and vertical restraints [Mar 26, 31]
- ☐ Read Viscusi, Harrington, and Sappington chapter 7.
- ☐ Skim 2020 Vertical Merger Guidelines (at www.justice.gov/atr/public/merger-enforcement.html).
- ☐ Bring the following slideshow handouts to class: *Vertical mergers and transaction costs. Successive monopolies and double marginalization. Foreclosure for monopoly extension. Other kinds of foreclosure. Law and policy on vertical mergers. Vertical restraints. Tying.*
- ☐ Slideshow quiz due Apr 1.
- ☐ Problem set due Apr 2.

C. Policy on monopolization and price discrimination [Apr 2, 7]
- ☐ Read Viscusi, Harrington, and Sappington chapter 8.
- ☐ Bring the following slideshow handouts to class: *Law on monopolization. Historic monopolization cases. Predatory pricing. Reputation models of predatory pricing. Law and policy on predatory pricing. Refusal to deal. Monopoly price discrimination. Market-segmenting price discrimination. Law and policy on price discrimination.*
- ☐ Slideshow quiz due Apr 8.
- ☐ Problem set due Apr 9.

D. The new economy and global antitrust [Apr 9, 14]
- ☐ Read Viscusi, Harrington, and Sappington chapter 9.
- ☐ Bring the following slideshow handouts to class: *Network effects. Microsoft cases. Two-sided platforms. Google cases. Competition policy in the European Union. Competition policy in China.*
- ☐ Slideshow quiz due April 15.
- ☐ No problem set. Instead, study for exam.

Third exam [Apr 16]
- • Prepare by reviewing slideshow handouts and studying old exams posted online (wmboal.com/antitrust).
- • You may use a simple calculator, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are NOT permitted
- • Exam seating is assigned, so please check the projector screen before you sit down.

Part 4: Economic Regulation

Big ideas: When monopoly is inevitable, regulatory agencies often set prices. To maximize economic efficiency, they should set prices equal to marginal cost, but sometimes they can't or won't.

Famous quote: "I can't tell one plane from the other. To me, they're all just marginal costs with wings."
--Alfred Kahn

A. Introduction to economic regulation [Apr 21, 23]
  □ Read Viscusi, Harrington, and Sappington chapter 10, and chapter 12 (through page 526).
  □ Bring the following slideshow handouts to class: *Brief history of regulation in the U.S. Theories of regulation. Economic theories of regulation. Natural monopoly. Pricing with economies of scale. Multipart tariffs. Multiproduct firms. Ramsey pricing.*
  □ Slideshow quiz due Apr 24.
  □ Problem set due Apr 28.

B. Regulation of electric power [Apr 28, 30]
  □ Read Viscusi, Harrington, and Sappington chapter 12 (pages 531-end), chapter 13, and chapter 17 (through page 683).
  □ Bring the following slideshow handouts to class: *Traditional rate-of-return regulation. Incentive regulation. Common costs and joint costs. Peak-load pricing in theory. Peak-load pricing in practice: electric power. Markets for wholesale electric power. The California energy crisis of 2000-01. Market power in wholesale power markets. The Texas power crisis of February 2021.*
  □ Slideshow quiz due May 1.
  □ Problem set due May 5.

C. Regulation and deregulation of transportation [May 5, 7]
  □ Read Viscusi, Harrington, and Sappington chapters 15 (through page 616) and 16.
  □ Bring the following slideshow handouts to class: *Effects of price regulation in competitive markets. Indirect effects of regulation. Measuring the effects of regulation. Regulation of railroads and trucking. Effects of deregulating railroads and trucking. Regulation of airlines. Effects of deregulating airlines.*
  □ Slideshow quiz due May 8.
  □ No problem set. Instead, study for final exam.

Final Exam

The University Registrar (www.drake.edu/registrar) has scheduled the final exam for this course on **Tuesday, May 12 from noon to 1:50 PM** in the regular classroom. The content of the final exam is comprehensive and includes questions from all parts of the course.

  • Prepare by reviewing the hour exams you have already taken and old final exams posted online (wmboal.com/antitrust).
  • Bring a straightedge to this exam—a ruler or an extra pencil.
  • You may use a simple calculator, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are NOT permitted.
  • Exam seating is assigned, so please check the projector screen before you sit down.

[end of syllabus]

PART 1

Review of Perfect Competition

Big ideas: Perfect competition is economically efficient because it ensures marginal-cost pricing.

Famous quote: "Every individual ... neither intends to promote the public interest, nor knows how much he is promoting it ...He intends only his own gain, and he is in this ... led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for society that it was no part of it. By pursuing his own interest he frequently promotes that of society more effectually than when he really intends to promote it."
--Adam Smith, *The Wealth of Nations* (1776)

GOVERNMENT REGULATION OF
BUSINESS: INTRODUCTION
Page 1

GOVERNMENT REGULATION OF BUSINESS: INTRODUCTION

• Why regulate industry?

Why regulate business?

• A free market is not necessarily an efficient, competitive market.
• Markets may fail in several possible ways.

Market failure

A. *Market power* might threaten economic efficiency.
B. One side of the market (e.g., consumers) might lack *information* to demand good products.
C. Businesses might create *external costs or benefits*.

Kinds of government regulation

A. Economic regulation and antitrust policy: controlling market power.
  1. Antitrust policy: promoting competition.
  2. Price and entry regulation: controlling monopoly.
B. Health and safety regulation: correcting for consumers' lack of information.
C. Environmental regulation: fixing externalities.

Antitrust policy: promoting competition

• Originated at state level in 19th century.
• Began at federal level with Sherman Act of 1890.
• Addresses price-fixing, practices that limit competition, and mergers.
• Enforcement through _____.
• Agencies: D_____ o J_____ and F_____ T_____ C_____.

Price and entry regulation: controlling monopoly

• Also originated at state level.
• Began at federal level with Interstate Commerce Commission in 1887.
• Many other regulatory agencies established in early 20th century.
• Enforcement through regulatory _____, which decide what firms may _____ the market and what _____ they may set.
• Many industries now deregulated.

GOVERNMENT REGULATION OF
BUSINESS: INTRODUCTION
Page 2

Economic evaluation of regulation

- Regulation improves an industry's performance if it increases economic efficiency.
- Changes in economic efficiency can be measured by changes in _____ surplus and _____ surplus.
- Growing recognition in government that economic efficiency is important.

Analyzing regulation

- *Normative views*: What should be done?

- *Positive views*: What actually happens in regulatory agencies and why?

Positive views of regulation

- *Naive view*: What actually happens is what should happen to maximize efficiency.
- *Capture theory*: Regulatory agencies are "captured"—that is, controlled—by the firms they are supposed to regulate.
- *Competitive theory*: Regulated firms and their customers compete for influence over regulatory agencies.

Market failure versus government failure

- Sometimes regulation decreases economic efficiency in an industry.
- Sometimes regulation is a "cure that is worse than the disease."

Conclusions

- Regulation can increase economic efficiency by
  - controlling market power,
  - correcting for consumers' lack of information, or
  - fixing externalities.
- We focus here on controlling market power by promoting competition (_____) and controlling monopoly (_____).
- However, sometimes government failure is worse than market failure.

DEMAND
Page 1

DEMAND

- How do consumers respond to changes in a good's price?

Demand relation (or demand curve)

- *Demand relation* = relation between the price of a good and the quantity that buyers wish to buy.
- Can be represented by:
  - schedule or table.
  - mathematical formula.
  - graph.

The "Law of Demand"

- Price and quantity demanded are negatively related, *ceteris paribus.*
- Ceteris paribus means " _____ _____."
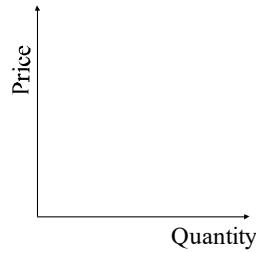
Simple example of demand relation: demand for coconuts

Price	Quantity
$10	0
$9	100
$8	200
$7	300
$6	400
$5	500
$4	600
$3	700
$2	800
$1	900
$0	1000
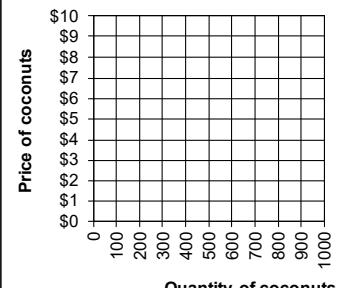
Reasons for Law of Demand

(1) Substitution effect: As price of one good rises, consumers substitute other goods that become relatively cheaper.

- Example: If price of beef rises, consumers switch to _____ .
- Example: If price of orange juice rises, consumers switch to _____ .

Reasons for Law of Demand

(2) Income effect: Even if no substitutes are available, a rise in price implies consumer cannot afford as much as before. Purchasing power of income falls, so buy less of everything, including this good.

- Example: If apartments rents go up, consumers cut back on everything, move to

  _____ .

DEMAND
Page 2

Other factors influencing the quantity demanded

- Prices of related goods.
- Income of consumers.
- Expected future prices of same good.
- Population and demographic structure.
- Product quality.
- Preferences.

Change in demand = shift in demand curve

- When these other factors change, we say there is a *change in demand.* The demand curve *shifts.*
- By contrast, when price of good itself changes, no change in demand and no shift in curve.
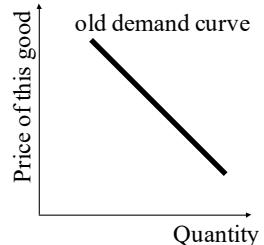
Effect of *prices of related goods* on quantity demanded

- Can be positive or negative.
- *Substitute* = good whose price has a _____ effect on quantity demanded of first good.
- *Complement* = good whose price has a _____ effect on quantity demanded of first good.

Effect of *income* on quantity demanded

- Can be positive or negative.
- *Normal good* = good whose demand _____ as income increases.
- *Inferior good* = good whose demand _____ as income increases.

Conclusions

- The *Law of Demand* states that price and the quantity demanded by consumers are _____ related, *ceteris paribus.*
- It holds because any price change has a _____ *effect* and an _____ *effect.*
- Other things can change the quantity demanded, shifting the *demand curve*, including the _____ of related goods and the _____ of consumers.

SUPPLY
Page 1

SUPPLY

- How do producers respond to changes in a good's price?

Supply relation (or supply curve)

- *Supply relation* = relation between the price of a good and the quantity that sellers wish to sell.
- Can be represented by:
  - schedule or table.
  - mathematical formula.
  - graph.

The "Law of Supply"

- Price and quantity supplied are positively related, *ceteris paribus.*
- Ceteris paribus means "_____ _____."

(graph: Price on vertical axis, Quantity on horizontal axis)
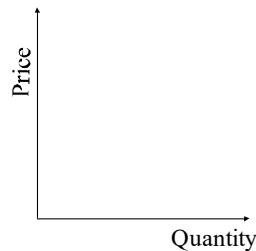
Simple example of supply relation: supply of coconuts

Price	Quantity
$1	0
$2	200
$3	400
$4	600
$5	800
$6	1000
$7	1200

(graph: Price of coconuts ($0–$10) vs Quantity of coconuts (0–1000))
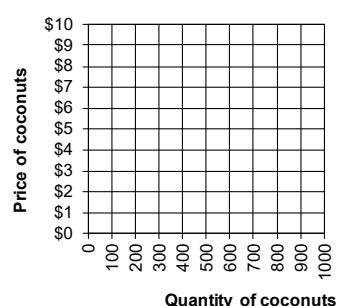
Reasons for Law of Supply

- Increasing opportunity cost generates the law of supply.
  - As more of the good is produced, the cost of producing an additional unit usually _____.
  - A _____ price must be offered to induce suppliers to sell more.

Other factors influencing the quantity supplied

- Prices of inputs.
- Technology.
- Government regulations.
- Expected future prices of same good.
- Number of suppliers.

SUPPLY
Page 2

Change in supply = shift in supply curve

- When these other factors change, we say there is a *change in supply*. The supply curve *shifts*.
- By contrast, when price of good itself changes, no change in supply and no shift in curve.

old supply curve

Price of this good
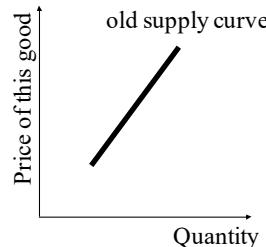
Quantity

Effect of *prices of inputs* on quantity supplied

- Have a negative effect on quantity supplied.
- Reason: Because an increase in input prices increases the cost of producing the good.

Example: increase in wages of fast-food workers shifts supply of fast food to the _____

- Fast-food workers are an input to making fast food.

Price of fast food

Supply of fast food

Quantity of fast food
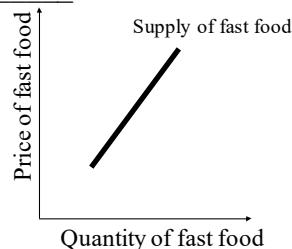
Example: decrease in price of petroleum shifts supply of gasoline to the _____

- Petroleum is an input to making gasoline.

Price of gasoline

Supply of gasoline

Quantity of gasoline
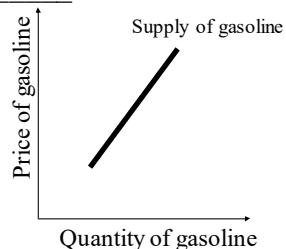
Effect of *technology* on quantity supplied

- New production technology has a positive effect on quantity supplied.
- Reason: Improved production methods _____ the cost of production, by allowing producers to do more with less.
- Examples:

Example: development of "lean" production methods shifts supply of manufactured goods to the _____

- "Lean" production methods use fewer workers, less factory space, and less energy.

Price of manufactures

Supply

Quantity of manufactures
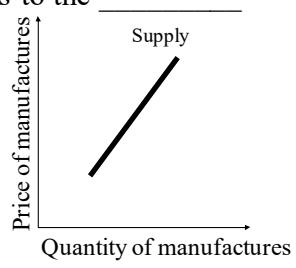
SUPPLY
Page 3

Effect of *government regulations* on quantity supplied

- Have a negative effect on quantity supplied to the extent that they increase the cost of production.
- Most government regulations *do* increase the cost of production—otherwise they would be adopted voluntarily!

Example: environmental regulations shift supply of electricity to the _____

- Environmental regulations require electricity generators to put "scrubbers" on smokestacks.
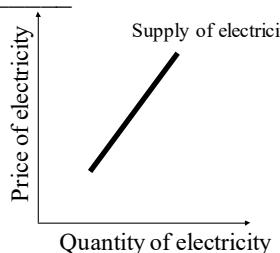
Effect of *expected future prices* on quantity supplied

- Have a negative effect on the quantity supplied.
  - If prices are expected to fall in the future, suppliers sell _____ now.
  - If prices are expected to rise in the future, suppliers sell _____ now.
- Examples:

Effect of *number of producers* on quantity supplied

- Has a positive effect on the quantity supplied.
- Reason: With more producers, output is greater.

Conclusions

- The *Law of Supply* states that price and the quantity supplied are _____ related, all other things held constant.
- It holds because as more of a good is produced, the cost of producing an additional unit usually _____.
- Other things can change the quantity supplied, shifting the *supply curve*, including the prices of inputs and the available production _____.

EQUILIBRIUM
Page 1

EQUILIBRIUM

- What determines market price and quantity?

Demand and supply together

- Demanders and suppliers simultaneously make decisions about how much they want to buy or sell, in response to the market price.
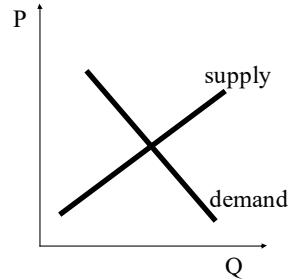
What if quantity demanded does not equal quantity supplied?

- Let:
  Q_D = quantity demanded.
  Q_S = quantity supplied.
- At any given price, Q_D might not equal Q_S.
- But in that case, price will tend to _____.
  - Not an equilibrium!

Excess demand = shortage

- At low prices, $Q_D > Q_S$.
- "Excess demand" or shortage.
- Some consumers are excluded.
- Excluded consumers *bid up* the price.
- Price tends to _____.
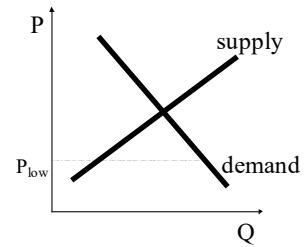
Example 1: market for coconuts
If price = $2, excess _____ = _____ units.
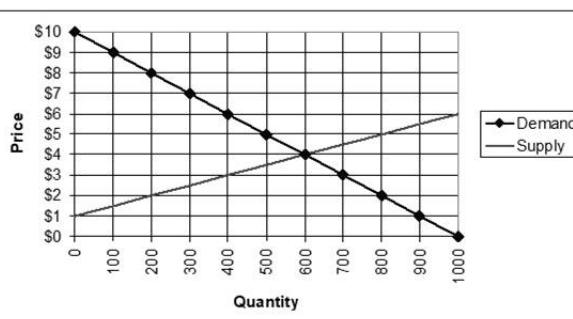
Excess supply = surplus

- At high prices, $Q_D < Q_S$.
- "Excess supply" or surplus.
- Some producers are excluded.
- Excluded producers *cut* the price.
- Price tends to _____.
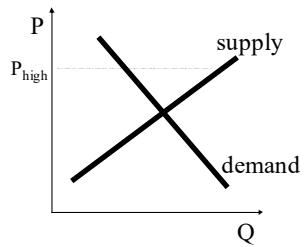
EQUILIBRIUM
Page 2

Example 1: market for coconuts
If price = $5, excess _____ = _____ units.
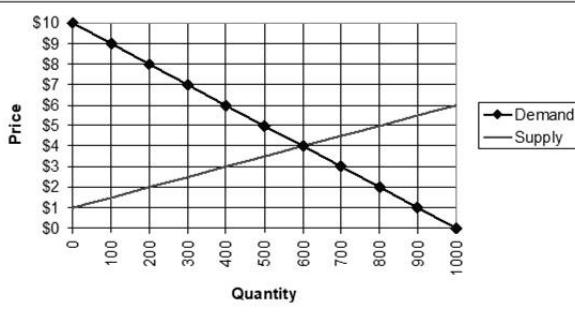
Market equilibrium

- The only stable price is where demand and supply curves intersect:
- P* = equilibrium price
- Q* = equilibrium quantity.
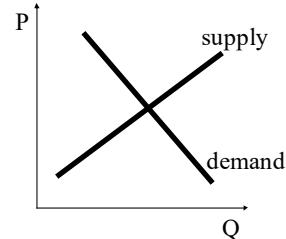
Revenue = spending

- Revenue to sellers
  = spending by buyers
  = P* × Q*
  = area of rectangle
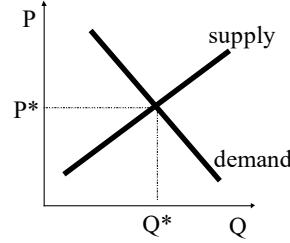
Example 1: market equilibrium
P*= ____, Q*= ____ , Revenue= _____.
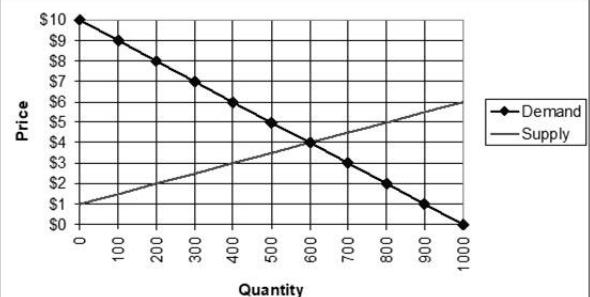
Example 2: market for steel
If price = $20, excess _____ = _____ tons.

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

Example 2: market for steel
If price = $70, excess _____ = _____ tons.

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

EQUILIBRIUM
Page 3

Example 2: market for steel

Equilibrium price = $_____.

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

Example 3: market for orange juice

- Suppose demand is given by
  $Q_D = 400 - 20P$
- And supply is given by
  $Q_S = -50 + 30P$
- Equilibrium means $Q_D = Q_S$,
  $400 - 20P = -50 + 30P$
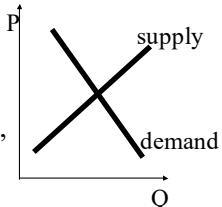
How soon do markets reach equilibrium?

- It may *take time* for markets to adjust to a new equilibrium.
- Usually, the better the communication between buyers and sellers,
  - the _____ the duration of any excess supply or excess demand.
  - the _____ the market reaches the new equilibrium.

Do markets always reach equilibrium eventually?

- *Government policies* may deliberately prevent price from reaching equilibrium.
- Examples:

Conclusions

- *Equilibrium price and quantity* are determined by the intersection of supply and demand curves.
- Any other price is likely to be unstable because it will create either
  a shortage (*excess _____*)
  or a surplus (*excess _____*) .

ELASTICITIES
Page 1

ELASTICITIES

- What is an elasticity?
- How are elasticities related to derivatives?

Elasticity: definition

- Suppose y is a function of x: y = f(x).
- The elasticity of y with respect to x is given by:

$$\varepsilon = \left(\frac{dy}{dx}\right) \cdot \left(\frac{x}{y}\right)$$

- Elasticity can be thought of as *the derivative of a function, corrected for size of y and x.*

Elasticity as ratio of percent changes

- Suppose y = f(x).
- % change in y = $\Delta y/y$.
- % change in x = $\Delta x/x$.
- Ratio $= \frac{\Delta y/y}{\Delta x/x} = \frac{\Delta y}{\Delta x}\frac{x}{y}$
- $\lim\limits_{\substack{\Delta x \to 0 \\ \Delta y \to 0}} \frac{\Delta y}{\Delta x}\frac{x}{y} = \frac{dy}{dx}\frac{x}{y} = \boldsymbol{\varepsilon}$

[Graph with curve, axes labeled y and x, showing Δy and Δx]
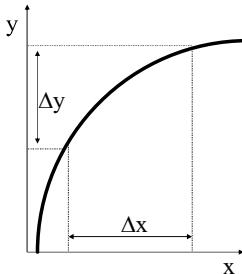
The meaning of elasticity

- $\varepsilon = \frac{\%\ change\ in\ y}{\%\ change\ in\ x}$.
- Percent change in y
  = ε × percent change in x.
- Example: Suppose $\varepsilon = 3$ and x increases by 1%. Then y increases by (approximately) _____.

Finding formulas for elasticities: example

- Suppose y = 200 - 50x.
- Then ε = (dy/dx) (x/y)
  = (-50) (x/y)

Finding formulas for elasticities: another example

- Suppose y = 1 - 2/x
- Then ε = (dy/dx) (x/y)
  = $(2/x^2)$ (x/y)
  = $(2/x^2)$ (x/(1 - 2/x))

ELASTICITIES
Page 2

Alternative definition of elasticity using natural logarithms

- Recall differentiation rule for logarithms:
  - d ln(y) / dy = _____
  - d ln(x) / dx = _____
- Substituting and canceling gives:

$$\varepsilon = \frac{dy}{dx}\left(\frac{x}{y}\right) =$$

Elasticity from logarithmic relationship

- Economist Douglas (with help of mathematician Cobb) estimated aggregate production function for U.S. using least squares:
  ln(output) = constant + 0.74 ln(labor input)
  $\qquad\qquad$ + 0.26 ln(capital input).
- Elasticity of output with respect to labor input = _____.
- Elasticity of output with respect to capital input = _____.

Cobb, Charles W.; Douglas, Paul H. (1928). "A Theory of Production". *American Economic Review 18* (Supplement): 139–165.

Sign of elasticity = $\left(\frac{dy}{dx}\right)\left(\frac{x}{y}\right)$

- If x and y are both positive, sign of derivative is the same as sign of elasticity.
- Negatively-related variables have _____ elasticities.
- Positively-related variables have _____ elasticities.
- Unrelated variables have _____ elasticities.

Elasticities for proportional variables

- Suppose y = a x, where a is a constant.
- Then dy/dx = a.
- Elasticity = (dy/dx) (x/y)
  = _____ = _____.
- Proportional variables have unitary elasticity.

Elasticities of simple power functions

- Suppose $y = a\, x^b$, where a and b are given constants.
- Then $\varepsilon = (dy/dx)\ (x/y)$
  $= (ab\ x^{b-1})\ (x/(a\ x^b)\,)$
  $= ab\ x^{b-1}\ x\ a^{-1}\ x^{-b}$
  $= ab\ a^{-1} = $ _____.
- Thus, simple power functions have constant elasticities equal to their powers.

Elasticities of simple power functions: examples

- Suppose $y = 5\ x^4$. Then $\varepsilon = $ _____.

- Suppose $y = 7\ x^{1/2}$. Then $\varepsilon = $ _____.

- Suppose $y = 3\ x^{-1/3}$. Then $\varepsilon = $ _____.

- Suppose $y = 27/x$. Then $\varepsilon = $ _____.

ELASTICITIES
Page 3

Slopes and derivatives have units of measure

- Example: Suppose q = quantity of gas (in gallons) and p = price of gas (in dollars).
- Then dq/dp = limit of slope: change in quantity of gas / change in price.
- Units of measure for the derivative (or slope) are _____ ("gallons per dollar").

Elasticities are pure numbers

- Continuing example, elasticity = $\left(\frac{dq}{dp}\right)\left(\frac{p}{q}\right)$.
- Units of measure for this elasticity are $\left(\frac{gallons}{dollars}\right)\left(\frac{dollars}{gallons}\right)$.
- Elasticity is unit-free because units of measure _____.

Change in units of measure affects slope, but not elasticity

- Suppose quantity was measured in liters instead of gallons. Then q and dq/dp would both increase by a factor of 3.8.
- Suppose price were measured in cents instead of dollars. Then p would increase by a factor of 100 and dq/dp would decrease by a factor of 100.
- But elasticity = $(dq/dp)(p/q)$ would be _____.

Conclusions

- The calculus definition of elasticity is _____.
- Negatively-related variables have negative elasticities.
- Proportional variables have elasticities = _____.
- Power functions have constant elasticities.
- Elasticities are _____ numbers, unaffected by units of measure.

THE PRICE ELASTICITY OF DEMAND
Page 1

THE PRICE ELASTICITY OF DEMAND

- What is the "price elasticity of demand"?
- What does its value reveal?

Price elasticity of demand

- The price elasticity of demand measures the responsiveness of demand for a good to its price:

$$\varepsilon = \frac{\%\ change\ Q}{\%\ change\ P}$$

where changes are measured along the demand curve.
- "Law of Demand" implies $\varepsilon < 0$ (but many authors drop negative sign).

Calculus definition

- Given a demand function $Q = f(P)$.

- Price elasticity of demand $= \varepsilon =$

- Or equivalently, $\varepsilon =$

What the value of $\varepsilon = \frac{\%\ chg\ Q}{\%\ chg\ P}$ means

- If Q is very sensitive to P,
  - then ε is _____ in absolute value,
  - say "demand is more elastic."
- If Q is *not* very sensitive to P,
  - then ε is _____ in absolute value,
  - say "demand is less elastic."
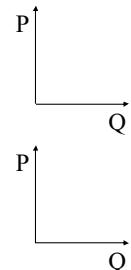
Some definitions

Unitary-elastic demand: $|\varepsilon| = 1$.

Elastic demand: $|\varepsilon| > 1$.

Inelastic demand: $|\varepsilon| < 1$.

-1   0

Some estimates of price elasticities of demand

- Food: -0.21
- Medical services: -0.22
- Electricity: -1.14
- Automobiles: -1.20
- Beer: -0.26
- Wine: -0.88
- Cigarettes: -0.35

Source: Reported in Nicholson, *Microeconomic Theory: Basic Principles and Extensions, 6th edition*, Dryden, 1995, p. 219, table 7.3.

THE PRICE ELASTICITY OF DEMAND
Page 2

What determines ε?
Close substitutes

- Demand is more elastic (|ε| is larger) if close substitutes for a good are available.
- Examples of goods with close substitutes:

  _____

- Examples of goods without close substitutes:

  _____

What determines ε?
Share in total budget

- Demand is more elastic (|ε| is larger) if the good occupies a large share of consumers' total budgets.
- Examples of goods that occupy a large share of consumers' budgets:

  _____

- Examples of goods that occupy a small share of consumers' budgets:

  _____

What determines ε?
Time to respond

- Demand is more elastic (|ε| is larger) the more time consumers have had to anticipate and adjust to a price change.
- Examples where consumers have little time to respond to a price change:

  _____

- Examples where consumers have ample time to respond to a price change:

  _____

Extreme case:
perfectly elastic demand

- $\varepsilon = \frac{\% \, chg \, Q}{\% \, chg \, P}$

  $= \underline{\hspace{3cm}}$.
- Even the smallest price increase reduces quantity demanded to zero.
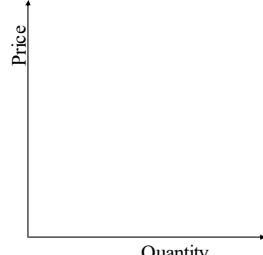
Extreme case:
perfectly inelastic demand

- $\varepsilon = \frac{\% \, chg \, Q}{\% \, chg \, P} = \underline{\hspace{1.5cm}}$.
- A price increase or decrease does not change quantity demanded.
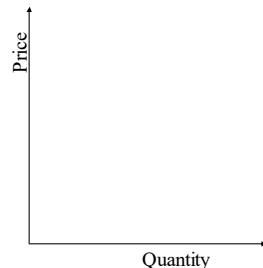
Conclusions

- Price elasticity of demand $\varepsilon = \frac{dQ}{dP} \cdot \frac{P}{Q}$.
- Elastic demand means |ε| _____ 1.
- Inelastic demand means |ε| _____ 1.
- Value of ε depends on availability of substitutes, share of good in consumers' budgets, and time for adjustment.

ELASTICITY AND REVENUE
Page 1

ELASTICITY AND REVENUE

- When the price of a good rises, does revenue received by sellers also rise?

Revenue and the demand curve

- Revenue = P × Q
- Revenue = area of rectangle whose upper right corner just touches the demand curve.
- Note: spending by buyers = revenue received by sellers.
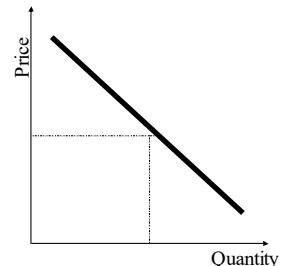
Effect of price change on revenue

- Price increase affects revenue two ways:
  - price _____.
  - quantity _____.
- What happens to revenue depends on which effect is stronger.
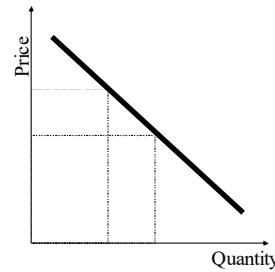
Percent changes in revenue

- Price elasticity of demand =
$$\varepsilon = \frac{dQ}{dP} \cdot \frac{P}{Q} = \frac{\% \, chg \, P}{\% \, chg \, Q}$$
- Since revenue = P × Q, then % chg revenue
$$\approx \underline{\hspace{5cm}}.$$

Inelastic demand

If $|\varepsilon| = \left|\frac{\% \, chg \, Q}{\% \, chg \, P}\right| < 1$,
- % increase in P > % decrease in Q,
- so price increase causes _____ in revenue.
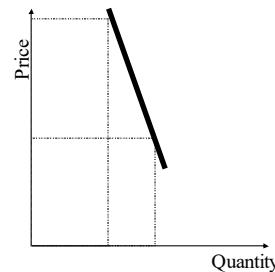
Elastic demand

If $|\varepsilon| = \left|\frac{\% \, chg \, Q}{\% \, chg \, P}\right| > 1$,
- % increase in P < % decrease in Q,
- so price increase causes _____ in revenue.
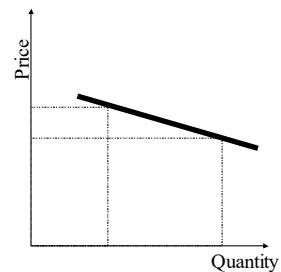
ELASTICITY AND REVENUE
Page 2

Unitary-elastic demand

If $|\varepsilon| = \left|\frac{\% \, chg \, Q}{\% \, chg \, P}\right| = 1$,

- % increase in P
  = % decrease in Q,

- so price increase
  causes _____
  in revenue.
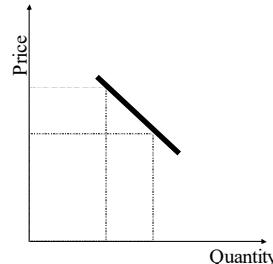
Effect of price change on revenue: formal proof using calculus

Differentiate revenue (TR) with respect to price, using product rule.

$$\frac{d \, TR}{d \, P} = \frac{d}{dP}(Q \times P) = \frac{dQ}{dP} \cdot P + Q \cdot 1$$

$$= \frac{dQ}{dP} \cdot \frac{P}{Q} \cdot Q + Q = \varepsilon \cdot Q + Q$$

Conclude:
- dTR/dP _____ if $\varepsilon > -1$ (inelastic).
- dTR/dP _____ if $\varepsilon < -1$ (elastic).

Example 1

- Suppose a college is considering raising tuition 10% and the price elasticity of demand for its enrollment is -1.5.
- Demand is thus _____.
- Will this increase tuition revenues?

Example 1: solution

- Set $-1.5 = \frac{\% \, chg \, Q}{\% \, chg \, P} = \frac{\% \, chg \, Q}{+10\%}$
- Solving: % chg Q = _____ %.
- If nothing else changes, enrollment _____ by about _____ %.
- % chg revenue $\approx$ % chg Q + % chg P
  = _____ %. So in fact, tuition revenue will _____.

Example 2

- Suppose output of wheat has fallen by 2% and the price elasticity of demand for wheat is -0.4.
- Demand is thus _____.
- Will wheat farmers' revenue fall?

Example 2: solution

- Set $-0.4 = \frac{\% \, chg \, Q}{\% \, chg \, P} = \frac{-2\%}{\% \, chg \, P}$
- Solving: % chg P = _____ %.
- If not thing else changes, wheat price _____ by about _____ %.
- % chg revenue $\approx$ % chg Q + % chg P
  = _____ %. So in fact, farm revenue will _____.

ELASTICITY AND REVENUE
Page 3

Conclusions

- If demand is inelastic, then an increase in price will _____ spending by buyers (or revenue received by sellers).
- If demand is elastic, then an increase in price will _____ spending.
- If demand is unitary-elastic, then a change in price will _____ spending.

THE PRICE ELASTICITY OF SUPPLY
Page 1

THE PRICE ELASTICITY OF
SUPPLY

- What is the price elasticity of supply?
- What does it measure?

The elasticity concept has many applications

- Recall: *elasticity* is ratio of percent changes between any two related variables.
- Elasticity of Y with respect to X is
$$\frac{\%\ change\ Y}{\%\ change\ X} = \frac{\Delta Y/Y}{\Delta X/X}$$
- In principle, elasticity concept can be used to measure sensitivity of *any* variable to *any other* variable.

Price elasticity of supply: informal definition

- The price elasticity of supply is defined by
$$\beta = \frac{\%\ change\ Q}{\%\ change\ P} = \frac{\Delta Q/Q}{\Delta P/P},$$
where changes are measured along the _____ curve.
- By the "Law of Supply," β must be ___ 0.

Calculus definition of price elasticity of supply

- Calculus definition is limit of informal definition, as ΔQ and ΔP shrink to zero.
- *Price elasticity of supply =*
$$\beta = \frac{dQ/Q}{dP/P} = \left(\frac{dQ}{dP}\right)\frac{P}{Q} = \frac{d\ln(Q)}{d\ln(P)}$$
where changes are measured along the supply curve.

What the value of β means

- If Q is very sensitive to P,
  - then β is _____ .
  - say "supply is more elastic."
- If Q is not very sensitive to P,
  - then β is _____ .
  - say "supply is less elastic."

P

Q

P

Q
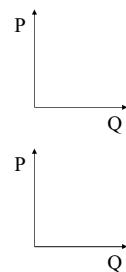
What determines β?

Supply is more elastic (β is larger):
- if inputs required in production have lots of other uses. Example: _____
  _____
  _____.
- if producers have lots of time to anticipate and adjust to price changes. Example: _____
  _____
  _____.

THE PRICE ELASTICITY OF SUPPLY
Page 2

Extreme case: perfectly elastic supply

- β = infinity.
- even the smallest price decrease reduces quantity supplied to zero.
- Example: _____
  _____
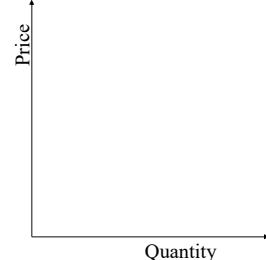
Extreme case: perfectly <u>inelastic</u> supply

- β = 0.
- a price increase or decrease does not change quantity supplied.
- Example:
  _____
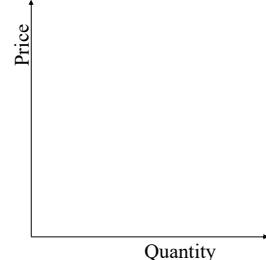
Some estimates of long-run elasticities of supply

- Corn: 0.27
- Wheat: 0.03
- Aluminum: nearly infinite
- Coal (eastern US): 15.
- Natural gas (US)   0.50

Source: Reported in Nicholson, *Intermediate Microeconomics and Its Application, eighth edition,* Fort Worth: Dryden, 2000, page 258, table 8.3 .

Conclusions

- The price elasticity of supply is defined as _____, measured along the supply curve.
- It is _____ if the inputs required to produce the good are freely available and have many alternative uses, and if producers have _____ to adjust to price changes.

COST CURVES
Page 1

COST CURVES

- How are a firm's costs related to the level of the firm's output?
- What is the difference between average and marginal cost?

The firm's total cost function: definition

- DEF: *Total cost of producing a target level of output:* TC = TC(q)
- TC(q) always upward-sloping. Why?
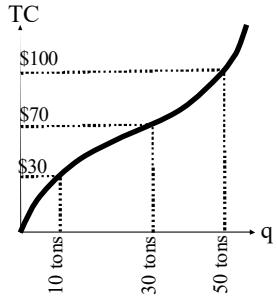
Average cost: definition

- *AC(q) = TC(q) / q.*
- Also called "unit cost."
- Note: AC = slope of chord connecting TC to origin.
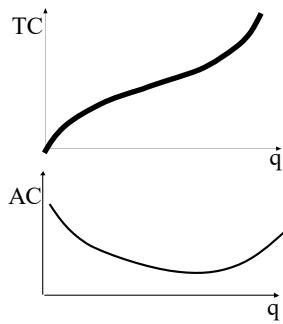
Costs under increasing returns to scale

- Increasing returns means inputs rise more slowly than output.
- Thus TC rises more slowly than q.
- AC = TC/q _____.
- "Economies of scale"
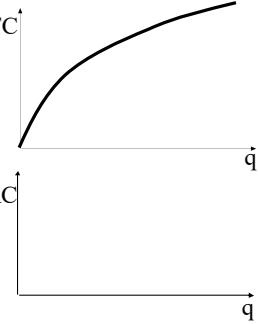
Costs under decreasing returns to scale

- Decreasing returns means inputs rise faster than output.
- Thus TC rises faster than q.
- AC = TC/q _____.
- "Diseconomies of scale"
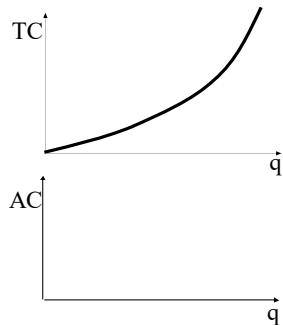
Costs under constant returns to scale

- Constant returns means inputs (x_1, x_2) are proportional to output.
- Thus TC is proportional to q.
- AC = TC/q is _____.
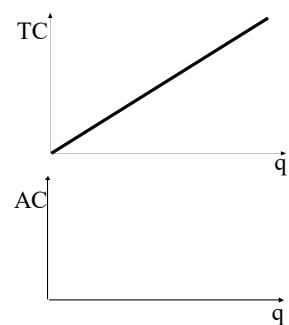
COST CURVES
Page 2

Efficient scale: definition

- *Quantity corresponding to minimum point on AC curve.*
- Occurs if firm enjoys first increasing returns, then decreasing returns to scale.
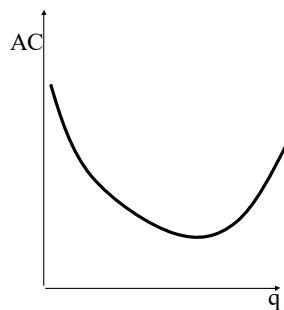
Breakeven price: definition

- *Minimum point on AC curve.*
- AC corresponding to efficient scale.
- Lowest price at which firm could cover its costs.
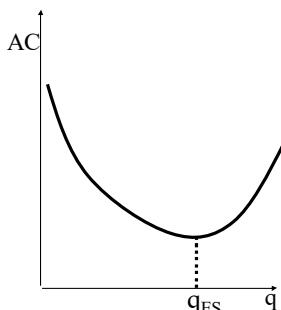
Marginal cost: definition

- $MC(q) = dTC(q)/dq.$
- MC is the increase in total cost caused by last unit of output produced.
- MC = _____ of line tangent to TC curve.
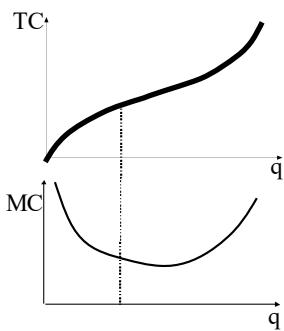
Evaluating slope of AC curve using "quotient rule"

$$\frac{d}{dq} AC(q) = \frac{d}{dq}\left(\frac{TC(q)}{q}\right)$$
$$= \frac{MC(q) \cdot q - TC(q)}{q^2}$$
$$= \frac{MC(q) - AC(q)}{q}$$

Relation between MC and AC curves

Previous calculus derivation shows that:
- If AC is falling, then MC   AC.
- Increasing returns to scale.
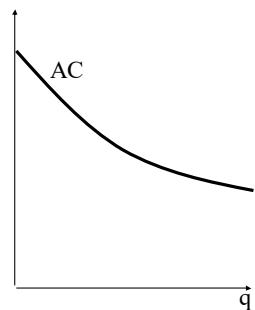
Relation between MC and AC curves (cont'd)

Previous calculus derivation shows that:
- If AC is rising, then MC   AC.
- Decreasing returns to scale.
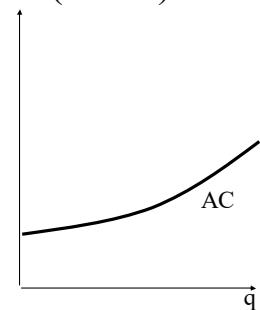
COST CURVES
## Page 3

Relation between MC and AC curves (cont'd)

Previous calculus derivation shows that:

- If AC is neither falling nor rising (flat), then MC ___ AC.
- Constant returns to scale.

AC

q

AC

q
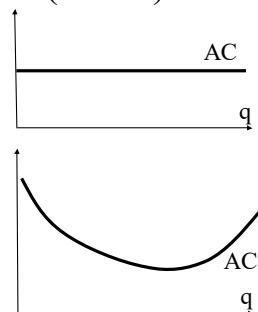
Relation between MC and AC curves: example

- TC = .01q³ - .2q² + 2q
- AC =
- MC =
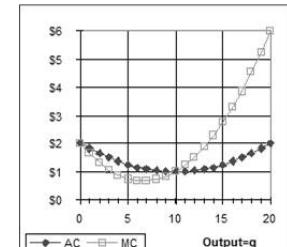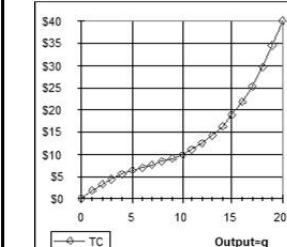
Shifts in cost curves

- All cost functions (TC, AC, and MC) depend on input prices and production technology.
- If these change:
  - TC, AC, and MC functions _____,
  - graphs of cost curves must _____.

Shifts in cost curves: example

- Consider production functions for farming.
- Suppose the price of fertilizer, seed, etc. increases.
- Then the cost curves shift _____.

TC

q

AC

q
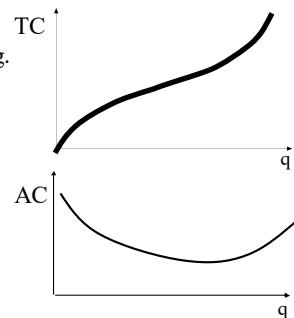
Shifts in cost curves: another example

- Consider production functions for computers.
- Suppose new technology makes it possible to assemble computers faster.
- Then the cost curves shift _____.

TC

q

AC

q
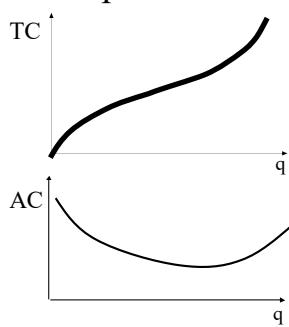
Conclusions

- *Total cost* (TC) rises with output (q).
- Whether it rises faster or slower than output depends on _____ in production.
- _____ = TC / q.
- _____ = d TC / d q.
- AC falls, rises, or remains constant, depending on whether MC is below, above, or equal to AC.

PROFIT MAXIMIZATION
Page 1

PROFIT MAXIMIZATION

- How should a firm choose its level of output to maximize profit?

Revenue and output

- Revenue = money received for outputs sold.
- Let TR(q) = total revenue function.
- Revenue generally rises with output.
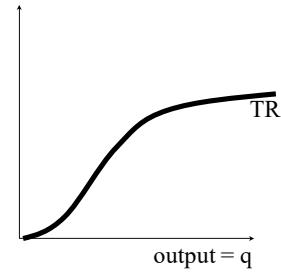
Cost and output

- Cost = money paid for inputs hired.
- Let TC(q) = total cost function.
- Cost generally rises with output.
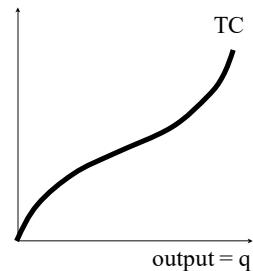
The output decision

- Revenue, cost, and profit all depend on how much output is produced and sold.
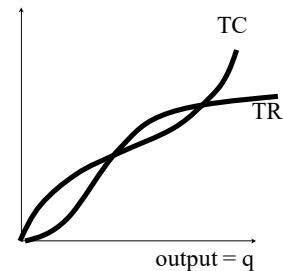
Profit = revenue - cost

- Profit
  = TR(q) - TC(q).
  = vertical gap between total revenue and total cost functions.
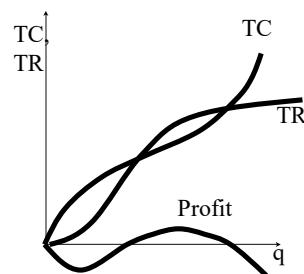
How to maximize profit

If slope of TC < slope of TR, should _____ output.
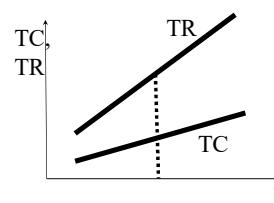
If slope of TC > slope of TR, should _____ output.
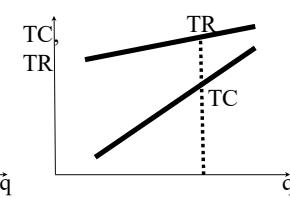
PROFIT MAXIMIZATION
Page 2

For what value of q is profit maximized? (intuition)

Profit is maximized where
- vertical gap between TR and TC is greatest.
- slope of TC = slope of TR.
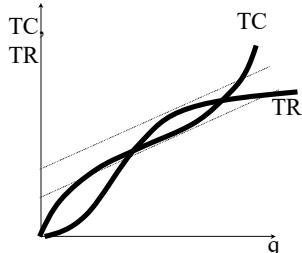
Marginal revenue and marginal cost

MR(q)
= marginal revenue
= slope of TR.

MC(q)
= marginal cost
= slope of TC.

- Thus profit is maximized when _____ .
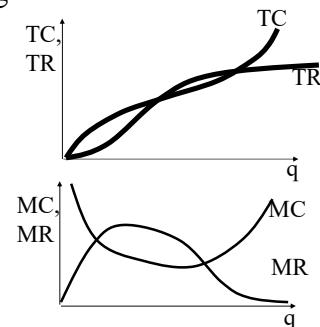
General rule for profit-maximization

- In math:
  Choose q such that MC(q) = MR(q).
- In words:
  Produce output up to point where cost of last unit starts to _____ its contribution to total revenue.

For what value of q is profit maximized? (calculus)

- Profit = TR(q) - TC(q).
- To maximize, set derivative equal to zero:

$$0 = \frac{d\ \text{profit}}{dq} = \frac{d\ \text{TR}}{dq} - \frac{d\ \text{TC}}{dq}$$
$$= MR(q) - MC(q)$$

- Therefore choose q so that

  _____ .

Qualification to the rule: direction of crossing

- MC can intersect MR from above or below.
- Here, which MR=MC intersection is the true profit maximum?
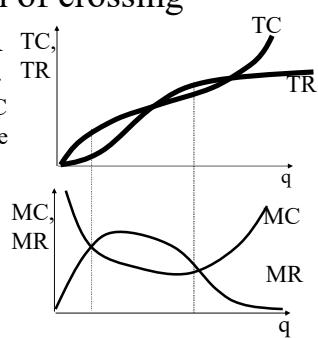
Exception to the rule: solution at the boundary

- Firm might make negative profit at all levels of output.
- In that case the firm should set q=0.
- The MC=MR rule does not apply.
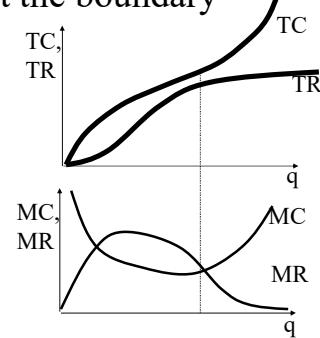
PROFIT MAXIMIZATION
Page 3

Marginal revenue for a price-taker

- TR(q) = p q.
- Suppose p is fixed.

Then:

- TR straight line through origin.
- MR(q)
  = d TR / dq
  = p, constant.

TC, TR

TC
TR

q

MC, MR

MC
MR=p

q
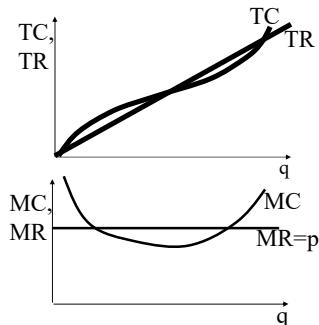
### Profit-maximization rule for a price-taker

- Suppose firm takes price as given.
  - That is, the output market is *competitive*.
- In words: Produce output up to point where cost of last unit starts to exceed _____ of good.
- Calculus: Choose q so that MC(q) = p.

Qualification for a price taker and exception

- Qualification: MC(q) must intersect p from below.
  - Otherwise, a profit *minimum*!
- Exception: Profit must not be negative.
  - Must have TR(q) > TC(q) *or equivalently,* p > AC(q).
  - Otherwise, could do better shutting down (q=0)!

Firm supply: definition

- *Function showing how much output a profit-maximizing firm will produce at any given price.*
- Graph is identical to MC curve, above its intersection with AC.

P

MC

AC

q
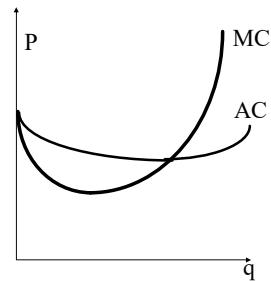
Example 1

- Suppose:
  - TC(q) = 2q + (q²/100)
  - p = $5.
- Then MC(q) =
- Setting MC(q) = $5 yields: q* =
- Profits = Revenue – TC(q) = 5q – TC(q)
  =

Example 2

- Suppose p = $20 and:

$$TC(q) = \frac{q^3}{300} - \frac{6q^2}{10} + 40q$$

- Then MC(q) =
- Setting MC(q) = $20 yields 2 solutions:
  - q =   and q =
- Which solution maximizes profit?

PROFIT MAXIMIZATION
Page 4

Graphs for Example 2

TR(q) —□— TC(q) —△— Profit(q)

MC(q) —□— AC(q) —△— MR=P
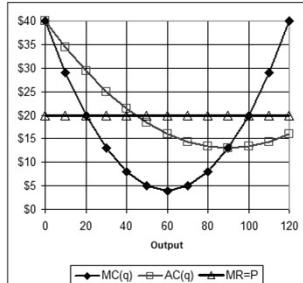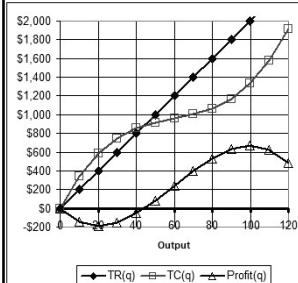
Conclusions

- To maximize profit, the firm should choose output such that _____ equals _____.
- This rule is valid if MC crosses MR from below and profit is not negative.
- If the firm takes price as given, this rule means choosing output such that _____ equals marginal cost.

THE FIRM'S COST IN THE SHORT RUN
Page 1

THE FIRM'S COST IN THE SHORT RUN

- What do the firm's cost curves look like when there is not enough time to adjust all inputs?

Responding to a drop in price

- Suppose a business like a copy shop faces a sudden change in demand—say, a drop in price.
- It can quickly reduce its costs for paper, toner, electricity, and maybe labor.
- But it may have signed a long-term lease for the copy machine and the store.
- What quantity should it produce now?

Adjusting inputs quickly

- All businesses find that some inputs are easier to adjust quickly than others.
- Examples: Easy or hard?
  - Materials inputs _____
  - Labor inputs _____
  - Equipment inputs _____
  - Buildings and structures _____

"Short-run" versus "long-run" behavior

- *Long run* = period of time over which people _____ fully adjust to a change.
- *Short run* = period over which people _____ fully adjust to a change.
- In short run, firm can adjust only *some* inputs to maximize profits.

Two kinds of inputs in the short run

- *Variable inputs* = inputs that can be adjusted in the short run.
  - Examples: _____
- *Fixed inputs* = inputs that cannot be adjusted in the short run. Levels are dictated by past decisions.
  - Examples: _____

### Two kinds of cost in the short run

- *Short-run variable cost (SVC)* = payments for variable inputs.
  - Examples: _____
- *Short-run fixed cost (SFC)* = payments for fixed inputs.
  - Examples: _____
- *Short-run total cost (STC)* = SVC + SFC.


THE FIRM'S COST IN THE SHORT RUN
Page 2

What the short-run total cost curve looks like

- SFC are constant, regardless of output.
- SVC start at zero and increase with output.
- STC = SFC + SVC.
- So intercept of STC = _____.
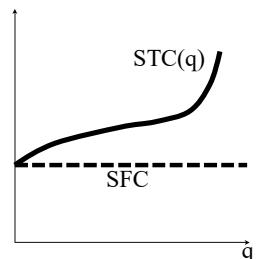
Copy shop example

- Suppose a copy shop pays $1200 per month to rent a store and $300 per month to lease a copy machine.
- Then its SFC = $_____.
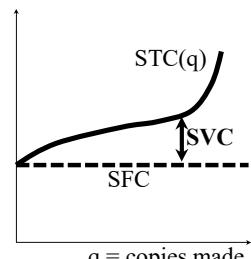
What are the copy shop's likely variable costs?

Payments that depend on the number of copies it makes, such as:
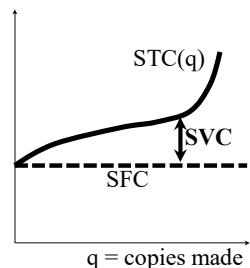
Short-run versus long-run total cost

- In general, short-run total cost STC(q) is higher than long run total cost TC(q).
- Reason: Given time to adjust *all* inputs, firm can cut costs.
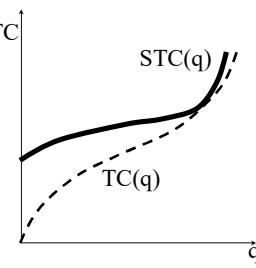
Short-run average cost concepts

- *Short-run average fixed cost (SAFC)* = _____.
- *Short-run average variable cost (SAVC)* = _____.
- *Short-run average total cost (SATC)* = STC / q = _____.

The SATC curve

- SATC typically falls and then rises.
- Minimum SATC = lowest price at which firm can avoid losses = *breakeven price*.
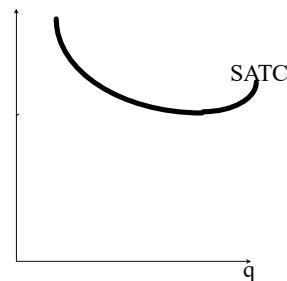
THE FIRM'S COST IN THE SHORT RUN
Page 3

The SAFC curve

- Recall SFC is constant.
- So SAFC = SFC/q must decrease with q, approaching _____.
- Example: If copy shop has SFC=$1500, then its SAFC = _____.
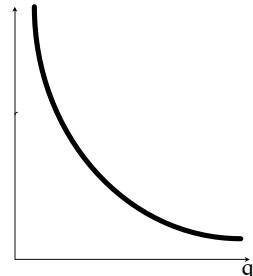
The SAVC curve

- SATC = SAFC + SAVC.
- So the gap between SATC and SAVC is just SAFC.
- So the gap must _____ with q.
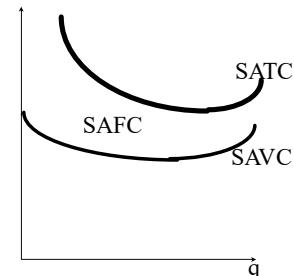
Short-run marginal cost

- *Short-run marginal cost (SMC)* = increase in short-run total cost caused by the last unit produced = d STC / d q = d SVC / d q .
- In short run, by definition, output and costs rise only from increase in *variable* inputs.
- SMC is _____ of STC (or SVC) curve.

SMC curve "pulls" SATC curve

- When SMC<SATC, SATC _____.
- When SMC>SATC, SATC _____.
- Curves intersect at minimum SATC.
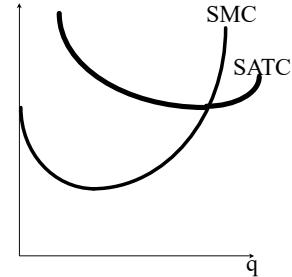
SMC also "pulls" SAVC

- When SMC<SAVC, SAVC _____.
- When SMC>SAVC, SAVC _____.
- Curves intersect at minimum SAVC.
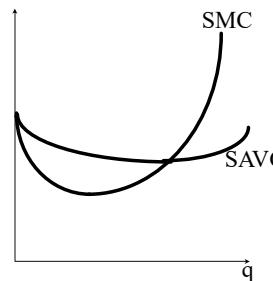
All three SR cost curves together

- Typically, all three curves are U-shaped.
- SMC intersects the other curves at their _____ points.
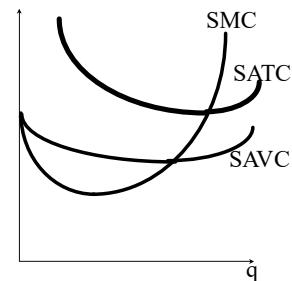
THE FIRM'S COST IN THE SHORT RUN
Page 4

Example 1: What is the breakeven price?

Breakeven price
= minimum SATC
= lowest price at which
firm can avoid losses
= $_____.
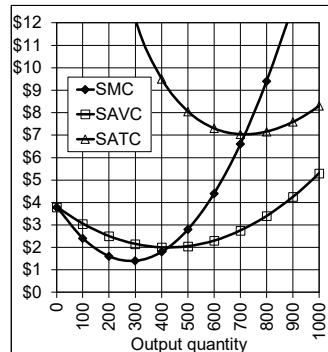
Example 2: What is the breakeven price?
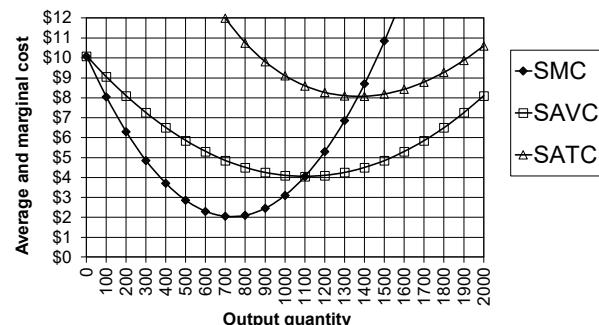
Example 3: What is the breakeven price?
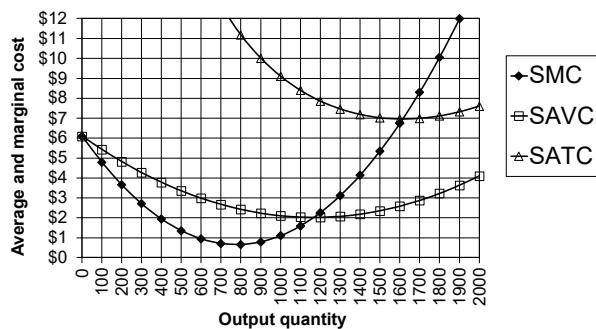
Conclusions

- In short run, the firm can vary some inputs to change output, but other inputs are _____.
- Avg. costs of these inputs per unit of output are called *SAVC* and *SAFC,* respectively.
- Short-run marginal cost (*SMC*) is the cost of an additional unit of output, produced by increasing _____ inputs only.
- SMC intersects SAVC and SATC at their _____ points.

PROFIT MAXIMIZATION IN THE SHORT RUN
Page 1

PROFIT MAXIMIZATION IN THE SHORT RUN

- How should a firm choose its level of output to maximize profits when some inputs are fixed?
- When should the firm shut down?

Assumptions

- *Short run:* Some inputs are variable, some are fixed.
- *"Price taker":* Assume again that firm cannot influence price (p) by changing output (q). Takes market price as _____.

A rule for profit maximization in the short run

Profits are maximized where:
- vertical gap between TR and STC is greatest.
- slope of STC = slope of TR.
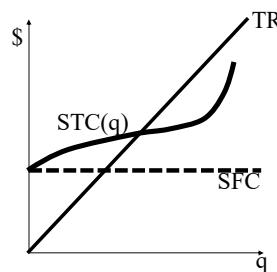
The "marginal cost = marginal revenue" rule again

- SMC(q) = slope of STC.
- MR=p = slope of TR.
- Thus profits are maximized when _____ = _____.
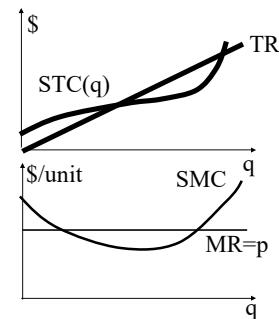
Qualification to the rule: direction of crossing

- SMC(q) must intersect p from below.
- Otherwise, a profit *minimum!*
- Here, which p=SMC intersection is the true profit maximum?
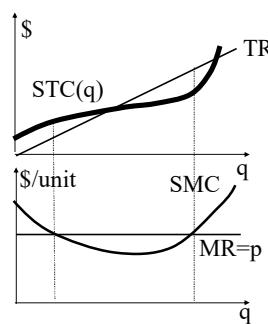
Exception to the rule: when to shut down completely

- If firm shuts down (setting q=0), then profit = _____
- If setting p=SMC causes greater losses than this, firm should shut down.
- The p=SMC rule does not apply.
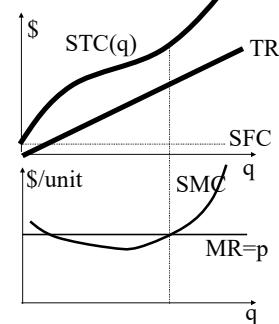
PROFIT MAXIMIZATION IN THE SHORT RUN
Page 2

Exception to the rule (cont'd)

- Should shut down if loss from shutting down is less than loss while operating.
- That is, shut down if
    profit while operating $< -$ SFC

- Shut down if revenue < SR variable cost.

Copy shop example

- Suppose a copy shop spends
    $3000 per month on paper
    $5000 per month on labor
    $500   per month on electricity
    $1200 per month to rent store*
    $300   per month to lease machine**
- Shop receives $9000 per month in revenue.
- Shut down? _____

* Just signed a three-year lease. ** Just signed one-year lease.

Why shutdown decision depends only on *variable* costs

Stay open for business	Shut down
• Revenue: $9000	• Revenue: $0
• Costs: $3000 paper $5000 labor $500 electricity $1200 rent store $300 lease machine	• Costs: $1200 rent store $300 lease machine

Sunk costs

- A firm's short-run fixed costs are an example of **sunk costs**.
- Sunk costs cannot be recovered or avoided.
- So they may be ignored in making decisions.
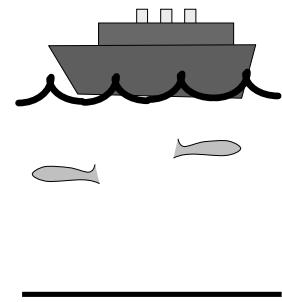
Short-run shutdown price

- Shut down if revenue < SR variable cost:
    TR   < SVC

- Shutdown price = minimum SAVC.

Shutdown price versus breakeven price

- If price < min SATC, firm makes losses, but it does not necessarily shut down.
    - min SATC = *breakeven price*.
- If price < min SAVC, firm will shut down.
    - min SAVC = *shutdown price*.
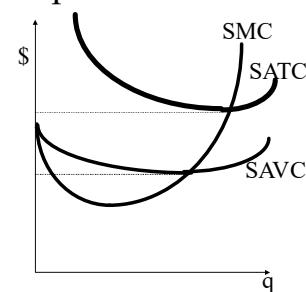
PROFIT MAXIMIZATION IN THE SHORT RUN
Page 3

Short-run supply by the firm

- If price > min SAVC, firm chooses output using SMC curve.
- If price < min SAVC, firm shuts down.
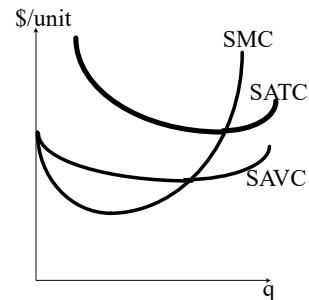
Example: deriving firm's supply curve from its cost curves

- Shutdown price = $ _____.
- Below this price, firm's supply curve = _____ output.
- Above this price, firm's supply curve = _____ curve.
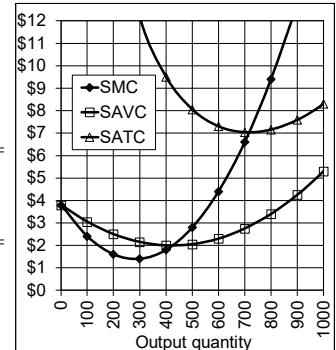
Example: deriving firm's supply curve from its cost curves (cont'd)

- If P = $9, firm produces about _____ units output.
- If P = $4, firm produces about _____ units output.
- If P = $1.50, firm produces _____ units output.
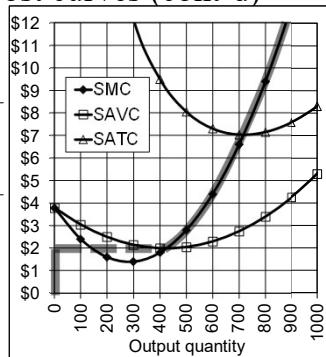
Conclusions

- To maximize profits in the short run, the price-taking firm chooses output so that *price equals* _____.
- This rule is valid if SMC crosses price from below and losses are less than SFC--that is, if price is greater than _____.
- If price is below minimum SAVC, then the firm can reduce its losses by shutting down.
- SFC are _____ and cannot be avoided.

SHORT-RUN MARKET EQUILIBRIUM
Page 1

SHORT-RUN MARKET EQUILIBRIUM

- What does a short-run industry supply curve look like?
- Why is a short-run competitive equilibrium efficient?

Competitive equilibrium: assumptions

- Consumers take prices and income as _____, choose quantities of goods to maximize individual utility.
- Firms (producers) take prices of inputs and outputs as _____, choose quantities of inputs and output to maximize individual profit.

Time for adjustment

- _____: consumers can adjust quantity demanded but firms cannot adjust inputs or output.
- _____: firms can adjust variable inputs only.
- _____: firms can adjust all inputs, new firms can enter the industry, and old firms can leave.

Very short run supply: assumptions

- Firms have no time to adjust any inputs or output in response to prices.
  - Thus quantity supplied is given.
- Consumers do have time to adjust purchases.
- Prices are flexible.
- Examples: _____

  _____

Price determination in the very short run

- Supply is perfectly inelastic.
- Demand slopes down.
- Price determined by intersection.
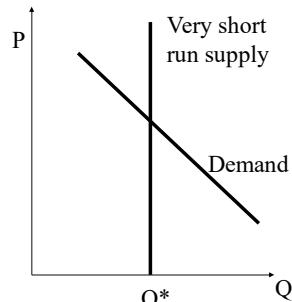
Efficiency of markets in the very short run

- Price P* rations demand so that output is distributed to its most valued uses.
- Gains from trade are exhausted.
- However, price P* does _____ affect quantity supplied.

SHORT-RUN MARKET EQUILIBRIUM
Page 2

Short-run supply: assumptions

- Some inputs of the firm are fixed, others are variable.
- The number of firms in the industry is fixed.
- Prices of inputs used by the industry are fixed.

Short-run supply: the individual firm

- Each firm sets quantity so that P = SMC.
- Unless P < SAVC, in which case firm shuts down.
- Firm supply curve = SMC curve, above its intersection with SAVC.

Short-run supply: the industry

$5

Firm A — 300
Firm B — 400

Minimum SAVC
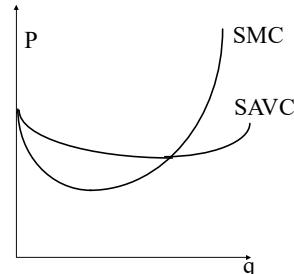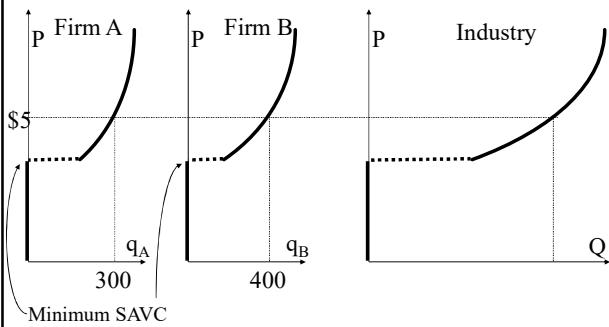
Price determination in the short run

- Price P* *and* Q* determined by intersection of demand and supply.
- If P* > min SATC, then make profits.
- If P* < min SATC, then make losses.

Minimum SAVC
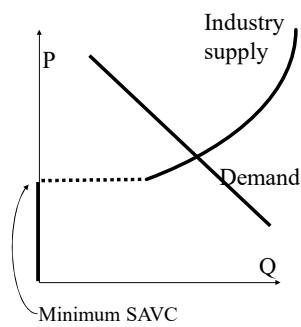
Efficiency of competitive markets in the short run: total output

- As before, price P* rations demand so that output is distributed to its most valued uses.
- But now, price P* also determines total output Q*:
  - Suppliers' MC of last unit = demanders' marginal willingness-to-pay for last unit.

Allocation of production across firms: the problem

- Suppose a given level of output Q* must be allocated between two firms (A and B):
  $$Q^* = q_A + q_B.$$
- How should output levels q_A and q_B be allocated to minimize combined total costs $= STC_A(q_A) + STC_B(q_B)$?

SHORT-RUN MARKET EQUILIBRIUM
Page 3

Allocation of production across firms: the solution

- Must minimize: $STC_A(q_A) + STC_B(Q^*-q_A)$.
- To minimize, set derivative = 0:

$$0 = \frac{d}{dq_A}[STC_A(q_A) + STC_B(Q^* - q_A)]$$
$$0 = SMC_A(q_A) - SMC_B(Q^* - q_A)$$
$$0 = SMC_A(q_A) - SMC_B(q_B)$$

- Conclusion: _____ .

Efficiency of competitive markets in the short run: allocation of production

- Do markets automatically allocate production across firms so that MCs are equal?
- _____, because to maximize profit, each firm chooses output so that its SMC = market price:
$$SMC_A = P^* = SMC_B .$$

Conclusions

- In the very short run, supply is perfectly _____ and price merely rations demand.
- In short run, supply is _____ of firms' SMC curves.
  The market price efficiently
  - rations demand.
  - determines _____ .
  - _____ across firms.

LONG-RUN MARKET EQUILIBRIUM
Page 1

LONG-RUN MARKET EQUILIBRIUM

- What does a long-run industry supply curve look like?
- Why is long-run competitive equilibrium efficient?

Long-run supply: assumption (1)

- In the long run, firms can adjust *all* inputs to maximize profits.
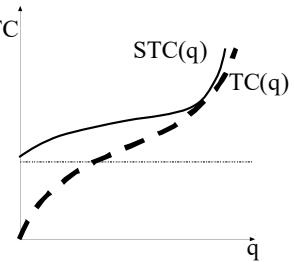
Profit maximization: the representative firm

- Each firm sets quantity so that P = MC.
- Unless P < AC, in which case firm produces nothing.
- Firm supply curve = MC curve, above its intersection with AC.
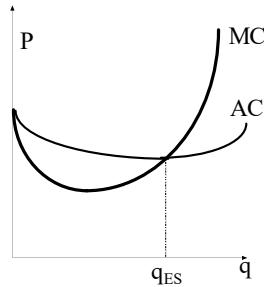
Long-run supply: assumption (2)

- Potential firms can *enter* the industry to exploit profit opportunities.
- Existing firms can *exit* the industry to avoid losses.

Profits and entry of new firms

- Suppose P > minimum AC for potential new firms.
- Potential firms could make profits.
- Then these firms will enter the industry.
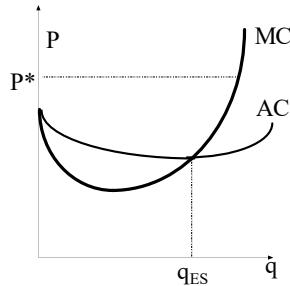
Entry pushes P* down

- Entry of new firms shifts SR supply right.
- P* falls.
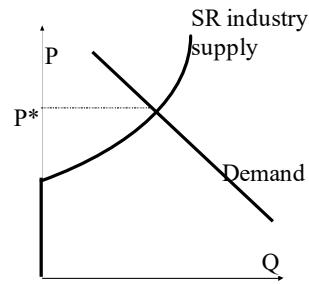
LONG-RUN MARKET EQUILIBRIUM
Page 2

Exit pushes P* up

- Conversely, if existing firms are making losses, some will exit the industry.
- Exit shifts SR supply left.
- P* rises.
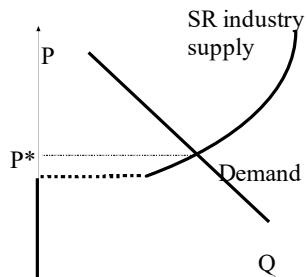
When does entry or exit stop?

- In the long run, entry or exit shifts the short-run industry supply curve until
  - no potential entrant could make positive profits.
  - no existing firm makes losses.

The long-run zero-profit condition

- If all existing firms have the same cost curves as potential entrants, then
  - all existing firms have _____ economic profits.
  - P = MC = _____ for all firms.

The long-run zero-profit condition

- If all existing firms have the same cost curves as potential entrants, then
  - all existing firms have ___zero___ economic profits.
  - P = MC = ___minimum AC___ for all firms.

Example 1: U-shaped AC curve

- Suppose all firms have classic U-shaped long-run AC curves.
- Then long-run equilibrium occurs when P* = min AC.
- Each firm produces q_{ES}, and makes zero profits.
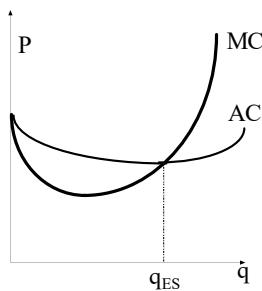
Example 2: horizontal AC curve

- Suppose all firms have horizontal long-run AC curves.
- Then long-run equilibrium occurs when P* = MC = AC.
  - even without entry or exit.
- Firm size cannot be determined.
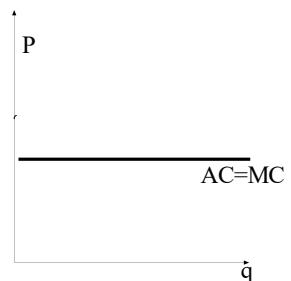
LONG-RUN MARKET EQUILIBRIUM
Page 3

Long-run supply: assumption (3)

- Suppose all firms' cost curves are identical (or at least have same min AC),
- and each firm's costs curves are unaffected by other firms' behavior.
- "Constant cost industry"

Long-run industry supply

- Then long-run industry supply is horizontal at the representative firm's min AC.
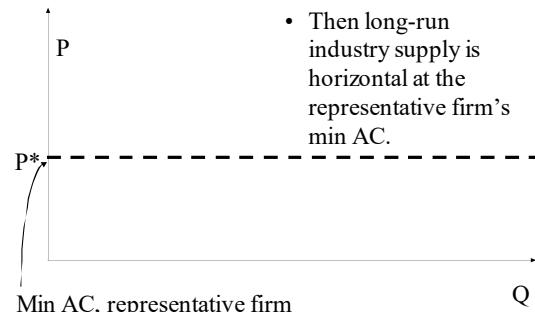
Effect of increase in demand: long-run response
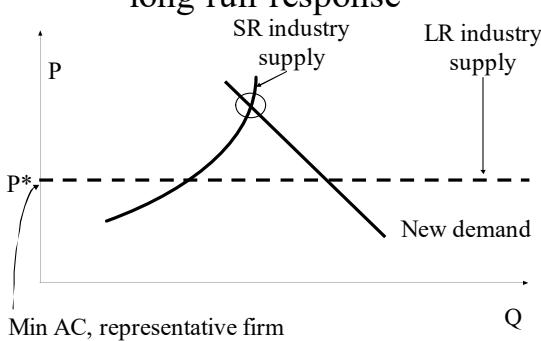
Effect of decrease in demand: short-run response
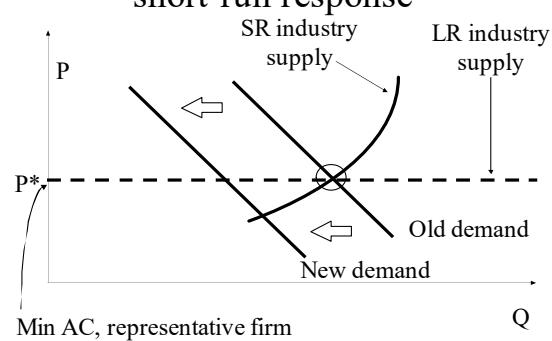
Effect of decrease in demand: long-run response
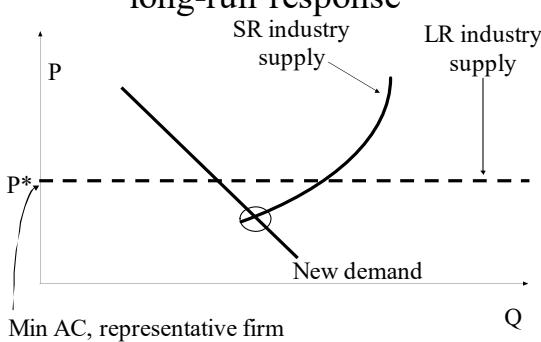
Efficiency of markets in the long run

- As in very short run, price P* rations demand so that output is distributed to its most valued uses.
- As in short run, price P* determines total output Q* so that suppliers' MC of last unit = demanders' marginal willingness-to-pay for last unit.
- As in short run, price P* allocates production across firms to _____ total costs.
- In addition, in long run, only firms with lowest _____ produce output.

LONG-RUN MARKET EQUILIBRIUM
Page 4

Conclusions

- In the long run, firms can
  - adjust all inputs to maximize profits,
  - _____ or _____ an industry to exploit profit opportunities or to avoid losses.
- If all firms have same cost curves and their costs are unaffected by other firms, long-run industry supply curve is _____.
  - After demand shifts, price always returns to the same value in the long run.

WILLINGNESS-TO-PAY AND CONSUMER SURPLUS
Page 1

WILLINGNESS-TO-PAY AND CONSUMER SURPLUS

- How can we measure the gains from trade for consumers?

Two ways to read a demand curve

1. Horizontally: for any given price, the curve shows how many units consumers are willing to buy.
2. Vertically: for any given quantity, the curve shows the maximum price that consumers are willing to pay for the last unit.

Reading the demand curve horizontally

- At a price of $5 per gallon, consumers would buy _____ million gallons.
- At a price of $3 per gallon, consumers would buy _____ million gallons.
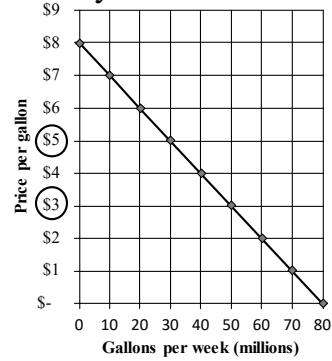
Reading the demand curve vertically

- Consumers are willing to pay a maximum of $_____ for the 40 millionth gallon
- Consumers are willing to pay a maximum of $_____ for the 60 millionth gallon.
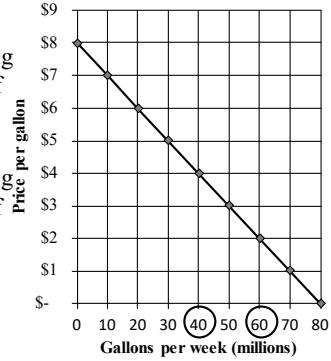
Why willingness-to-pay falls

- First few gallons are applied to _____-valued uses (going to work, shopping, etc.).
- Often there are few or no substitutes available for these uses.
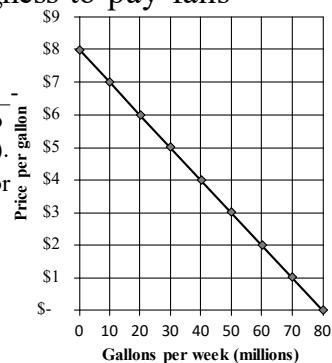
Why willingness-to-pay falls (cont'd)

- Later gallons are applied to _____-valued uses (recreation, leisure travel, etc.).
- Often substitutes are available for these uses (air or train travel, etc.).
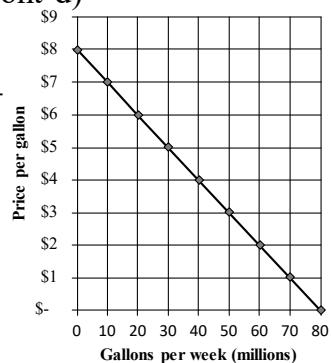
WILLINGNESS-TO-PAY AND CONSUMER SURPLUS
Page 2

Price on demand curve = willingness-to-pay = consumers' marginal benefit

- Maximum price consumers are willing to pay for a unit = marginal benefit (in $) that consumers enjoy from that unit.
- Rational consumers buy until marginal benefit equals _____.

Price = willingness-to-pay only for the last unit purchased

- If price = $3, consumers buy 50 million gallons.
- The 50 millionth gallon is worth about $____ to consumers.
- Prior gallons are worth _____ than $3.
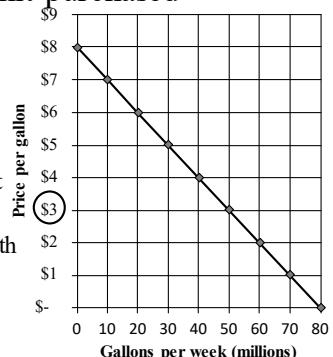
Total willingness-to-pay for all units

- Compute this as area under demand curve.
- Example: if price = $4, consumers buy 40 million gallons.
- Total willingness-to-pay = shaded area = $_____ million.
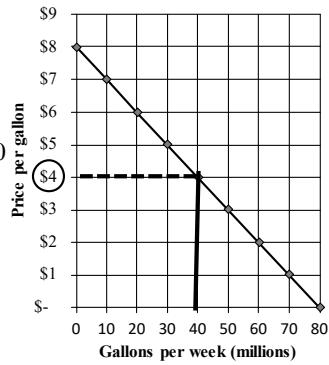
Consumer surplus for a particular unit: definition

- *Difference between what the consumer is willing to pay for a particular unit and what the consumer actually pays.*
- = height of demand curve minus market price P*.
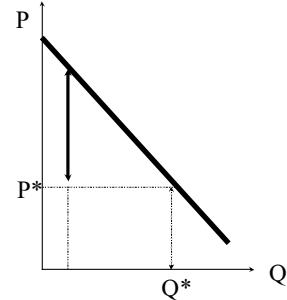
Consumer surplus for a particular unit: example

- Suppose price of gasoline is $4.
- Consumer surplus for the 10 millionth gallon = $_____.
- Consumer surplus for the 30 millionth gallon = $_____.
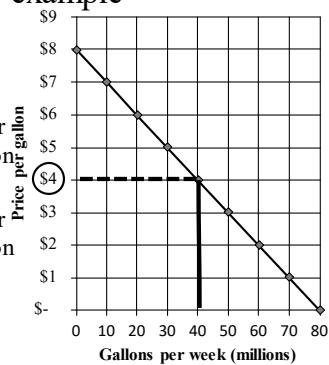
Total consumer surplus: definition

- Total CS = sum of consumer surpluses for all units purchased.
- Total CS = benefit to consumers of being able to buy as much of the good as they want (at the market price) rather than being unable to buy it at all.
- Often just called "consumer surplus."

WILLINGNESS-TO-PAY AND CONSUMER SURPLUS
Page 3

Total consumer surplus for all units

- Compute this as area between demand curve and price.
- Example: if price = $4, consumers buy 40 million gallons.
- Total consumer surplus = shaded area = $_____ million.

Price per gallon

Gallons per week (millions)
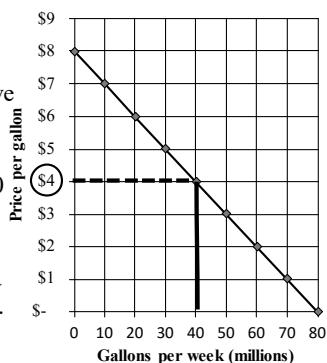
Total willingness-to-pay = spending + total consumer surplus

- Total consumer surplus is area of triangle.
- Spending = P* × Q* = area of rectangle.
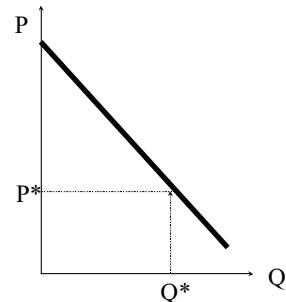
Total willingness-to-pay = spending + total consumer surplus: example

- Suppose price = $4.
- Total willingness-to-pay = $_____ million.
- Spending = $4 × 40 = $_____ million.
- Total consumer surplus = $_____ million.

Price per gallon

Gallons per week (millions)
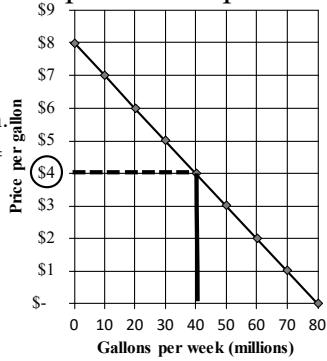
How much is a price reduction worth to consumers?

- Common (but incorrect) answer = simple cost saving with no change in quantity.
- Correct answer = increase in

  _____.

Simple cost saving from a price decrease

- Suppose price of gasoline fell from $4 to $2.
- Simple cost saving = change in price × old quantity = $_____ million.

Price per gallon

Gallons per week (millions)
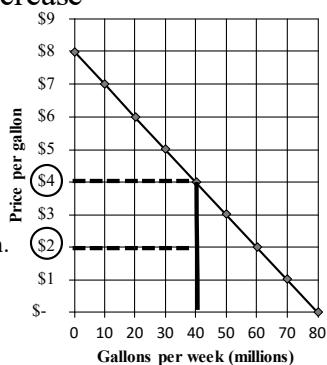
Value to consumers of a price decrease

- Change in consumer surplus
= area of
_____
= height × avg of parallel sides
= $2 × (1/2)(40+60) million
= $_____ million.

Price per gallon

Gallons per week (millions)
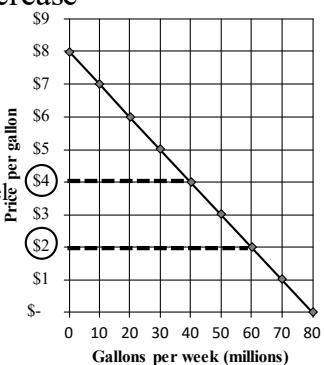
WILLINGNESS-TO-PAY AND CONSUMER SURPLUS
Page 4

Value to consumers of price decrease is always _____ than simple cost saving

- The difference is greater…
  - the more elastic (flatter) the demand curve.
  - the bigger the price change.

P

Q
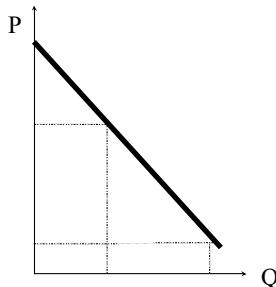
Impact on consumers of a rightward shift in supply

- Suppose the supply of shirts shifts right.
- The price falls from $7 to $_____.
- The benefit to consumers = increase in consumer surplus = $_____.

Price per shirt

0 10 20 30 40 50 60 70 80

→Demand →Old supply
→New supply
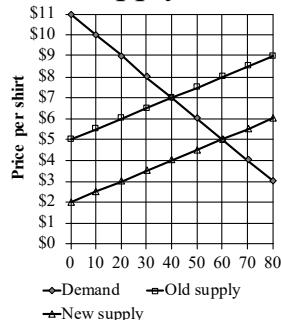
Impact on consumers of a leftward shift in supply

- Suppose the supply of gasoline shifts left.
- The price rises from $4 to $_____.
- The loss to consumers = decrease in consumer surplus = $_____.

Price per gallon

0 1 2 3 4 5 6 7 8
Millions of gallons

→Demand →Old supply
→New supply
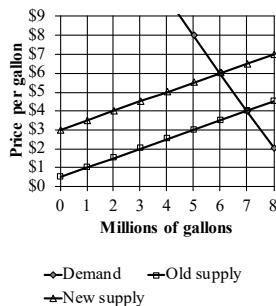
Conclusions

- Height of demand curve = how much a person would be *willing to pay* for that unit.
- *Willingness-to-pay* for successive units _____.
- *Consumer surplus* = _____ between how much a person is willing to pay and the price actually paid (P*).
- *Total consumer surplus* = _____ between demand curve and horizontal line at P*.

MARGINAL COST AND PRODUCER SURPLUS
Page 1

### MARGINAL COST AND PRODUCER SURPLUS

• How can we measure the gains from trade for producers?

Two ways to read a supply curve

1. *Horizontally*: for any given price, the curve shows how many units producers want to produce and sell.
2. *Vertically*: for any given quantity, the curve shows the minimum price producers must be paid to supply that quantity.

Reading the supply curve horizontally

• At a price of $5 per gallon, producers would sell _____ million gallons.
• At a price of $3 per gallon producers would sell _____ million gallons.
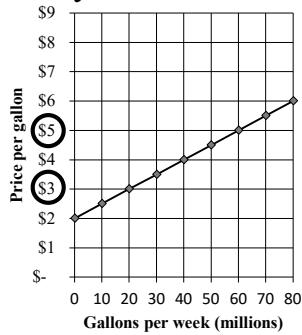
Reading the supply curve vertically

• Producers must be paid a minimum of $_____ for the 40 millionth gallon.
• They must be paid a minimum of $_____ for the 80 millionth gallon.
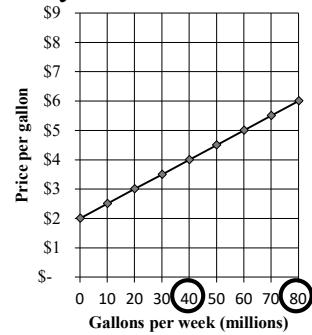
Why the minimum price producers must be paid rises

• When the price is low, producers use only their most efficient factories, fields, machines, oil wells, etc.
• These _____-cost methods of production are profitable even when the price is low.
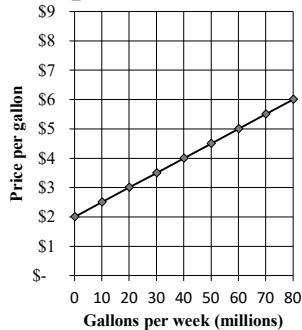
Why the minimum price producers must be paid rises (cont'd)

• When the price is high, producers also use their less efficient factories, fields, machines, oil wells, etc.
• These _____-cost methods of production are profitable only when the price is high.
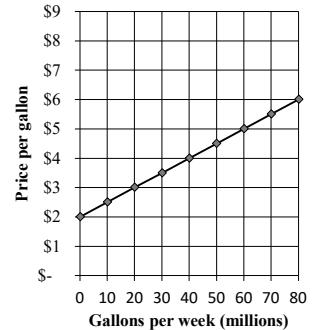
MARGINAL COST AND PRODUCER SURPLUS
Page 2

Price on supply curve = producers' marginal cost of production

- Minimum price producers must be paid = marginal cost to producers of producing the last unit.
- Rational producers sell until their marginal cost equals the market _____.

Price = marginal cost only for the last unit sold

- If price = $5, producers sell 60 million gallons.
- The 60 millionth gallon cost about $_____ to produce.
- Prior gallons cost _____ than $5 to produce.
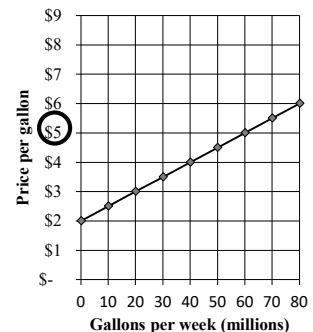
Producer surplus for a particular unit: definition

- Difference between minimum price producer must be paid and what the producer is actually paid.
- = market price minus height of supply curve.
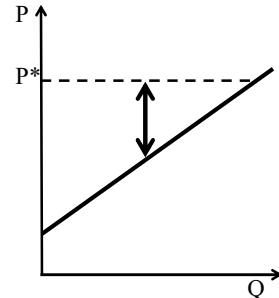
Producer surplus for a particular unit: example

- Suppose market price = $5.
- Producer surplus for the 20 millionth gallon = $_____.
- Producer surplus for the 40 millionth gallon = $_____.
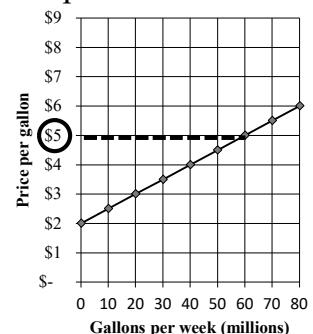

Total producer surplus: definition

- Total PS = sum of producer surpluses for all units sold.
- Total PS = net benefit to producers of being able to sell as much of the good as they want (at a given price) rather than being unable to sell it at all.
- Often just called "producer surplus."

Total producer surplus for all units

- Compute this as area between supply curve and market price.
- Example: if price = $5, producers sell 60 million gallons.
- Total producer surplus = shaded area = $ _____ million.
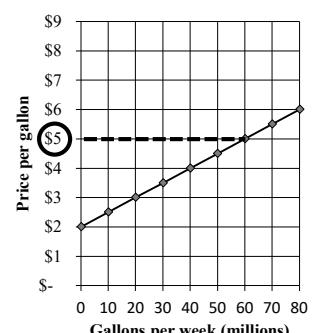
MARGINAL COST AND PRODUCER SURPLUS
Page 3

Changes in PS

- If the market price rises, PS _____.
- If the market price falls, PS _____.
- The change in PS measures the impact on producers (firms and input owners) of a change in price.
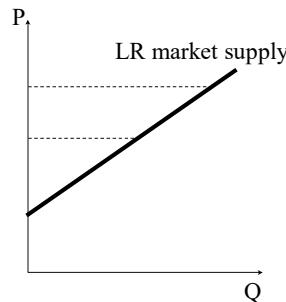
Example: increase in producer surplus from a rightward shift in demand

- Suppose the demand for food shifts right.
- The price rises from $3 to $_____.
- The benefit to producers = increase in producer surplus = $_____.
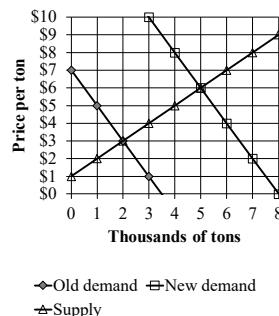
Example: decrease in producer surplus from a leftward shift in demand

- Suppose the demand for film cameras shifts left.
- The price falls from $25 to $_____.
- The harm to producers = decrease in producer surplus = $_____.
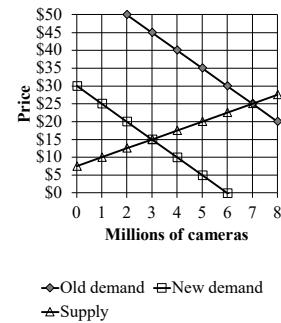
Total surplus = consumer surplus + producer surplus

- Consumer surplus = area between demand curve and market price.

- Producer surplus = area between supply curve and market price.
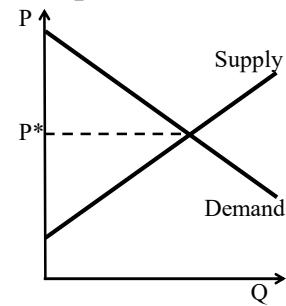
Total surplus: example

- Equilibrium price = $_____ .
- Consumer surplus = $_____ million.
- Producer surplus = $_____ million.
- Total surplus = $_____ million.
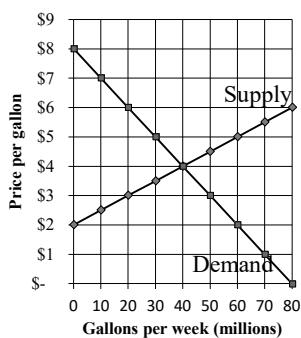
Conclusions

- Height of supply curve = marginal cost to producers of each unit sold.
- Marginal cost for successive units _____.
- Producer surplus = _____ between marginal cost and actual market price.
- Total producer surplus = _____ between supply curve and market price.

ECONOMIC EFFICIENCY AND WELFARE ANALYSIS
Page 1

ECONOMIC EFFICIENCY AND WELFARE ANALYSIS

- How can we measure gains and losses from changes in the economy?

Economics and public policy

- An important application of economics is deciding whether government policies are worthwhile.
- *Welfare economics* = branch of economics that tries to quantify the benefits and costs of government policies, and other changes in the economy.

"Win-win" changes

- Occasionally, a policy or other change in the economy creates one or more winners and _____ losers.
- A change that creates at least one winner and _____ losers is called a *Pareto improvement*.*

*Vilfredo Pareto, 1848-1923, Italian economist working in France.

Example of a Pareto improvement

- Suppose at a particular intersection, cars initially are not permitted to turn right while traffic light is red.
- Then rule is changed so that cars may turn right on red. Assuming no safety issues...
- Drivers wanting to turn right _____.
- Other drivers _____.

"Win-lose" changes

- Unfortunately, most changes in the economy create _____ winners and losers.
- Example: The invention of radial tires, which last several times as long as older designs, reduced employment in the U.S. tire industry by an estimated 40%.

Examples of "win-lose" changes

Change	Winners	Losers
Invention of radial tires		
Invention of personal computers		
Quotas on imports of peanuts		
Elimination of quotas on imports of garments		

ECONOMIC EFFICIENCY AND WELFARE ANALYSIS
Page 2

Deciding on "win-lose" changes

- If a proposed government policy creates both winners and losers, how can we decide whether it *should* be done?
- This is a problem in _____ economics.
- Economists in the 1930s proposed a conceptually simple test.

The compensation test of Kaldor and Hicks

- If the gains to the winners are greater than the losses to the losers, the change is said to pass the *compensation test*.
- In principle, winners could potentially compensate losers and still come out ahead.
- In practice, winners rarely do so.

Nicholas Kaldor, "Welfare Propositions of Economics and Interpersonal Comparisons of Utility," *The Economic Journal*, Vol. 49, No. 195 (Sept. 1939), p. 550.
John R. Hicks, "The Foundations of Welfare Economics,"
The Economic Journal, Vol. 49, No. 196 (Dec. 1939), pp. 710-711.

Potential Pareto improvement

- A change that passes the compensation test is also called a *potential Pareto improvement* because if compensation were paid, it would be a *Pareto improvement.*
- Note that for any such change, if we add up the gains and losses to everyone in society, we get a _____ number.

Example of potential Pareto improvement

- Suppose a government program benefits farmers by $5 billion but costs taxpayers $3 billion.
- This program _____ the compensation test.
- It is also called a _____ Pareto improvement (even if farmers do not actually compensate taxpayers).

Pareto improvements versus potential Pareto improvements

- Venn diagram

All economic changes
Potential Pareto improvements
Pareto improvements
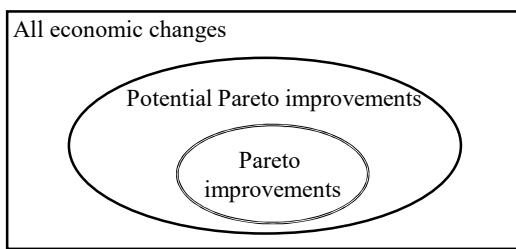
Calculating gains and losses

- To add up gains and losses, they must be in the same units.
- Conventionally, economists use _____ (or some other currency).
- Often, gains and losses occur through changes in prices.
- Gains and losses are then measured as changes in consumer or producer _____ .

ECONOMIC EFFICIENCY AND WELFARE ANALYSIS
Page 3

Economic efficiency

- If a policy or other change creates a net gain or benefit for society, it is said to
_____ *economic efficiency.*
- If a policy or other change creates a net loss for society, it is said to _____
economic efficiency.
  - The amount of net social loss is sometimes called the "deadweight loss."

Does the compensation test always give the right answer?

- **Should** we add up gains and losses without regard to who gets them?
- This is a _____ question.
- Yes, if you feel that ...
_____ .
- No, if you feel that ...
_____ .

Criticisms of the compensation test: What about the losers?

- In practice, winners rarely compensate losers.
- If you feel the losers are much more deserving than the winners, you might _____ a policy that passes the compensation test.
- For example, if you feel that tire workers are more deserving than tire consumers, you might _____ banning radial tires.

Criticisms of the compensation test: Efficiency versus equity

- Sometimes an increase in economic efficiency brings a decrease in _____ (equality, fairness).
- For example, suppose a policy makes rich people better off by $2 billion and makes poor people worse off by $1 billion.
- Passes compensation test but makes society less equal.

But consistent use of the compensation test might spread losses around

- If the compensation test is applied to *many* policy decisions, _____ will benefit at least some of the time.
- For example, tire workers are also consumers of garments and peanuts.
- If we stick to the compensation test for *all* decisions, maybe _____ can be a net winner overall.

Conclusions

- A change where at least one person gains and no one loses is called a _____ improvement.
- A change where the gains to the winners are greater than the losses to the losers passes the _____ ,
is a _____ Pareto improvement, and increases economic _____ .

PERFECT COMPETITION
Page 1

PERFECT COMPETITION

- What is "perfect competition"?
- Why do firms take price as a given?

Competition and perfect competition: definitions

- *Competition* = process by which each firm tries to increase its own profits at the possible expense of _____ firms' profits.
- *Perfect competition* = competition among firms that produce perfect _____ and take the market _____ as given.

What it means to "produce perfect substitutes"

- Consumers don't care whom they buy from.
- Products of different firms are identical in consumers' eyes—no brand preference.
- Consumers buy from firm offering lowest _____.
- Examples: _____
  _____
  _____

What it means to "take market price as given"

- Firm must match price charged by rivals.
- Firm believes it will not affect price by changing output.
  - Cannot push price _____ by selling less.
  - Cannot push price _____ by selling more.
- No "market power" (i.e., pricing power).

"Price-taking" firm perceives its demand curve to be perfectly elastic

- Firm's revenue = P*×q and MR = P*.
- Example: suppose market price P* = $5
- Then TR = $5 × q and MR = $5.
- Selling one more unit increases firm's revenue by $5.

$5

MR=$5

q
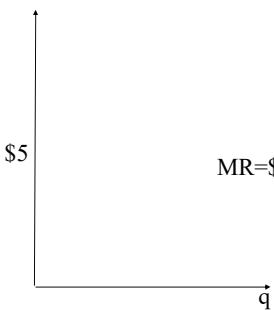
Market demand curve versus firm's demand curve

- Why would a *firm* perceive its demand to be perfectly elastic...

... when the *market* demand slopes down?

P

$5

q

P

$5

Q
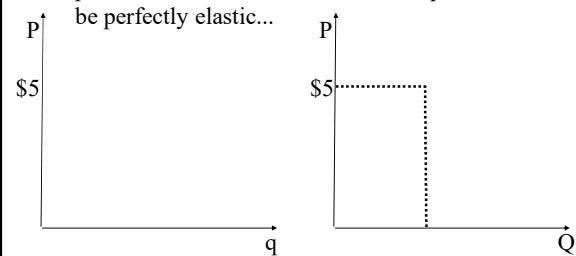
PERFECT COMPETITION
Page 2

Why firms often perceive their demand to be perfectly elastic

Firm believes if it sells more, total output Q* and market price P* will hardly change, either because it ...

- will simply take business away from its rivals, or
- is too _____ to make a difference.
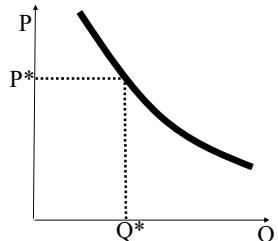
What is exact relationship between market elasticity and firm's elasticity?

- Let $\varepsilon_M = \frac{\Delta Q/Q}{\Delta P/P}$ = market elasticity of demand.
- Assume that if firm increases its own output by some amount (Δq), then its rivals do _____ change their outputs.
  So $\Delta q = \Delta Q$.
- What is the *firm's* elasticity of demand?

What is exact relationship between market elasticity and firm's elasticity? (cont'd)

- Let S = q/Q = firm's market share.
  So q = S Q.
- Let $\varepsilon_F = \frac{\Delta q/q}{\Delta P/P}$ = firm's elasticity of demand.
- Substitute: $\frac{\Delta q/q}{\Delta P/P} = \frac{\Delta Q/(SQ)}{\Delta P/P} = \frac{\Delta Q/Q}{\Delta P/P} \cdot \frac{1}{S}$.

- So $\varepsilon_F =$

So a firm with small market share must perceive its own demand to be very elastic

- Example:
  Suppose *market* elasticity = ε = -4 and firm's market share = S = 0.05.
- Then *firm's* elasticity = -4/0.05 = _____ .

A very elastic demand curve is practically horizontal
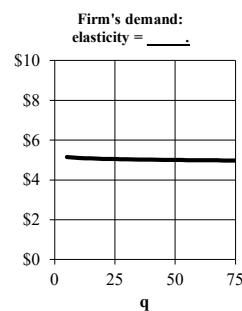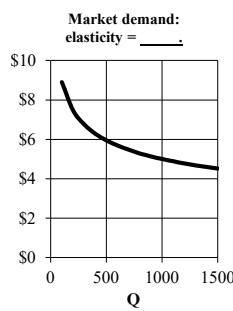
Price taking: short-run versus long-run

- Firm sometimes has market power in short run but not _____ run.
- Initially, might be one of only a few firms in the industry.
- Later, many more firms enter industry and firm's market share _____ .
- Examples: _____
  _____

PERFECT COMPETITION
Page 3

Conclusions

- Perfect competition arises if consumers view firms' outputs as perfect _____ and firms take market price as _____.

- A firm takes price as given if it thinks the price will _____ change if it sells more, either because it will simply take business away from its rivals, or because it is too _____ to make a difference.

EFFICIENCY OF COMPETITIVE MARKETS
Page 1

EFFICIENCY OF PERFECTLY COMPETITIVE MARKETS

- Are perfectly competitive markets efficient?
- Do they divide the gains from trade equally between buyers and sellers?
- Why are some groups opposed to competition?

What is so efficient about the competitive equilibrium?

- Suppose equilibrium in the market for tee-shirts occurs at Q=500.
- Is this more efficient than, say, Q=300 or Q=600?
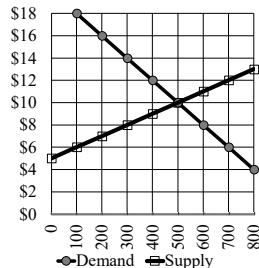
Inefficiency from too little output

- Suppose only 300 tee-shirts were produced.
- Then consumers would be willing to pay $ _____ for another tee-shirt.
- Marginal cost of making another tee-shirt would be $ ____.
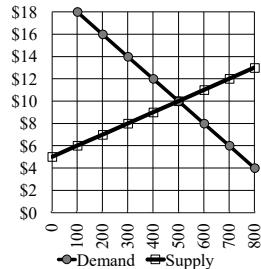
Inefficiency from too little output (cont'd)

- Marginal benefit to consumers of another tee-shirt exceeds marginal cost to producers.
- So increasing output passes the

  _____

  (whether or not producers are actually paid for the teeshirt).

Inefficiency from unexploited surplus

- Put differently, there is a *surplus* of $14-$8 = $ ___ from making 301st tee-shirt.
- No matter how that surplus is divided, producing 301st teeshirt is a potential Pareto improvement.
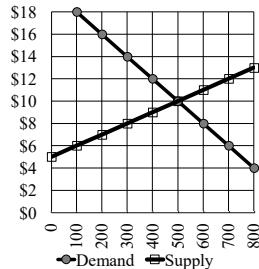
Inefficiency from unexploited surplus

- Put differently, there is a *surplus* of $14-$8 = $ 6 from making 301st tee-shirt.
- No matter how that surplus is divided, producing 301st teeshirt is a potential Pareto improvement.
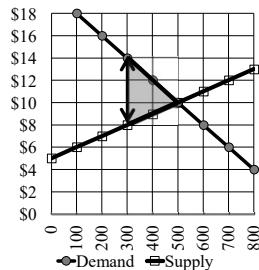
EFFICIENCY OF COMPETITIVE MARKETS
Page 2

Inefficiency from too much output

- Suppose 600 tee-shirts were produced.
- Then consumers were willing to pay only $ _____ for 600th tee-shirt.
- But marginal cost of making 600th tee-shirt was $ _____.
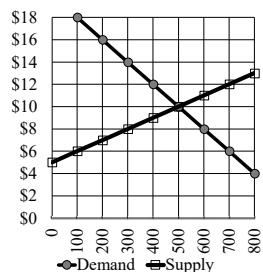
Inefficiency from too much output (cont'd)

- The cost savings from producing one less tee-shirt exceeds the lost benefit to consumers.
- So decreasing output passes the _____ (whether or not consumers actually receive a refund).
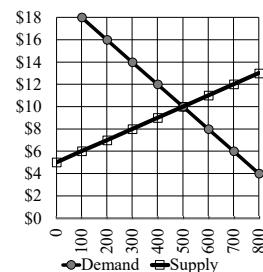
Inefficiency from negative surplus

- Put differently, there is a *negative surplus* of $11-$8 = $ _____ from producing 600th tee-shirt.
- Not producing 600th tee-shirt is a potential Pareto improvement.

Inefficiency from negative surplus

- Put differently, there is a *negative surplus* of $11-$8 = $ _3_ from producing 600th tee-shirt.
- Not producing 600th tee-shirt is a potential Pareto improvement.
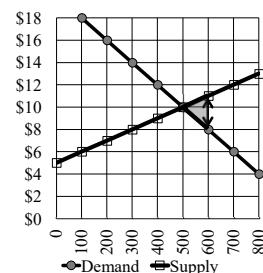
Efficiency of competition

- Starting from the competitive level of output, no increase or decrease can pass the _____.
- Put differently, the competitive level of output maximizes the _____.
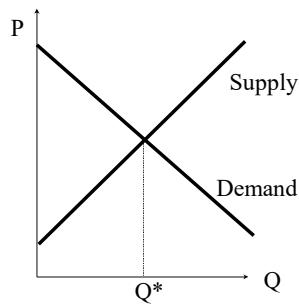
Why competition is efficient

- Competition ensures that price = _____.
- Everyone willing to pay marginal cost of the good, will buy it.
- Anyone not willing to pay marginal cost, will not buy it.
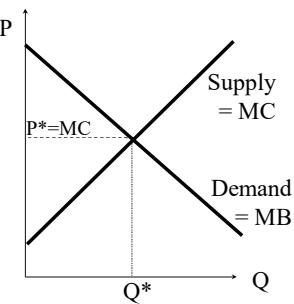
EFFICIENCY OF COMPETITIVE MARKETS
Page 3

Gains from trade

- Through _____ pricing, competition *maximizes* the total surplus.
- But it also *divides* that surplus between consumers and producers.
- We can measure how much they gain using concepts of consumer surplus (CS) and producer surplus (PS).

Measuring gains from trade in a competitive market

- CS = area between demand curve and horizontal line at P*.
- PS = area between the supply curve and the horizontal line at P*.
- Total gains from trade in this market = total surplus = CS + PS.
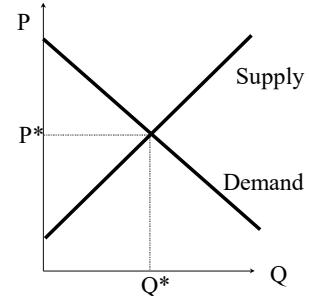
Gains from trade need NOT be equal
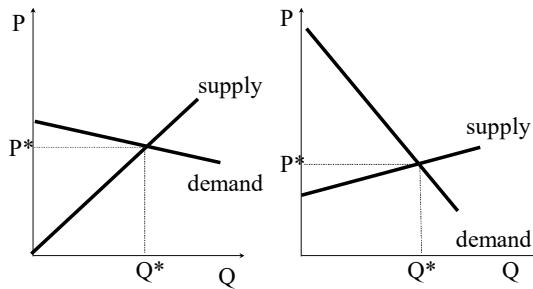
Why the market mechanism is sometimes controversial

- Everyone likes the idea of maximizing total surplus.
- Not everyone likes the way competitive markets _____ the surplus between consumers and producers.
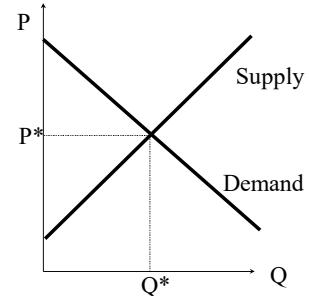
Market controls

- Although total surplus is maximized by competition, groups of buyers or sellers may enjoy higher surplus if the market is controlled in some way.
- They may try to get government to impose regulations like _____ _____.
- Or they may try to gain *market power.*

When markets are not competitive

- We can compare free competition with regulation or monopoly by comparing gains from trade: _____ surplus, _____ surplus, and total surplus.
- Measurement of gains from trade from changes in markets is called "_____ analysis."

EFFICIENCY OF COMPETITIVE MARKETS
Page 4

Conclusions

- Competition, through _____ pricing, ensures that the level of output is _____.
- Total gains from trade in a market are the sum of consumer and producer _____, which are not necessarily equal.
- Competition maximizes the _____ surplus, but some groups may do better with government controls or market power.

WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS
Page 1

WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS

- How can we measure the welfare effects of price controls or quotas?
- Do the gains to the winners exceed the losses to the losers?

Consumer and producer surplus under competition

- Under competition, price and quantity are determined by intersection of supply and demand.
- Consumer and producer surplus are triangles above and below price line.
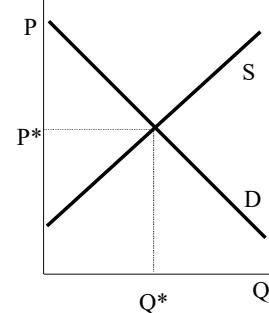
Effects of market controls

- Price floors, price ceilings, and quotas all create winners and losers.
- Using concepts of consumer and producer surplus, we can measure the _____ to winners and _____ to losers.

Price floor (legal minimum price)

- A price floor creates permanent excess _____.
- Some producers are not able to sell all they want at the legal minimum price.
- Quantity actually traded is _____ equilibrium quantity.
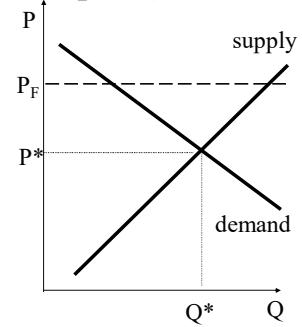
Price floor reduces consumer surplus
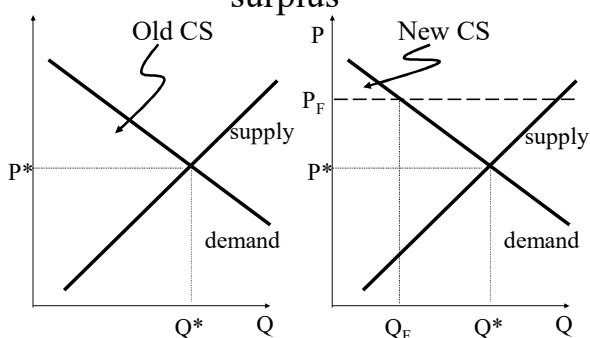
Loss of consumer surplus from price floor

- Consumers face a higher price and buy fewer units.
- Loss of consumer surplus = area of trapezoid between new and old prices.
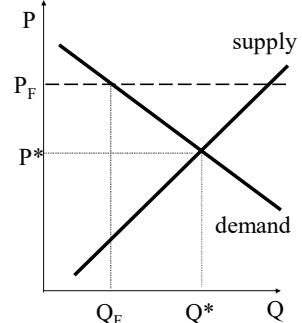
WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS
Page 2

Price floor changes producer surplus

Old PS   New PS
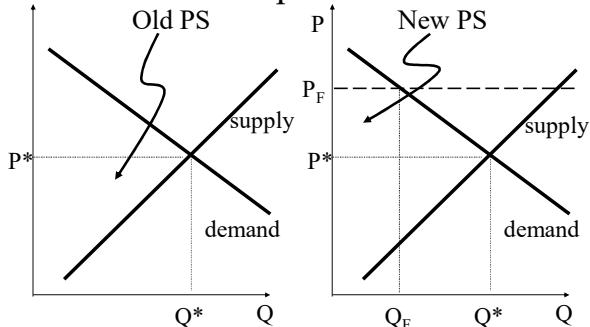
Price floor may increase or decrease producer surplus

- Producers sell fewer units but enjoy a higher price on each unit they still sell.
- Producer surplus increases by area of rectangle, decreases by area of lower triangle.
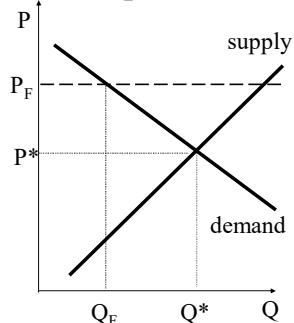
Deadweight loss from a price floor

- Part of consumers' loss is producers' gain.
- But part of consumers' loss is no one's gain.
- And producers also lose something.
- Deadweight social loss is sum of areas of two triangles.
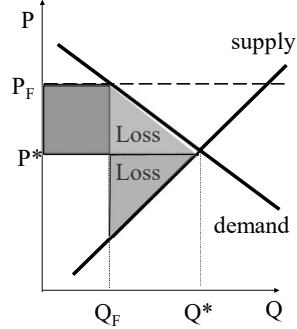
Summing gains and losses from a price floor

- Thus gains to producers from a price floor are less than losses to consumers.
- A price floor fails the _____ test.
- In other words, a price floor is not _____.

Example of price floor

- Suppose P_F = $6.
- CS decreases by $ _____.
- PS increases by ____ - ____ =$ _____ .
- Deadweight loss = $ _____.
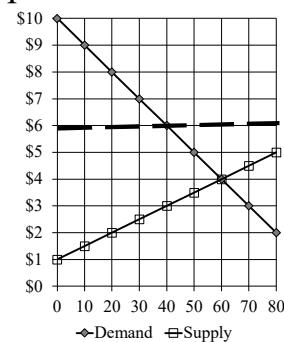
Price ceiling (legal maximum price)

- A price ceiling creates permanent excess _____.
- Some consumers are not able to buy all they want at the legal maximum price.
- Quantity actually traded is _____ equilibrium quantity.
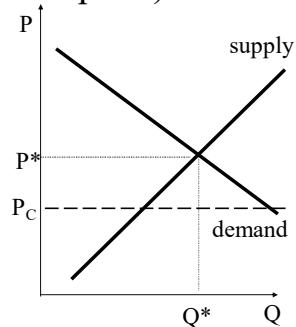
WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS
Page 3

Price ceiling reduces producer surplus

Old PS   New PS

P_F

P^* P^*

P_C

supply   supply

demand   demand

Q^* Q_C Q^*
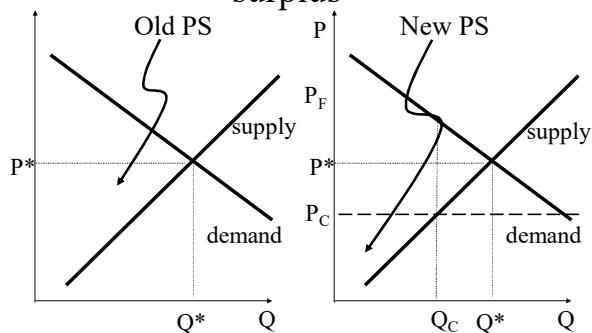
Loss of producer surplus from price ceiling

- Producers face a lower price and sell fewer units.
- Loss of producer surplus = area of trapezoid between new and old prices.
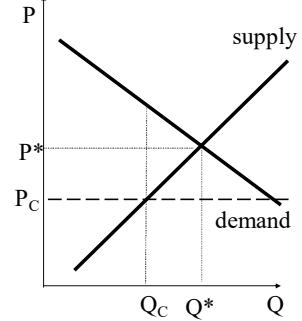
Price ceiling changes consumer surplus

Old CS   New CS

P_F

P^* P^*

P_C

supply   supply

demand   demand

Q^* Q_C Q^*
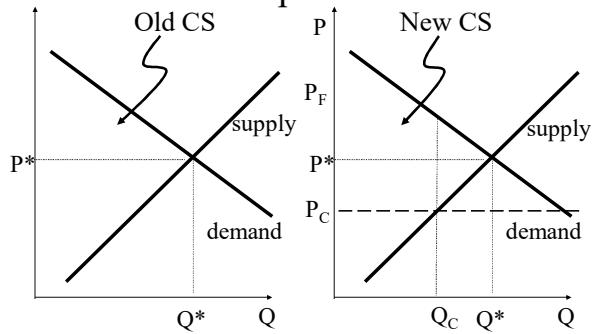
Price ceiling may increase or decrease consumer surplus

- Consumers buy fewer units but enjoy a lower price on each unit they still buy.
- Consumer surplus increases by area of rectangle, decreases by area of upper triangle.
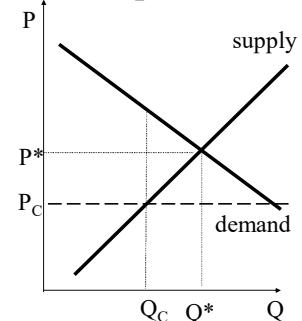
Deadweight loss from a price ceiling

- Part of producers' loss is consumers' gain.
- But part of producers' loss is no one's gain.
- And consumers also lose something.
- Deadweight social loss is sum of areas of two triangles.
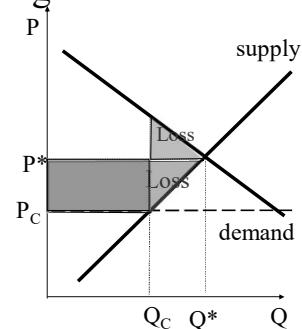
Summing gains and losses from a price ceiling

- Thus gains to consumers from a price ceiling are less than losses to producers.
- A price ceiling fails the _____ test.
- In other words, a price ceiling is not _____ .

WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS
Page 4

Example of price ceiling

- Suppose $P_C = \$3$.
- PS decreases by $ _____$.
- CS increases by $\_\_\_\_ - \_\_\_\_ = \$\_\_\_\_\_$.
- Deadweight loss = $\$_____$.
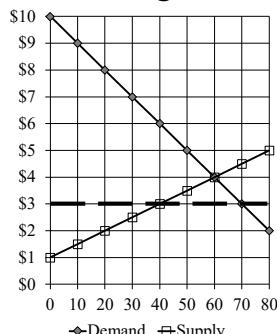
Quota on sellers

- Quota on sellers bends supply curve up vertically.
- Price is pushed up above equilibrium price.
- Effect is similar to price floor.
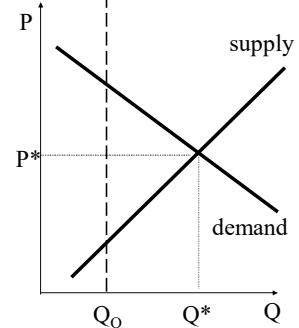
Quota on sellers reduces consumer surplus

- Consumers face a higher price and buy fewer units.
- Consumer surplus shrinks by area of trapezoid between new and old prices.
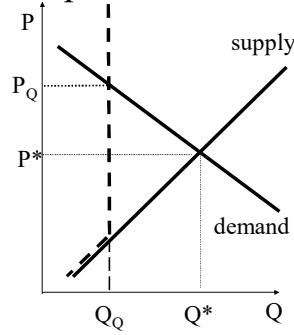
Quota on sellers may increase or decrease producer surplus

- Producers sell fewer units but enjoy a higher price on each unit they still sell.
- Producer surplus increases by area of rectangle, decreases by area of lower triangle.
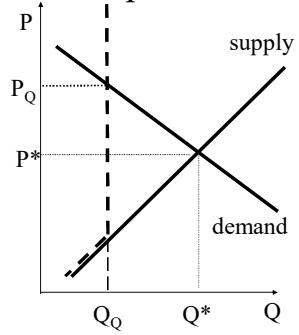
Deadweight loss from a quota on sellers

- Part of consumers' loss is producers' gain.
- But part of consumers' loss is no one's gain.
- And producers also lose something.
- Deadweight social loss is sum of area of two triangles.
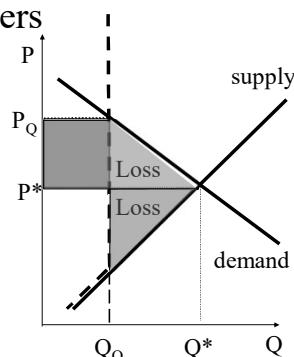
Summing gains and losses from a quota on sellers

- Thus gains to producers from a quota are less than losses to consumers.
- A quota on sellers fails the _____ test.
- In other words, a quota on sellers is not _____.

WELFARE ANALYSIS OF PRICE CONTROLS AND QUOTAS
Page 5

Conclusions

- Price floors, price ceilings, and quotas all create_____.
- Gains to winners are less than losses to losers, so they all fail the _____ test.
- In other words, they are never

    _____.

PART 2

Antitrust Theory

Big ideas: Monopoly, oligopoly and collusive markets are economically inefficient because they push price above marginal cost and reduce the quantity traded. But concentrated markets are not necessarily inefficient.

Famous quote: "People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices."
--Adam Smith, *The Wealth of Nations* (1776)

MONOPOLY AND BARRIERS TO ENTRY
Page 1

MONOPOLY AND BARRIERS TO ENTRY

- What is a "monopoly"?
- Why do monopolies arise?

Monopoly: definition

- *DEF: Single seller in the market.*
- Faces entire market demand curve.
- Cannot take price as given, must recognize that own output influences price.
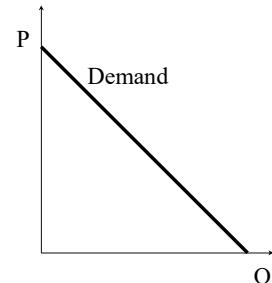
Why monopolies exist

- *Barriers to entry* by new firms.
  - Legal barriers:
    1. government franchise monopoly
    2. patent monopoly
    3. regulation such as Food and Drug Administration
  - Technical barriers:
    1. ownership of a unique resource
    2. "natural" monopoly

Legal barriers: (1) government franchise monopoly

Government sometimes permits only one firm in industry.

Historical examples:

Examples today:

Government franchise monopoly (cont'd)

- Why do governments grant franchises?
- Historically:

- Today:

Legal barriers: (2) patent monopoly

- In U.S., patent protection lasts for 20 years in most cases.
- Extremely important in some industries:

- Important in other industries:

MONOPOLY AND BARRIERS TO ENTRY
Page 2

Patent monopoly (cont'd)

- Why do governments provide patent protection?

Technical barriers:
(1) ownership of a unique resource

- If a particular resource is required to produce some good, then ownership of the resource confers monopoly power.
- Historical examples:

- Examples today:

Technical barriers:
(2) "natural" monopoly

- *DEF: Output is more cheaply produced by one firm rather than by several firms.*
- Economies of scale (falling average cost) imply natural monopoly.
- Note: "natural" monopoly has _____ to do with natural resources.

Example of natural monopoly: suppose a total of 60 units of output must be produced

- If produced by 1 firm, AC = $_____ .
- If produced by 2 firms, AC = $_____ .
- If produced by 3 firms, AC = $_____ .
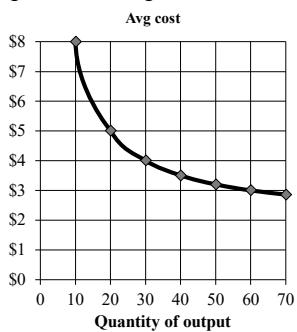
"Natural" monopoly in the real world

- Electric power distribution.
- Natural gas distribution.
- Airlines serving small communities.
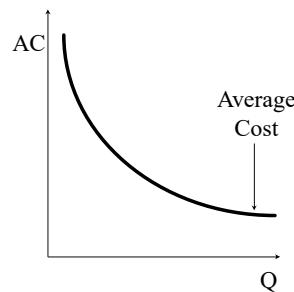
Is the software industry a natural monopoly?

- Example: Suppose it costs
  - $100 million to develop a new word processing program.
  - $5 per copy to put the program on a CD-ROM, package it, and ship it to retail outlets.
- Then TC = $100 million + 5Q.
- So AC = _____ .

MONOPOLY AND BARRIERS TO ENTRY
Page 3

Is the software industry a natural monopoly? (cont'd)

Q	AC
1 million	$_____
10 million	$_____
100 million	$_____ .

- Whenever there are big up-front costs to making a product, natural monopoly results.

Avg cost

Millions of copies
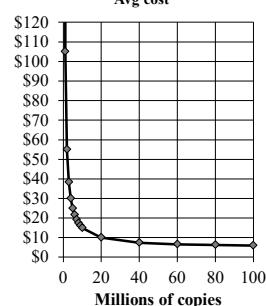
Why called "natural monopoly"?

- Competition is *unstable,* because _____ firms can drive out _____ firms.

Avg cost

Quantity of output
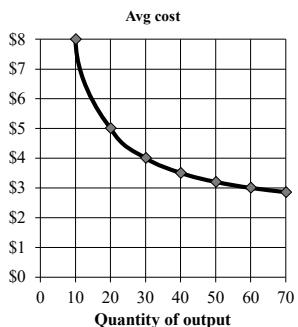
Conclusions

- A *monopolist* is a "_____."
- Monopolies arise because of

  _____.
- Legal barriers include government franchises and patents.
- Technical barriers to entry include: ownership of a unique resource and _____ *monopoly* (economies of scale).

THE MONOPOLIST'S MARGINAL REVENUE
Page 1

THE MONOPOLIST'S MARGINAL REVENUE

- How is marginal revenue for a monopolist different from marginal revenue for a competitor?

Monopolist must cut price to increase sales

- When a monopolist sells 1 more unit at price P*, revenue rises by P*.
- However, to sell that unit, monopolist must cut price on existing units, so revenue also falls by (Q* × ΔP).
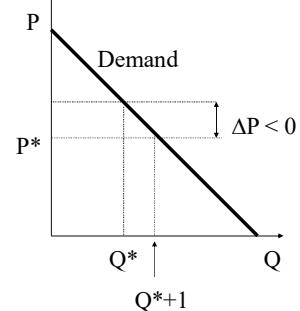
For monopolist, marginal revenue < price

- Thus MR = price of additional unit sold, minus the cut in price times the existing units sold.
- MR = P* + Q*(ΔP) < P*.
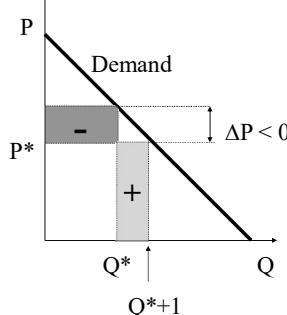
Example 1

- Suppose an ice-cream vendor can sell 5 ice-cream cones per hour at a price of $1.00.
- If vendor drops price to $0.95, can sell 6 ice-cream cones per hour.
- What is the vender's marginal revenue of the sixth cone?
  $0.95?

Example 1 (cont'd)

MR = P + Q × ΔP
= $0.95 + 5 × (-$0.05)

= $_____

Example 1 (cont'd)

MR = P + Q × ΔP
= $0.95 + 5 × (-$0.05)

= $ __$0.70__ .
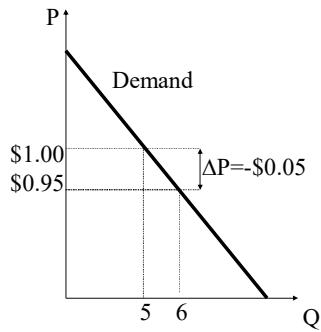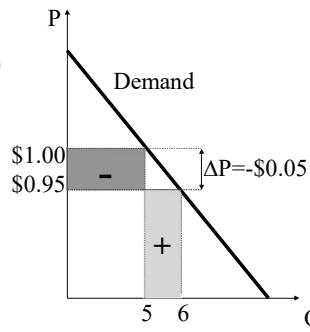
THE MONOPOLIST'S MARGINAL REVENUE
Page 2

Calculus definition of marginal revenue

- Marginal revenue (MR) = increase in total revenue from producing and selling one more unit of output.
- MR = d TR / d Q.
- If a firm takes price as given, then P is constant, so TR = P×Q and MR = _____.
- But if P changes as a function of Q, then MR = d[P(Q) × Q] / d Q.

Finding marginal revenue when demand is linear: example

- Suppose demand is given by:
  P = 10 − (Q/4).
- TR = Q × P
  = 10 Q − (Q²/4).
- MR = dTR / dQ
  = _____.
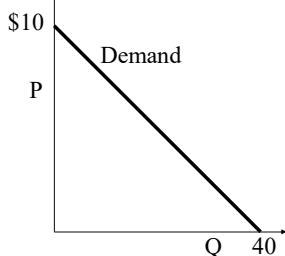
Finding marginal revenue when demand is a power function: example

- Suppose demand is given by:
  P = 12 Q^{-1/3} .
- TR = Q × P
  = 12 Q^{2/3}.
- MR = dTR / dQ
  =
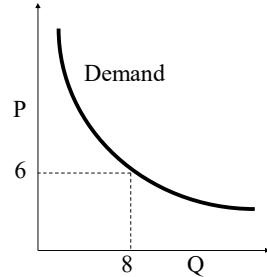
General form of marginal revenue curve when demand is a linear function

Suppose P = a - bQ.
- TR = Q × P
  = Q (a-bQ)
  = aQ - b Q².
- MR = dTR / dQ
  = _____.
- *Conclusion:* MR has _____ price-intercept but _____ slope as the demand curve.

Slope=-b
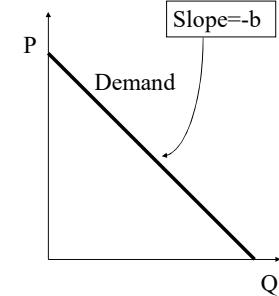
Marginal revenue when demand is power function (cont'd)

Suppose P = c Q^d .
- TR = Q × P = c Q^{d+1}.
- MR = dTR / dQ
  = c (d+1) Q^d.
- *Conclusion:* MR has _____ exponent but _____ coefficient as demand curve.
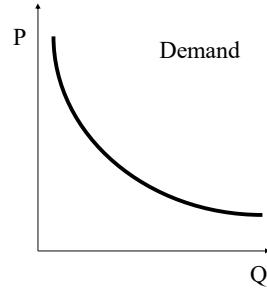
Marginal revenue and elasticity

- Using the product rule for derivatives,

$$ MR = \frac{d\,TR}{d\,Q} = \frac{d}{dQ}(Q \times P) $$
$$ = P + Q\frac{dP}{dQ} = P\left(1 + \frac{Q}{P}\frac{dP}{dQ}\right) $$
$$ = $$

THE MONOPOLIST'S MARGINAL REVENUE
Page 3

Conclusions

- A monopolist has *market power:* it can change the market price by changing its own output quantity.
- *Marginal revenue* is _____ than price for a monopolist because it faces _____-sloping demand.
- In particular, MR = _____ < P.

MONOPOLY PRICING
Page 1

MONOPOLY PRICING

- How does a monopolist choose what quantity to produce and what price to charge?

The firm's problem (review)

- Profit = TR(Q) - TC(Q).
- As before, assume the firm chooses output level Q to maximize profits:

$$\max_{Q} \quad TR(Q) - TC(Q)$$

The firm's first-order condition (review)

- To find profit maximum, set derivative with respect to quantity equal to zero:

$$0 = \frac{d\,TR}{d\,Q} - \frac{d\,TC}{d\,Q} = MR - MC$$

- Therefore choose Q* so that

  _____ .

- But a *monopolist's* marginal revenue is _____ than price, as we have seen.

Solution to monopolist's problem

- First-order condition implies that monopolist chooses Q_M such that $MC(Q_M) = MR(Q_M)$.
- Chooses price P_M on demand curve at Q_M.
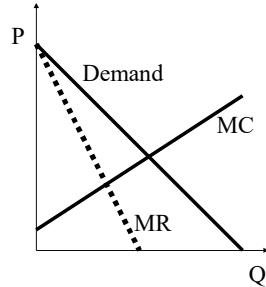
Example: linear demand

- Suppose demand is given by:
  P = 7 – 0.05 Q.
- Then total revenue =
  TR = _____ .
- MR = dTR/dQ
  = _____ .
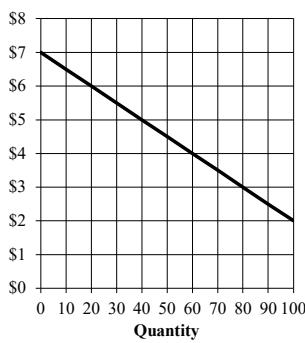
Example: linear demand (cont'd)

- Suppose MC = 1 + 0.05 Q.
- Set MR=MC and solve for Q_M = _____ .
- Substitute into demand equation to get P_M = _____ .
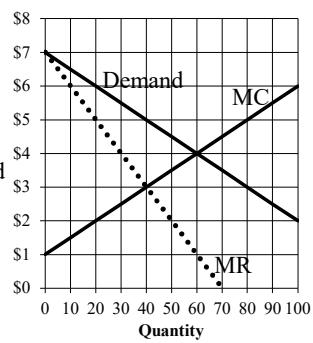
MONOPOLY PRICING
Page 2

Example: constant-elasticity demand

- Suppose $P = 20 \, Q^{-1/2}$ and MC = 2.
- TR = _____.
- Set MR = _____ = MC = 2.
- Q* = _____.
- P* = _____.

Demand (ε = -2)

MR

Quantity
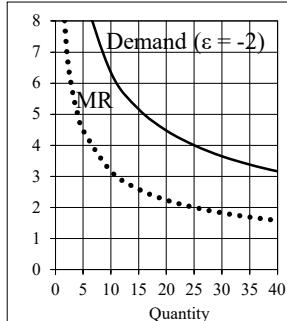
Monopolist's markup over marginal cost

- Since:

$$MC = MR = P\left(1 + \frac{1}{\varepsilon}\right)$$

- Dividing each side by $(1 + 1/\varepsilon)$ gives:

$$P = \frac{MC}{1 + 1/\varepsilon}$$

- This pricing formula is especially useful when demand has constant elasticity ε.

The "Lerner index" of market power

- *DEF:* The fraction of price that represents a markup over marginal cost.
- Lerner* index = (P-MC)/P.
- For a monopolist, $P = MC / [1+(1/\varepsilon)]$.
  - So: $P + P(1/\varepsilon) = MC$
    $P - MC = P \, |1/\varepsilon|$
  - Lerner index = (P-MC)/P = _____.

*Abraham (Abba) Lerner (1903-1982), Russian-born British economist who spent much of his adult life in the U.S.

The "Lerner index" of market power: examples

- If elasticity = -2, Lerner index = _____. So _____ of the price represents a markup over marginal cost.
- If elasticity = -10, Lerner index = _____ So _____ of the price represents a markup over marginal cost.
- The bigger the elasticity (in abs. value) the _____ the markup over marginal cost.

The "Lerner index" of market power: one more example

- If demand is horizontal, and thus elasticity = - infinity, Lerner index = _____
- This is the situation for a competitive firm.
- _____ of the price represents a markup over marginal cost.

P

elasticity = - infinity

q
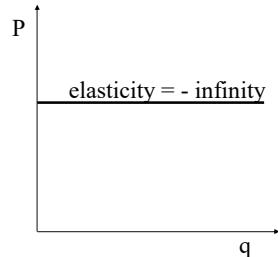
Conclusions

- To maximize profits, monopolist sets Q_M so that $MC = MR = P(1 + 1/\varepsilon) < P$.
- Thus $P_M =$ _____.
- The less elastic the demand (smaller ε in absolute value), the _____ the markup of price over marginal cost.
- Rearranging gives the *Lerner index* of market power: $L = (P_M - MC)/P_M =$ _____.

WELFARE ANALYSIS OF MONOPOLY
Page 1

WELFARE ANALYSIS OF MONOPOLY

- What's wrong with monopoly?

Monopoly profit

- A monopolist sets price _____ MC.
- A monopolist enjoys positive economic profit even in the long run because it is protected by barriers to _____.
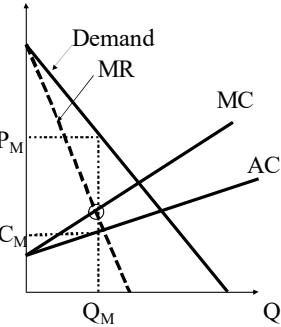
What's wrong with monopoly?

- "Monopoly" has negative connotations in most people's minds.
- Noneconomic arguments against monopoly are often vague and inconsistent.
- Goal here is to clarify economic arguments against monopoly.

Noneconomic arguments against monopoly

- *Argument:* Big is bad.
- *Weakness:* _____ _____ _____ _____

- *Argument:* Concentration of power is bad for society.
- *Weakness:* _____ _____ _____

- *Argument:* Bad for income distribution.
- *Weakness:* _____ _____ _____

Economic arguments against monopoly

- *Argument:* Because price is greater than marginal cost, some welfare (potential gains from trade) is lost.
- Some buyers who are willing to pay the marginal cost are not served.
- Monopolies are not _____ .

Measuring loss of social welfare (deadweight loss)

- Deadweight loss = loss of potential gains from trade.

  = area between demand and MC curves from Q_M to $Q*$.
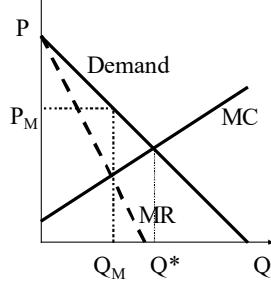
WELFARE ANALYSIS OF MONOPOLY
Page 2

Measuring deadweight loss: example #3 again

- Choose Q_M where MR=MC and P_M on demand curve.
- $Q_M =$ _____.
- $P_M =$ _____.
- But $Q^* =$ _____.
- Deadweight loss = $_____.
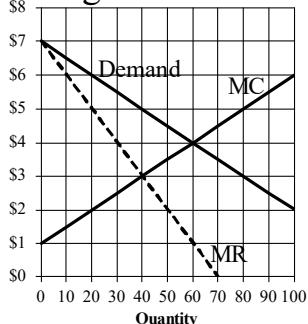
More economic arguments against monopoly

- *Argument:* Barriers to entry may reduce incentives for efficiency (e.g., cost minimization).
- *Argument:* May encourage rent-seeking behavior.
  - DEF: *Rent-seeking* = devotion of resources to erect barriers to entry.

An economic argument in favor of monopoly

- *Argument:* Monopolist may have greater incentive than a competitor to develop lower-cost methods of production (Joseph Schumpeter*).
- Possible example:
  _____
- But evidence for greater technical innovation is weak at best.

Joseph Schumpeter 1883–1950) Austrian-born American economist and political scientist.

Conclusions

- While noneconomists often have numerous arguments against monopoly, these are often vague and inconsistent.
- Economists have a specific argument: _____from pricing _____ marginal cost.
- Additional economic arguments include loss of technical efficiency and _____ _____ behavior.

THE STRUCTURE-CONDUCT-PERFORMANCE PARADIGM
Page 1

THE STRUCTURE-CONDUCT-PERFORMANCE PARADIGM

•What is the traditional view of industries that lie between competition and monopoly?

Between competition and monopoly

• What about industries that lie between competition and monopoly?
• The *structure-conduct-performance* paradigm was developed by economists at Harvard during the 1930s and 1940s to try to understand such industries.

The SCP paradigm

• They argued that the inherent s_____ of an industry determines the c_____ or behavior of its firms, which determines the economic p_____ of the industry as a whole.

Structure

Conduct

Performance
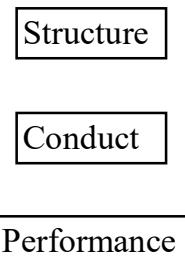
Structure: given facts of an industry, as stressed by the Harvard school

• Concentration: number of firms and how equal they are in size.
• _____ barriers to entry: franchises, patents.
• _____ barriers to entry: ownership of scarce resources, economies of scale ("_____ monopoly"), cost advantage of more experienced firms ("learning by doing").

Structure: other possible given facts of an industry

• Price elasticity of market demand.
• Product differentiation: do rival firms produce *perfect* substitutes?
• Brand loyalty of consumers.
• Diversification of firms into multiple product lines.
• Continuous versus lumpy sales.

Conduct: how firms behave

• Pricing practices: price competition, collusion, or something in between.
• Exclusionary practices: methods of disciplining or excluding rivals.
• Advertising.
• Spending on research and development.

THE STRUCTURE-CONDUCT-PERFORMANCE PARADIGM
Page 2

Performance: end result for society

- Economic efficiency: sum of _____ surplus and _____ surplus.
- If we cannot measure CS and PS, look at
  - Average cost and profit.
  - Output level and product quality.
  - Markup of price over marginal cost.
- Speed of technical change.

What is wrong with the SCM paradigm?

- Industries differ in many respects.
- No simple relationship between "structure" and "conduct."
- Sometimes "conduct" can affect "structure."

Structure → Conduct → Performance
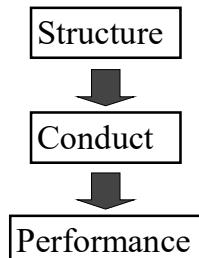
How "conduct" can affect "structure"

- Mergers and exclusionary practices affect concentration.
- R&D affects speed of technical change.
- If one firm has low cost, it might set low prices and become large, _____ industry concentration.

Structure → Conduct → Performance
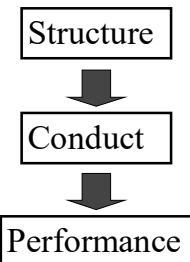
Conclusions

- The S_____-C_____-P_____ paradigm, developed by the Harvard school, argued that concentration and entry barriers determine firm behavior, which determines economic performance.
- But the SCP paradigm is oversimplistic.
- Elements of "structure" sometimes depend on "conduct."

ANTITRUST STATUTES AND THEIR ENFORCEMENT
Page 1

ANTITRUST LAWS AND THEIR ENFORCEMENT

- What are the three most important laws in the U.S. that protect competition?
- How are they enforced?

The Sherman Act of 1890

- Law was a reaction to large business combinations ("trusts") in 1880s.
- Economic depression had encouraged formation of _____ to limit competition and raise prices in many industries.
- Farmers' organizations, labor unions, and small business campaigned to make trusts illegal.

Sherman Act Section 1

- "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 illegal."
- Penalties include imprisonment and fines.

Sherman Act Section 2

- "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..."
- Penalties include imprisonment and fines.

The Clayton Act of 1914

- Sherman Act not as effective as hoped.
- Clayton and FTC Acts passed to strengthen antitrust.
- Clayton Act Sections 2 and 3 specifically outlawed price discrimination and vertical restrictions which tend "to substantially lessen competition or tend to create a monopoly."

Clayton Act Section 7

- Section 7 outlawed mergers that "lessen competition," but was largely ineffective because of legal loophole.
- Firms could still legally buy all the assets of other firms.
- Loophole plugged by Celler-Kafauver Act of 1950.

ANTITRUST STATUTES AND
THEIR ENFORCEMENT
Page 2

Clayton Act Section 7

- Section 7 outlawed mergers that "lessen competition," but was largely ineffective because of legal loophole.
- Firms could still legally buy all the <u>assets</u> of other firms.
- Loophole plugged by Celler-Kafauver Act of 1950.

> Buildings, machines, railroad tracks, etc.

Federal Trade Commission (FTC)
Act of 1914

- Section 5 reinforced other antitrust laws by outlawing "unfair methods of competition."
- Also protected consumers from "unfair and deceptive practices."
- Created new agency that could both investigate and judge cases.
- Commission decisions can be appealed to U.S. Court of Appeals.

Shared enforcement

- The Antitrust Division of the U.S. Department of Justice (DOJ) and Federal Trade Commission (FTC) together enforce federal antitrust laws.*
- States also enforce own antitrust laws.
- Private parties can bring suit if they think they were harmed—e.g., by price-fixing. Most antitrust cases are brought by private parties.

*DOJ is responsible for criminal investigations. FTC and DOJ share responsibility for civil cases.

U.S. Department of Justice
(also called "DOJ")

- Argues cases in federal courts for the government.
- **Antitrust Division** prosecutes cases related to competition policy.
- **Criminal suits** = actions in court that can lead to fines (money penalties) for companies, and fines or prison for persons.
- **Civil suits** = actions in court that can require companies or persons to do certain things, or stop doing certain things. Most actions are civil.

U.S. Supreme Court
Has 9 judges.
Decides whether Court of Appeals has applied law correctly.

13 Courts of Appeals
(also called "circuit courts" or "appellate courts")
Each has 3 judges.
Decide whether District Court has applied law correctly.

94 District Courts
(also called "trial courts")
Each has 1 judge and sometimes a jury.
Hear evidence and decide cases.

Federal Trade Commission
(also called "FTC")
Has 5 commissioners.

Antitrust laws are vague

- What do these terms mean: "restraint of trade," "monopolize," "lessen competition," and "unfair methods of competition" ?
- Courts have been given substantial latitude to interpret laws, and their interpretation has changed over time.
- To know what conduct is illegal, you must study court decisions.

ANTITRUST STATUTES AND
THEIR ENFORCEMENT
Page 3

"*Per se* rule" versus "rule of reason"

- Courts have judged some business activities to be *per se* illegal—that is, always illegal _____ of circumstances.
- Other activities are judged under the "rule of reason"—that is, _____ on circumstances. They may be judged illegal if they appear to lessen competition, but legal otherwise.

Purpose of antitrust law

- Economists think purpose is to promote _____.
- Courts increasingly agree: "It is competition, not competitors, that the Act protects." *
- However, other goals—like protection of small business—have sometimes influenced court decisions in the past.

* Brown Shoe Company v. United States, 370 U.S. 294, 344 (1962).

Outcomes of antitrust cases: actions

- Government cases often result in judgments or consent decrees requiring defendants to take certain actions.
  - _____.
  - _____.

Outcomes of antitrust cases: fines and prison terms

- Violations of Sherman Act can bring fines or prison terms, especially for price-fixing (Section 1).
- Penalties were mild through early 1990s.
- Fines have since _____.

Fines resulting from actions by Antitrust Division of Department of Justice
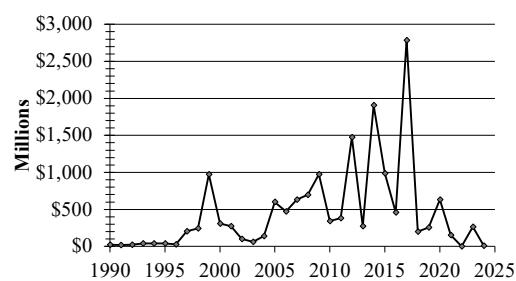
SOURCE: U.S. Department of Justice, Antitrust Division Workload Statistics.

Treble (×3) damages in private cases

- Injured parties (e.g., customers victimized by a cartel) can also sue.
- If plaintiff successful, defendant is ordered to pay damages based on plaintiff's loss.
- Damages are then *automatically* multiplied by _____.
- Defendants frequently settle.

ANTITRUST STATUTES AND
THEIR ENFORCEMENT
Page 4

Exemptions from antitrust law

- Agricultural marketing cooperatives.
- Export trade associations.
- Insurance (where regulated by state law).
- Labor unions.
- Fishermen's marketing cooperatives.
- Newspapers ("joint operating agreements").
- Professional sports leagues (when negotiating television rights).

https://www.justice.gov/atr/file/761131/download

Conclusions

- Key antitrust statutes are Sherman Act, Clayton Act, and FTC Act.
- Dept of Justice and FTC share enforcement.
- Injured private parties can bring suit for _____ damages.
- Economists think antitrust should promote _____. Courts increasingly agree.
- Fines for price-fixing have soared recently.

OLIGOPOLY
Page 1

OLIGOPOLY

- What is an oligopoly?
- Why are there many models of oligopoly?

What is an oligopoly?

- A market with a small number of sellers.
- There may be barriers to entry, but not as high as in monopoly.
- Examples:

Why an oligopolist is different from a competitive firm

- An oligopolist can change the market price by changing its own quantity.
- It has "market power" = power over price.
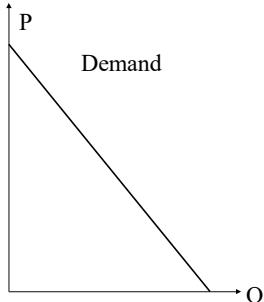
Why an oligopolist is different from a monopolist

- But an oligopolist has rivals.
- If it raises price, some of the benefit goes to its rivals.
- If it lowers price, some of the harm falls on its rivals.
- Thus an oligopolist has _____ incentive to restrict output and raise price than a monopolist has.

What will the oligopolist's rivals do?

- Exactly how much incentive the oligopolist has to reduce output depends on *how it conjectures its rivals will respond*.
- Will rivals _____ in restricting output?
- Will rivals _____ the oligopolist by increasing their output and expanding their market shares?
- Will rivals simply keep their output _____?

A language for oligopoly theory

- To keep track of our assumptions, the language of game theory is useful.
- A "strategy" in game theory is an action by a firm that rival firms take as _____ when they decide what to do.

OLIGOPOLY
Page 2

Conclusions

- An oligopolist is one of a _____ number of sellers in the market.
- Theories of oligopoly must make assumptions as to what each firm conjectures its rivals will do.
- _____ provides a language to keep track of these assumptions.

BASIC GAME THEORY
Page 1

BASIC GAME THEORY

• What is "game theory"?
• How can it help us think about imperfect competition?

What is "game theory"?

• A mathematical approach for thinking about human interaction.
• Has been applied to economics, politics, defense policy, and even ecology.
• Very helpful for thinking about incentives facing _____ firms.
• Helps clarify our assumptions, especially about equilibrium.

Basic ingredients of a "game"

• *Players* = decision makers (at least 2).
• *Strategies* = choices available to each player (at least 2).
• *Payoffs* = final returns to players at end of game. Payoffs depend on strategies played.

Representation of a game in "strategic form" (also called "normal form")

		Player #2		
		Strategy	Strategy	Strategy
	Strategy	Payoffs	Payoffs	Payoffs
Player #1	Strategy	Payoffs	Payoffs	Payoffs
	Strategy	Payoffs	Payoffs	Payoffs

Example 1: assumptions

• Suppose a particular market is served by two firms, each enjoying a per-unit profit rate (price – avg cost) of $1.
• Total quantity in market is 100 million units.
• Without advertising, they split the market and each enjoy $_____ million profit.

Example 1: assumptions (cont'd)

• If one firm advertises, that firm takes 75% market share.
• But advertising costs $10 million.
• So that firm enjoys a profit of $75 million - $10 million = $_____ million.
• The other firm enjoys a profit of $_____ million

BASIC GAME THEORY
Page 2

Example 1: assumptions (cont'd)

- If *both* firms advertise, each firm takes 50% market share.
- So each firm enjoys a profit of
  $50 million - $10 million = $_____ million.

Example 1 in strategic form

Firm #2

		Do not advertise	Advertise
Firm #1	Do not advertise	#1 gets $____ m, #2 gets $___ m.	#1 gets $____ m, #2 gets $___ m.
	Advertise	#1 gets $____ m, #2 gets $___ m.	#1 gets $____ m, #2 gets $___ m.

What is the likely outcome in example 1?

- Suppose initially neither firm advertises.
  - Firm #1 will want to advertise to increase its profit from $50 to $_____ million.
- Suppose only Firm #1 advertises.
  - Firm #2 will want to advertise to increase its profit from $25 to $_____ million.
- Alternatively, suppose only Firm #2 advertises.
  - Firm #1 will want to advertise to increase its profit from $25 to $_____ million.

"Best replies"

In the language of game theory,
- If firm #2 does *not* advertise, Firm #1's best reply is to _____.
- If firm #2 *does* advertise, Firm #1's best reply is still to _____.
- Firm #2's best replies are similar.

Nash equilibrium = stable outcome

- A stable outcome—formally, a "Nash equilibrium"—is a situation where *neither player wants to change strategies*.
- Put differently, a Nash equilibrium is a pair of strategies that are _____ to each other.
- In this game, the Nash equilibrium is for both firms to _____.

Nash equilibrium is not necessarily best for everyone

- Both firms would be better off if they could cooperate and agree not to advertise.
- But if we rule out cooperation, the most likely outcome is for both firms to _____.

BASIC GAME THEORY
Page 3

Example 2: assumptions

- Suppose two firms must choose technical standards for their products.
- Each firm favors a different standard.
  - Firm #1 prefers standard A.
  - Firm #2 prefers standard B.
- However both products will sell more if they are compatible—that is, if they use the same standard.

Example 2: assumptions (cont'd)

- If both firms choose standard A, then Firm #1 enjoys profit of $20 million and Firm #2 enjoys profit of only $10 million.
- If both firms choose standard B, then Firm #1 enjoys profit of only $10 million and Firm #2 enjoys profit of $20 million.
- If the firms choose different standards, neither firm enjoys any profit.

Example 2 in normal form

		Firm #2	
		Standard A	Standard B
Firm #1	Standard A	#1 gets $___ m, #2 gets $___ m.	#1 gets $___ m, #2 gets $___ m.
	Standard B	#1 gets $___ m, #2 gets $___ m.	#1 gets $___ m, #2 gets $___ m.

What is the likely outcome in example 2?

- Suppose initially that each firm chooses its preferred standard. Will either firm want to change strategies? _____!
- Firm #1's best reply to "Standard B" is _____.
- Firm #2's best reply to "Standard A" is _____.

Nash equilibrium

- Suppose both firms choose Standard A. Will either firm want to change strategies? _____!
- Suppose both firms choose Standard B. Will either firm want to change strategies? _____!
- So there are ___ Nash equilibria in this game.

Interdependence

- In example 1, the best action for each firm was to advertise, regardless of the other firm's action.
  - "Advertise" was each firm's *dominant strategy*.
- In example 2, the best action for each firm depended on the other firm's action.
  - Interdependence is common feature of oligopoly.

BASIC GAME THEORY
Page 4

Conclusions

- Games consist of _____, who
  choose _____, which in turn
  determine _____ to each player.
- A *Nash equilibrium* is a stable pair of
  strategies that are _____
  to each other.
- Game theory is helpful for thinking about
  incentives facing interdependent firms.

COURNOT DUOPOLY
Page 1

COURNOT DUOPOLY

- What happens if two firms take each others' *quantities* as given, instead of prices?

What is Cournot duopoly?

- A model of market power in which each firm sets its quantity, taking as given the _____ produced by the other firm.
- Two firms behave symmetrically.
- Firms do not cooperate, but seek to maximize own profits.

Cournot, A. A. (1838). *Recherches sur les principes mathématiques de la théorie des richesses*. Paris: Hachette. Chapitre VII «De la concurrence des producteurs».

Intuitive motivation for the Cournot equilibrium

- Suppose first oligopolist, taking its rival's output level as given, sets its quantity.
- Now suppose second oligopolist, taking first's output as given, sets its quantity.
- Suppose process continues back and forth. What equilibrium price and total output result?

Cournot firm's marginal revenue: graphical interpretation

- When Cournot duopolist #2 sells 1 more unit, revenue rises by price of that unit, but also falls by $q_2 \times (\Delta P/\Delta Q)$.
- Thus $MR_2 = P^* + q_2 (\Delta P/\Delta Q)$.
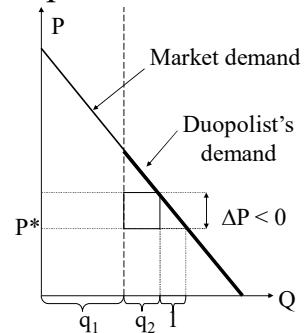
Cournot firm's marginal revenue: calculus interpretation

- Cournot firm #i has revenue given by $TR_i = q_i \times P$.
- So Cournot firm #i has marginal revenue $MR_i = P + q_i (dP/dQ)$.
- But MR_i depends on q_{other}, the output chosen by the other firm.
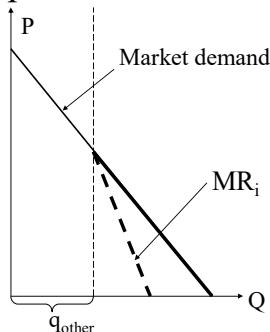
Cournot firm's best reply function

- Each Cournot firm sets MR_i = its marginal cost, to maximize profit.
- But MR_i depends on the output (q) of its rival.
- Thus firm sets its output in *reply* to its rival's output.
- Function relating firm's profit-maximizing output to its rival's output is called its "best reply function."*

*Also called "reaction function."

COURNOT DUOPOLY
Page 2

Example 1

- Suppose there are two firms in the market: #1 and #2.
- Suppose market demand is
$P = 9 - (Q/100)$
$= 9 - (q_1+q_2)/100$.
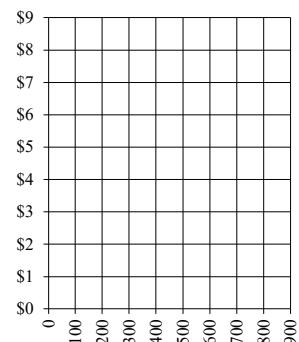
Example 1:
firm #2's best reply function

- $TR_2 = q_2 \times P =$
- $MR_2 = \partial TR_2/\partial q_2 =$
- Suppose firm #2's $MC_2 = \$2$.
- Set $MC_2 = \$2 = MR_2$ and solve to get best reply function: $q_2 = f_2(q_1) =$

Equilibrium in the Cournot model

- Each firm sets its quantity, taking as given the quantity produced by other firm.
- Solving *both* firms' best reply functions simultaneously gives Cournot-Nash equilibrium.
- At this equilibrium, _____ firm wants to change its own output level.

Example 1:
firm #1's best reply function

- It is easy to show that for firm #1,
  - $TR_1 = q_1 \times P = 9q_1 - (q_1{}^2+q_1q_2)/100$
  - $MR_1 = \partial TR_1/\partial q_1 = 9 - (2q_1 + q_2)/100$
- Suppose firm #1's $MC_1 = \$4$.
- Set $MC_1 = \$4 = MR_1$ and solve to get:
$q_1 = f_1(q_2) =$ _____.

Example 1:
Cournot equilibrium

- We found firm #2's best reply function was $q_2 =$ _____.
- We found firm #1's best reply function was $q_1 =$ _____.
- Solving gives:
$q_1 =$_____, $q_2 =$_____.

Firm #1's best reply
Firm #2's best reply
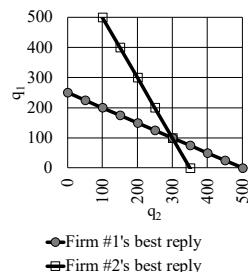
Example 1:
total market quantity and price

Total output = Q
$= q_1 + q_2 =$ _____.

Substituting into demand equation,
$P = 9 - (Q/100) =$ _____.

Demand
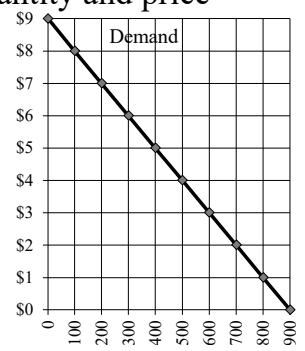
COURNOT DUOPOLY
Page 3

Typical characteristics of Cournot equilibrium

- Both firms charge the same price (here, \$5), which is _____ than the marginal costs of either firm (here, \$2 and \$4).
- This creates _____ loss, as some consumers willing to pay the marginal cost are excluded.
- The firm with the lower marginal cost gets the _____ market share.

Symmetry in the Cournot model

- If firms have *identical costs*, then their best reply functions will take identical forms.
- Then they will end up setting the _____ quantity levels.
- Symmetric problems are easier to solve!

Example 2

- Again suppose there are two firms in the market: #1 and #2.
- Suppose market demand is
  $P = 8 - (Q/50)$
  $= 8 - (q_1+q_2)/50$.
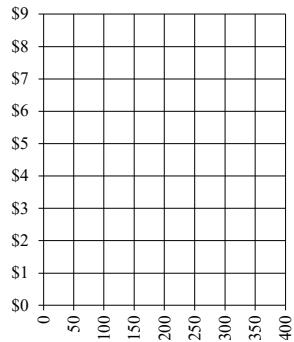
Example 2: firm #1's best reply function

- Then $TR_1 = 8q_1 - (q_1^2 + q_1q_2)/50$.
- So $MR_1 = $ _____.
- Suppose $MC_1 = MC_2 = \$2$.
- Set $MR_1 = 2$ and solve for firm #1's best reply function: $q_1 = $ _____.

Example 2: symmetric Cournot equilibrium

- We found firm #1's best reply function was $q_1 = $ _____ .
- But $MC_1 = MC_2$ so $q_1 = q_2$ (symmetry).
- Substituting: $q_1 = $ _____ .
- Solving, $q_1 = $ ____ $= q_2$.

Firm #1's best reply
Firm #2's best reply
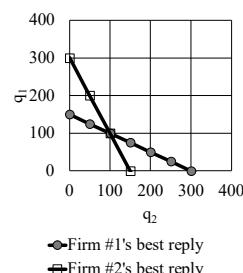
Example 2: total market quantity and price

- Total output $= Q$
  $= q_1 + q_2$
  $= $ _____.
- Substituting into demand equation,
  $P = 8 - (Q/50)$
  $= $ _____.
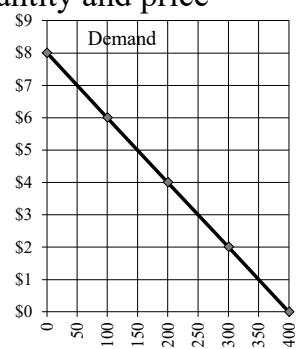
Demand

COURNOT DUOPOLY
Page 4

Example 2: deadweight loss

- Deadweight loss = area between demand and MC, from the actual output to the efficient output.
- Efficient output level = _____ .
- Deadweight loss = $_____ .
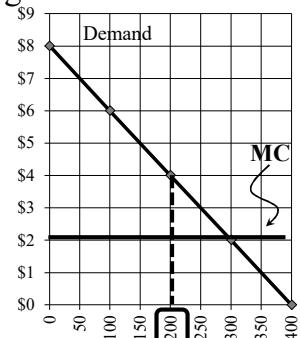
Comparison with price competition

- Under price competition, each firm takes market _____ (not quantity) as given.
- Each competitive firm views its marginal revenue as equal to that *price*.
- Each competitive firm sets MC = P.
- As a result, equilibrium output is efficient and _____ than Cournot level.

Comparison with monopoly

- Monopolist's marginal revenue is always _____ than Cournot oligopolist's marginal revenue.
- When a Cournot oligopolist expands output, price falls, and part of the harm falls on its _____ .
- Monopolist has no rivals. It bears the entire harm from price fall.

Example 2: comparisons

- Market demand is $P = 8 - Q/50$, MC=$2.
- Competition:
  - P = MC = $2, Q = _____ .
- Monopoly:
  - Market MR = _____ .
  - Setting market MR = MC = $2 gives Q = _____ , P = _____ .

Example 2: graph of comparisons

- Price competition: price = MC, zero deadweight loss.
- Cournot duopoly: higher price, some deadweight loss.
- Monopoly: highest price, greatest deadweight loss.
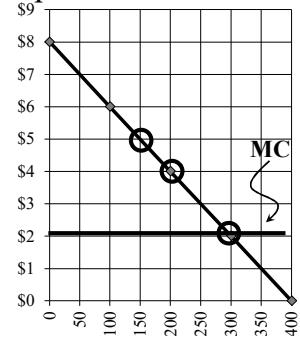
Conclusions

- The *Cournot duopoly model* consists of two firms that each take the other's _____ as given.
- Equilibrium is found by simultaneously solving both firms' _____ *functions.*
- The Cournot equilibrium price lies _____ monopoly and competition.

COURNOT OLIGOPOLY
Page 1

COURNOT OLIGOPOLY

- What happens if more than two firms all take each others' *quantities* as given, instead of prices?

What is Cournot oligopoly?

- A model of market power in which each firm sets its quantity, taking as given the total _____ produced by other firm(s).
- All firms move simultaneously. No "dominant firm."
- Firms do _____ cooperate, but each seeks to maximize its own profit.

*Antoine A. Cournot (1801-1877), *Recherches sur les Principes Mathematiques de la Theorie des Richesses*, 1838.

Intuitively appealing features of Cournot oligopoly model

We will show that the fewer the firms in the industry,

- the _____ the equilibrium price,
- the _____ the % markup of price over marginal cost (Lerner index),
- and the _____ the deadweight loss.

Cournot firm's marginal revenue

- Each Cournot firm #i has revenue given by $TR_i = q_i P$.
- Each Cournot firm #i has marginal revenue $MR_i = P + q_i (dP/dQ)$.
- But TR_i and MR_i depend on rivals' output quantity.
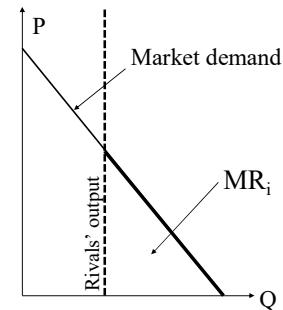
Equilibrium in Cournot oligopoly with *n* firms

- Each firm sets its quantity according to rule $MC_i = MR_i$, taking as given total _____ produced by other *n-1* firms.
- If this equation holds for all *n* firms, then no firm will want to change its output level.
- Solving these *n* equations for all *n* firms simultaneously gives Cournot equilibrium.

Welfare analysis of Cournot equilibrium

- Solution lies on demand curve between MC and monopoly price.
- Some deadweight loss but not as much as monopoly.
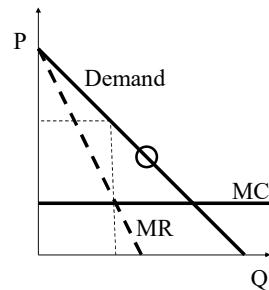
COURNOT OLIGOPOLY
Page 2

Another way to write the Cournot firm's marginal revenue

$$MR_i = P + q_i \frac{dP}{dQ}$$

$$= P + \left(\frac{q_i}{Q}\right)\left(\frac{dP}{dQ}\right)\left(\frac{Q}{P}\right)P = P + s_i\left(\frac{1}{\varepsilon}\right)P$$

where ε = market elasticity of demand and $s_i = q_i/Q$ = market share of firm #i.

Lerner index in Cournot oligopoly

Cournot firm #i chooses q_i so that
$MR_i = MC_i$.
But $MR_i = P + s_i(1/\varepsilon)P$.
So $P + s_i(1/\varepsilon)P = MC_i$.
$P - MC_i = s_i(1/|\varepsilon|)P$.

$$\frac{P - MC_i}{P} = \qquad .$$

Symmetric Cournot equilibrium with many firms

- Suppose each firm #i has *same* MC.
- By symmetry, $s_i = 1/n$ (that is, each firm has an equal share of total output).
- So Lerner index is

$$\frac{P - MC}{P} = \qquad .$$

Behavior of Cournot model as number of firms n increases

- Lerner index approaches_____.
- Price approaches
  _____.
- Market quantity Q approaches
  _____
  quantity.
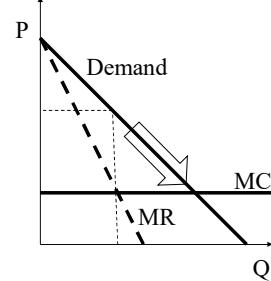
Extreme cases of Cournot equilibrium

Monopoly
- n = _____
- Lerner index =_____

Large number of very small firms
- n approaches _____
- Lerner index approaches _____
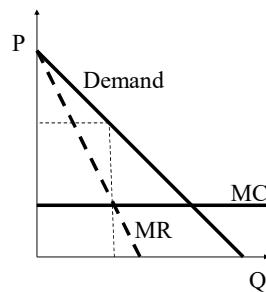
Estimates of Lerner indexes

- Tobacco: 0.65
- Food processing: 0.50
- Electrical machinery: 0.20
- Retail gasoline: 0.10
- Textiles: 0.07
- Rubber: 0.05

Timothy Bresnahan, "Empirical Studies of Industries With Market Power," in R. Shmalensee and R.D. Willig, eds., *Handbook of Industrial Organization*, Elsevier Science, 1989, table 17.1, p. 1051.

COURNOT OLIGOPOLY
Page 3

A spectrum of market structures

Price competition
(no DWL)

Cournot oligopoly
(some DWL)

Monopoly
(large DWL)
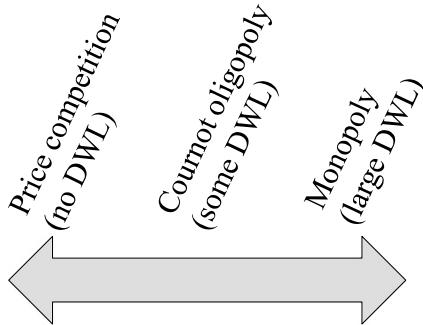
Conclusions

- Under *Cournot oligopoly*, firms each maximize profit taking take each other's _____ as given.
- A particular firm's Lerner index is $(P-MC_i)/P =$ _____ .
- If all firms have same MC, $(P-MC)/P =$ _____ .
- As number of firms n increases, equilibrium price approaches _____ .

COURNOT DUOPOLY
Page 1

BERTRAND DUOPOLY

- What happens if two firms take each others' *prices* as given, instead of quantities?

What is Bertrand* duopoly?

- A model of market power in which each firm sets its price, taking as given the _____ set by the other firm.
- Two firms behave symmetrically.
- Firms do not cooperate, but seek to maximize own profits.

*Bertrand, J. (1883) "Revue de *Recherches sur les Principes Mathematiques de la Theorie des Richesses*", *Journal de Savants* 67: 499–508. Bertrand's model was later formalized by Francis Edgeworth in 1889.

Assumptions of Bertrand model

- Homogeneous output: both firms produce same product.
- Both firms have _____ marginal cost and average cost.
- If firms set different prices, consumers buy only from _____ firm.
- If firms set same prices, consumer demand is split evenly between the two firms.

Firm #1's best reply

- Suppose firm #2 sets its price less than or equal to monopoly price p_M but greater than MC.
- Then firm #1's best reply is to set p_1 slightly below p_2.
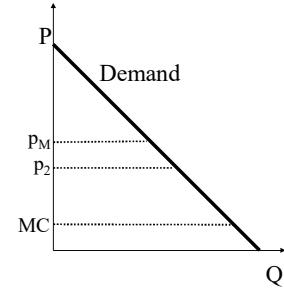
Firm #2's best reply

- Firm #2's best reply is symmetric.
- Firm #2's best reply is to set p_2 slightly below p_1.
- But not below MC, for then Firm #2 would make losses.
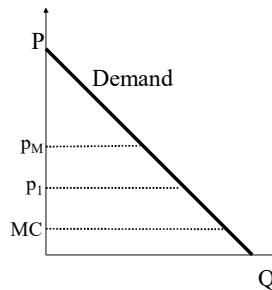
Equilibrium in the Bertrand model

- Equilibrium occurs when both firms set price equal to marginal cost: $p_1 = p_2 = MC$.
- Neither firm wants to lower price further, for then they will make losses.
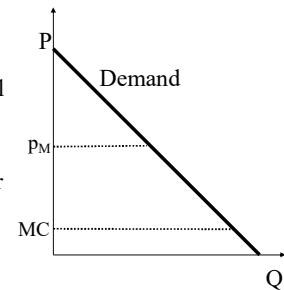
COURNOT DUOPOLY
Page 2

Example 1

Suppose
- Two firms in market: #1 and #2.
- Market demand is $P = 8 - (Q/50)$.
- $MC_1 = MC_2 = \$2$.

Demand
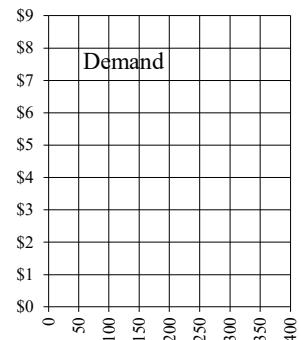
Example 1: monopoly outcome

It is easy to show that if the market were a monopoly,
- $Q_M =$ _____.
- $P_M = \$$ _____.

Demand

Example 1: Firm #1's best reply

- In Bertrand model, suppose firm #2 sets price p_2.
- Then firm #1's best reply is to set p_1 slightly below p_2.
- But never below MC or above monopoly price $P_M = \$5$.

—Firm #1's best reply

Example 1: Firm #2's best reply

- Suppose firm #1 sets price p_1.
- Then firm #2's best reply is to set p_2 slightly below p_1.
- But never below MC or above monopoly price $P_M = \$5$.

••• Firm #2's best reply

Example 1: Bertrand equilibrium

- Each firm undercuts the other's price slightly.
- Equilibrium occurs when both firms set price equal to marginal cost: $p_1 = p_2 = \$2$.

—Firm #1's best reply
••• Firm #2's best reply

Example 1: Bertrand outcome

- Equilibrium p=MC.
- Bertrand model predicts _____ outcome as competition, even with only 2 firms.

Demand

COURNOT DUOPOLY
Page 3

Is the Bertrand model realistic?

- Bertrand model assumes homogeneous product—outputs of firms are _____ substitutes for consumers.
- Consumers all buy from the cheapest firm, even if the price difference $|p_1 - p_2|$ is very _____ .

Bertrand model with differentiated products

- Bertrand model can be adapted to case of _____ substitutes, where not all consumers buy from the cheapest firm.
- Each firm has its own demand equation:
$$q_1 = q_1(p_1, p_2) \qquad q_2 = q_2(p_2, p_1)$$

- Again, each firm chooses its price, taking the other firm's _____ as given.

Example 2

- Suppose we have demand functions:
$$q_1 = q_1(p_1, p_2) = 110 - 20\,p_1 + 10\,p_2$$
$$q_2 = q_2(p_2, p_1) = 110 - 20\,p_2 + 10\,p_1$$
- Suppose $MC_1 = AC_1 = MC_2 = AC_2 = \$2$.
- Then firm #1's profit = $profit_1 = (p_1 - 2)\,q_1$

$$= $$
$$= \underline{\hspace{5cm}} .$$

Example 2: Firm #1's best reply function

- To maximize profit, set derivative with respect to p_1 equal to zero, holding p_2 constant:
$$0 = \frac{\partial\, profit_1}{\partial\, p_1} = 150 - 40p_1 + 10p_2$$

Example 2: Firm #1's best reply

- Solve to get best reply function:
$$p_1 = \frac{15 + p_2}{4}$$

Example 2: Firm #2's best reply

- Similarly, maximize firm #2's profit.
- Solve to get best reply function:
$$p_2 = \frac{15 + p_1}{4}$$

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COURNOT DUOPOLY
Page 4

Example 2: Bertrand equilibrium with differentiated products

- Solve best reply functions together to find equilibrium.
- This example is symmetric, so both firms set
$p_1 = p_2 = \$$_____,
greater than MC.
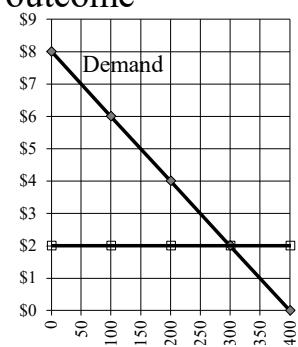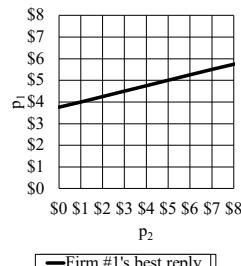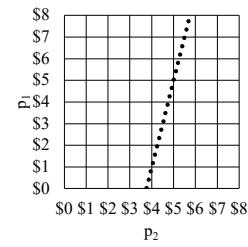
—Firm #1's best reply
••• Firm #2's best reply

Example 2: Bertrand equilibrium with differentiated products
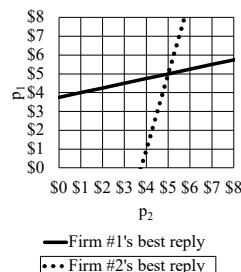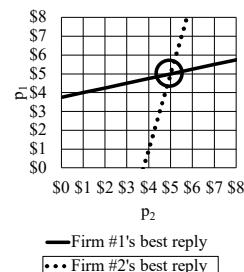
- Solve best reply functions together to find equilibrium.
- This example is symmetric, so both firms set
$p_1 = p_2 = \$$___5___,
greater than MC.

—Firm #1's best reply
••• Firm #2's best reply

Conclusions

- The *Bertrand duopoly model* consists of two firms that each take the other's _____ as given.
- Equilibrium is found by simultaneously solving both firms' _____ *functions.*
- If output is homogeneous, both firms set price _____ MC in equilibrium.
- If output is not homogeneous, both firms set price _____ MC in equilibrium.

JOINT PROFIT MAXIMIZATION (COLLUSION)
Page 1

JOINT PROFIT
MAXIMIZATION
(COLLUSION)

- What happens if firms collude to maximize the sum of their profits?

What is joint profit maximization?

- An oligopoly model in which all firms in an industry collude (cooperate) to maximize the *sum* of their profits, as if they were one big monopoly.
- Rough synonyms:
  - *collusion* = _____
  - *cartel* = _____

Profit maximization requires cost minimization

Profit maximization has two steps.

(1) Choose the right level of total output Q* to maximize profit.

(2) Allocate output across firms to minimize

_____ .

How should output be allocated across firms to minimize total costs?

- Suppose target output is $Q^* = q_1 + q_2$.
- How to allocate q_1 and q_2?
- That is, how much should each firm produce?

Output should be allocated so that marginal costs are _____

- Let $TC_1(q_1)$ = total cost of first firm, $TC_2(q_2)$ = total cost of second firm.
- Let $Q = q_1 + q_2$ = target total output.
  - Then $q_2 = Q - q_1$.
- Must minimize: $TC_1(q_1) + TC_2(Q-q_1)$
- Set derivative (w.r.t. q_1) equal to 0:
  - $0 =$

Joint marginal cost

- Only when $MC_1 = MC_2$ are total costs minimized.
- Now suppose total output Q is increased while keeping $MC_1 = MC_2$.
- Curve relating Q and MCs is called the

_____ curve.

JOINT PROFIT MAXIMIZATION (COLLUSION)
Page 2

Graphically, joint marginal cost = horizontal sum of individual firms' MCs

$MC_J \approx$ supply curve

- Graph of MC_J is same as competitive supply curve.
- But interpretation is different: colluders do _____ take price as given!
- Instead, they collude to *raise* price _____ the MC_J curve.

Cartel

Step (1) Choose total output Q*

- Firms maximize sum of their profits by setting MR = MC_J.
- Because P* > MC_J, there is deadweight loss.

Step (2) Allocate output across firms so that MCs are equal

Lerner index in JPM is same as in monopoly

- Definition of Lerner index = (P-MC)/ P.
- Joint profit maximization uses the same pricing rule as a monopolist: $P = \dfrac{MC_J}{1+\frac{1}{\varepsilon}}$.
- So Lerner index is same:

  Lerner index =

Conclusions

- Under *joint profit maximization*, firms act as one big monopoly and maximize the _____ of their profits.
- This requires that marginal costs be _____ across firms and that joint MC = market MR.
- Just like a monopoly, P > MC for every firm and Lerner index = _____ .

CARTELS IN THE REAL WORLD
Page 1

CARTELS IN THE REAL WORLD

- How do real cartels operate?
- What makes them successful?

How common are cartels?

- Economists used to think that cartels were _____ .
- But recently, enforcement of laws against cartels has become more effective—in the U.S., the E.U. and elsewhere.
- More cartels have been detected.

Levenstein, M.C. and Suslow, V.Y., (2006) "What Determines Cartel Success?" *Journal of Economic Literature,* Vol. 44, No. 1, pp. 43-95.

Annual Cartel Detections by the US DOJ Peaked in 2005-07

Connor, John M., "Cartels Portrayed: Detection, a 21-Year Perspective, 1990 to 2010, AAI Working Paper No. 11-05, 2011.

Rates of Discovery of All Cartels Are Rising over Time

Connor, John M., "Cartels Portrayed: Detection, a 21-Year Perspective, 1990 to 2010, AAI Working Paper No. 11-05, 2011.

International public cartels—members are countries, not firms

- Organization of Petroleum Exporting Countries (OPEC).
- International Coffee Organization.
- International Tripartite Rubber Organization (Thailand, Indonesia and Malaysia).

Traditional view is that public cartels are _____ subject to antitrust law.

Real cartels are not perfect

- Real cartels usually do _____ share profits, so each member firm wants largest possible market share, even if it has higher cost than other members.
- So real cartels cannot maximize profit—price is usually less than monopoly price, and output is not allocated to minimize total cost.
- But real cartels are usually successful in raising price _____ competitive price.

CARTELS IN THE REAL WORLD
Page 2

Tasks of a real cartel

1. Agree on target price.
2. Agree on output allocation or market shares. Often agree to maintain market shares held before the cartel.
3. Enforce agreement. Find some way to monitor member firms' prices or quantities and punish firms that cheat.

How long do cartels last?

- Economists used to think that cartels collapsed quickly from cheating.
- However, a recent study found
  - Median duration = _____ months.
  - Mean duration = _____ months.
  - These are underestimates according to author.

Connor, John M., "Cartels Portrayed: Cartel Structures, a 21-Year Perspective, 1990 to 2010, AAI Working Paper No. 11-04, 2011.

Threats to cartel stability

- Members might cheat—that is, violate agreement by decreasing price and increasing market share.
- New firms might enter industry. They must be brought into cartel—if not, cartel might collapse.
- Market demand might shift. Changes in demand require changes in price and output allocations.

Cartels are more successful…the _____ the number of member firms.

- Reason: If there are too many members, their behavior is more difficult to monitor.
- Also, each firm's individual profit from cartel may be only slightly higher than its profit from cheating.
- In fact, most cartels have had fewer than 10 members, though some have had more.

Levenstein, M.C. and Suslow, V.Y., (2006) "What Determines Cartel Success?" *Journal of Economic Literature,* Vol. 44, No. 1, pp. 43-95.

Number of Companies per Cartel: Worldwide, 1990-2010

628 cartels

Connor, John M., "Cartels Portrayed: Cartel Structures, a 21-Year Perspective, 1990 to 2010, AAI Working Paper No. 11-04, 2011.

Cartels are more successful…the more _____ is entry.

- Reason: Nonmembers will want to enter market when price is raised. Increased supply will undermine cartel.
- Example: After OPEC successfully raised price of oil in 1970s, many more countries began to explore for oil. For example, Ecuador changed from importing oil to exporting oil.
- Example: In 1990s, cartels for vitamin C and citric acid (food additives) were undermined by expansion of nonmembers.

CARTELS IN THE REAL WORLD
Page 3

Cartels are more successful…the more _____ the product.

- *Homogeneous product* = all firms produce same product.
- Reason: If member firms produce same product, it is easier to agree on price and monitor prices.
- Example: Suppose computer makers formed a cartel. Products are not homogeneous—computers are big or small, fast or slow, etc. Setting cartel prices would be complicated!

Cartels are more successful…the more _____ are members' prices.

- Reason: If prices are easier to see, then it is easier to coordinate prices and monitor compliance.
- Example: In early 1990s, U.S. airlines set prices (fares) through a common computer system. System allowed airlines to submit prices before they were available to customers.
- If one airline submitted a price increase, others could follow. If they did not follow, first airline could withdraw its price increase.

Cartels are more successful…the more _____ is demand.

- Reason: If market demand decreases, then cartel members will each sell fewer units.
- Some members might suspect that other members are secretly stealing their business.
- Others might decide to cheat because they are making losses.
- Example: A German cement cartel collapsed in 2002 because of decreasing demand.

Viscusi, W.K., Harrington, J.E. and Sappington, D.E.M., *Economics of Regulation and Antitrust, 5th edition,* MIT Press, 2018, pp. 145-146.

Cartels are more successful…the smaller and more numerous are _____.

- Reason: Big buyers may exert pressure for lower prices.
- Example: A cartel for electrical equipment, including circuit breakers, existed in the 1950s.
- Cartel collapsed when Florida Power & Light Company obtained a low price from Westinghouse, below the cartel price, for a large order of circuit breakers.

Viscusi, W.K., Harrington, J.E. and Sappington, D.E.M., *Economics of Regulation and Antitrust, 5th edition,* MIT Press, 2018, pp. 144-145.

Number of buyers

A recent study found
- _____ cartels with > 100 buyers.
- _____ cartels with ≤ 30 buyers.
- _____ cartels with 31-99 buyers or unknown number of buyers.

Connor, John M., "Cartels Portrayed: Cartel Structures, a 21-Year Perspective, 1990 to 2010, AAI Working Paper No. 11-04, 2011. See note to slide 14.

Beyond price and quantity

Real cartels sometimes make other kinds of agreements to limit competition.
- Agreements not to advertise.
- Agreements to divide sales territory.
- Agreements to standardize quality or pricing, to make it easier to enforce cartel pricing.

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CARTELS IN THE REAL WORLD
Page 4

What is tacit collusion?

- *Tacit collusion* = collusion _____ an oral or written agreement.
- Also called "conscious parallelism": when one firm raises price, the other does also.
- Difficult for courts or policymakers to deal with, because same behavior might occur with competition or oligopoly.
- Tacit collusion is less likely to be found illegal.

Matsushita Electric Industrial Co., Ltd. v. Zenith Radio Corp, 475 U.S. 574 (1986).

Practices that facilitate cartels

- "Most favored customer" clauses, to make selective price-cutting more costly.
- Long-term customer contracts.
- Advanced announcements of price changes. (example: airlines).

But these practices sometimes have efficiency justifications.

Conclusions

- Cartels are not unusual in the real world.
- Real cartels raise price, but usually not to the monopoly level.
- Cartels are more successful, the _____ the member firms, the more _____ is entry, and the more _____ is demand.
- Tacit collusion or "conscious parallelism" also occurs.

CHEATING IN A CARTEL
Page 1

CHEATING IN A CARTEL

• Why do cartel members have an incentive to cheat?

• How can a cartel prevent cheating?

Individual firm's marginal revenue

• When firm #2 sells one more unit, revenue rises by price of that unit: P*.

• However, selling another unit drives price _____, so revenue also falls by $q_2 \times (\Delta P / \Delta Q)$.

Market demand

Firm's demand

$\Delta P < 0$

P*

Rivals' quantity

q_1　q_2　1

Interdependence between firms

• But firm #1's revenue also _____ because price goes down.

• In an effective cartel, each firm considers effect of its actions on other firms.

• In a weak cartel, each firm considers only its own profit.

Market demand

Firm's demand

$\Delta P < 0$

P*

q_1　q_2　1

Cartel's *MR* versus individual firm's MR_i

• Suppose firm #i increases its output by one unit.

• Revenue of the cartel changes by this much:
$$MR = \frac{dTR}{dQ} = \frac{d}{dQ}\left(Q \cdot P(Q)\right) = P + Q\frac{dP}{dQ}$$

• But revenue of firm #i changes by this much:
$$MR_i = \frac{dTR_i}{dq_i} = \frac{d}{dq_i}\left(q_i \cdot P(Q)\right) = P + q_i\frac{dP}{dQ}$$
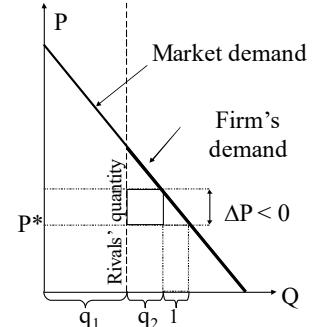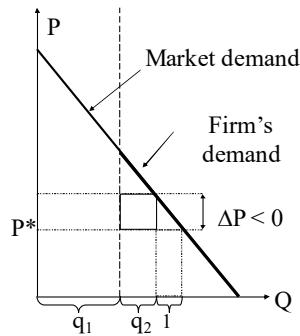
• Which is larger, MR or MR_i ?

Cartel's *MR* versus individual firm's MR_i: example

• Suppose market demand is P = 10 – (Q/20).

• So cartel's MR is MR = 10 – (Q/10).

• If MC = $2, then Q = _____, P = $_____.

$10
$9
$8
$7
$6
$5
$4
$3
$2
$1
$0
0 10 20 30 40 50 60 70 80 90 100

◆Demand ■Cartel MR ▲MC
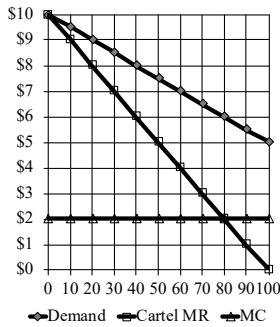
Cartel's *MR* versus individual firm's MR_i: example (cont'd)

• At Q=80, cartel's MR = P – Q ($\Delta P / \Delta Q$) = 6 – 80 (1/20) = $___ .

• But suppose Acme Mfg. has q=10.

• Then Acme's MR_i = P – q ($\Delta P / \Delta Q$) = 6 – 10 (1/20) = $_____ .

$10
$9
$8
$7
$6
$5
$4
$3
$2
$1
$0
0 10 20 30 40 50 60 70 80 90 100

◆Demand ■Cartel MR ▲MC
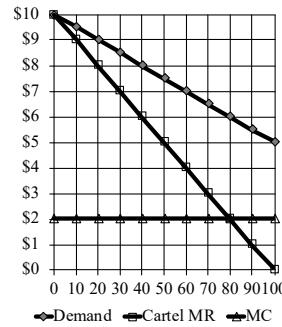
CHEATING IN A CARTEL
Page 2

Incentives to cheat

- When the *cartel's* MR = MC, every individual *firm's* MR_i > MC.
- Any individual firm can increase its *own* profit by producing _____ than its allocated quantity.

Consequences of cheating

- But by producing more output, it will drive _____ price.
- This will decrease other cartel members' profits by more than it increases its own profits.
- Cheating is good for the firm but _____ for the cartel!
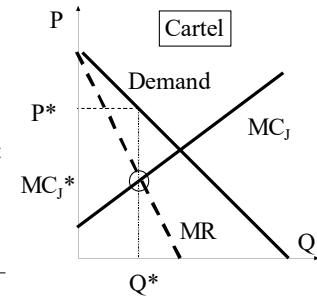
Example: duopoly

- Suppose $P = 8 - (Q/50)$ and $AC_1 = AC_2 = MC_1 = MC_2 = \$2$.
- It is easy to show that if firms collude and each produce 75 units, price is \$5 and each enjoys profit of \$_____.
- In another slideshow, we showed that if firms act as a Cournot oligopoly, each produces 100 units, price is \$4, and each enjoys profit of \$_____.

Example: consequences of cheating

- Suppose firm #1 produces 75 units and firm #2 cheats on the cartel and produces 100 units (the Cournot quantity).
- Then total output increases a little to _____. and price falls a little to \$_____.
- Firm #1 enjoys profit of \$_____.
- Firm #2 enjoys profit of \$_____.

Example: cheating as a game

- Obviously, firms can choose from many different quantities of output.
- But let's consider just these two output levels as alternative strategies and write the game in strategic (or normal) form.

Example in strategic form

CHEATING IN A CARTEL
Page 3

Example: Nash equilibrium

- Suppose each firm initially abides by the cartel and produces 75 units.
- Note that each firm's best reply is to cheat.
- The Nash equilibrium of this game is for _____ to cheat.
- But if both firms cheat, both are worse off.

Enforcing a cartel

- Each cartel member has strong incentive to cheat and produce too much.
- Joint profit-maximizing agreements therefore tend to fall apart, unless they find a mechanism to keep discipline.
- Most effective mechanisms:

Can a cartel police itself?

- Consider a cartel that *continues over time*.
- Suppose each firm can choose a "strategy" where its output in any period depends on output of other firm in previous periods.
- Then it might be possible for cartel to maintain collusion without merger or government help.

A "trigger strategy"

- Suppose firm #1 chooses the following strategy: "Produce 75 units unless firm #2 cheated in the last period, in which case produce 100 units every period forever."
- Any cheating by firm #2 will thus _____ end of cartel.
- What is firm #2's best reply to this strategy?

Cheating against a trigger strategy

- Firm #2 could cheat and produce 100 units.
- But cartel would collapse and thereafter firm #2 would need to produce 100 units.
- Profit = $_____ in first period, $_____ thereafter.
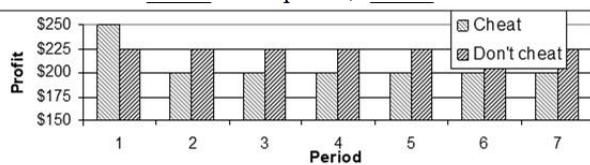
Best reply to a trigger strategy

- If firm #2 cares about future profit, its best reply to a trigger strategy is to produce _____ units forever.
- Another reply just as good is for firm #2 to mimic firm #1's trigger strategy.
- In fact, if both firms play trigger strategies, the result is a _____ equilibrium!

CHEATING IN A CARTEL
Page 4

More than one Nash equilibrium

- Of course, trigger strategies are not the only Nash equilibria.
- Another Nash equilibrium is for both firms to choose Cournot quantities forever, but this results in lower total profit.
- Choosing the *profit-maximizing* equilibrium requires communication and coordination.

Methods of coordination

- Explicit collusion:
  - Meetings.
  - Written or oral agreements.
- Tacit collusion
  - Geographic market division.
  - Price leadership (airlines).
  - Special pricing rules ("basing point pricing" in steel, 1/4 quotes in NASDAQ).

Occasional cartel breakdowns

- Difficult for cartel members to detect cheating in real world.
- Prices might decrease from random fluctuation in demand, even if no one is cheating.
- "Trigger" could be pulled by mistake.
- Trigger strategies might have to be modified to return to collusion after a few periods of Cournot output ("price wars").

Railroad price wars 1880-86

Robert H. Porter, "A Study of Cartel Stability: The Joint Executive Committee, 1880-1886," *Bell Journal of Economics*, Vol. 14, No. 2 (Autumn 1983), pp. 301-314.
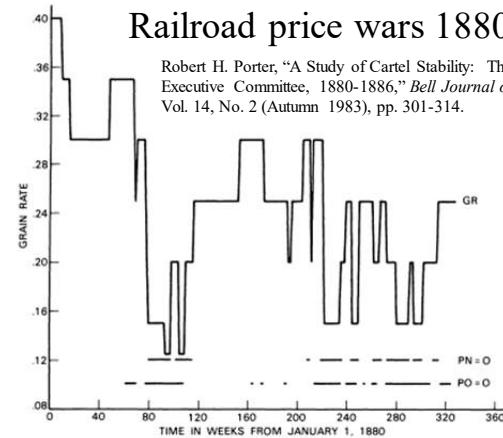
Conclusions

- Every member of a cartel has an incentive to cheat and produce _____ than its allocated quantity.
- Cartel discipline might be maintained by merger, government enforcement, or perhaps by the cartel itself through _____ strategies.
- Even if such strategies are used, a cartel requires communication and coordination.

ANTITRUST LAW ON PRICE FIXING
Page 1

ANTITRUST LAW ON PRICE-FIXING

• How have the courts treated price-fixing (cartels)?

Adam Smith (1776) on collusion

"People of the same trade seldom meet together, even for merriment and 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."

The Wealth of Nations, New York: Modern Library, 1937, Book I, Chapter X, p. 128.

Sherman Act Section 1

• "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…"

https://www.law.cornell.edu/uscode/text/15/1

"Per se" rule versus "rule of reason"

• U.S. Courts have held that some practices are *per se* (Latin: "in itself," always) illegal under antitrust laws.
• Other practices *might* be illegal, depending on the purpose and effect. For these practices, the "rule of reason" is used to determine legality.

Practices may have multiple effects

• Suppose in a competitive market, price = P_0 = AC_0.
• Suppose a certain practice (e.g., a merger) increases market power, raising price from P_0 to P_1.
• But it also lowers cost from AC_0 to AC_1.
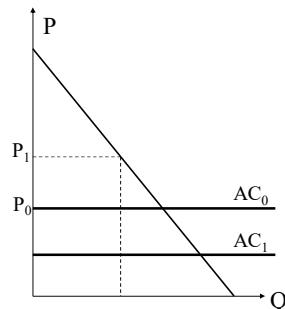
Welfare tradeoffs

• Thus this practice creates both
  • deadweight loss
  • and cost savings.
• Antitrust policy should weigh these against each other.
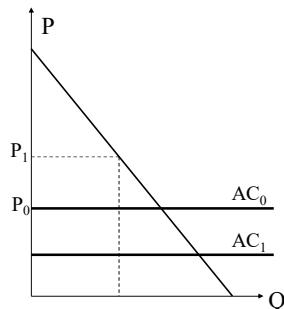
ANTITRUST LAW ON PRICE FIXING
Page 2

Price fixing is *per se* illegal

- Practices which are unlikely to have any beneficial effects (such as cost savings) are often held by courts to be *per se* illegal.
- Price fixing is best example—it only creates deadweight loss.
- Here are some important cases establishing that price fixing is *per se* illegal.

U.S. v. Addyston Pipe & Steel Co. (1899)

- Six manufacturers of cast iron pipe divided up U.S. cities and rigged bids.
- Court of Appeals decided the practice was *per se* illegal under Sherman Act, regardless of the "reasonableness" of resulting prices.
- Upheld by Supreme Court.

United States v. Trenton Potteries Co. et al. (1927)

- 23 manufacturers of vitreous pottery fixtures (bathroom bowls, tubs, etc.), having 82% of the market, belonged to an association that attempted to fix prices.
- Supreme Court again ruled that this practice was *per se* illegal, that government did not have to show prices were unreasonable.

Anomaly: Appalachian Coals Inc. v. U.S. (1933)

- Company created to act as joint selling agency for 137 coal producers, having 54% of market in Appalachian region.
- District court found the company in violation of Sherman Act in 1932.
- But, strangely, reversed by Supreme Court, probably influenced by Great Depression.
- Strange decision, hard to understand today!

Appalachian Coals, Inc. v. U.S., 288 U.S. 344, 360 (1933).

U.S. v. Socony-Vacuum Oil Co. et al. (1940)

- Major oil refiners agreed to purchase surplus gasoline of independent refiners to keep price up.
- Found guilty by district court.
- Sustained by Supreme Court, which reiterated that "price-fixing agreements are unlawful *per se* under the Sherman Act."

U.S. v. Socony-Vacuum Oil Co. et al., 310 U.S. 150, 218 (1940).

Other industries

- Sherman Act applied to professions (doctors, lawyers, etc.) since Goldfarb v. Virginia State Bar (1975).
- "Rule of reason" used for collegiate sports since NCAA v. University of Oklahoma et al. (1984).

ANTITRUST LAW ON PRICE FIXING
Page 3

What counts as a "price-fixing agreement"?

- "No formal agreement is necessary"* but there must be evidence of communication.
  - Interstate Circuit, Inc. et al. v. U.S. (1939).
  - *American Tobacco Co. et al. v. U.S. (1946).
  - U.S. v. Paramount Pictures, Inc. (1948).
- Conscious parallelism (parallel behavior without communication) is not a violation.
  - Theatre Enterprises, Inc. v. Paramount Film Distributing Corp. (1954).

Penalties for price-fixing

- If Department of Justice prosecutes, then penalties can include fines and prison.
- Conviction typically followed by private suits by injured parties to collect damages.
- Clayton Act Section 4 entitles injured parties to collect _____ (×3) damages.

Why treble damages?

- One rationale might be that only a fraction of violators are actually caught.
- To maintain deterrent, must inflate damages.

How damages are typically computed

- Let P_C = price set by collusion.
- Let Q_C = quantity sold with collusion
- Let P^* = "but for" price—that is, the price likely charged without collusion.
- $P_C - P^*$ = "overcharge."
- $(P_C - P^*) \, Q_C$ = typical formula for damages.

Damages are greater than collusive profits, but less than loss of consumer surplus

- Damages = [ ]
- Profit from collusion = [ ] − [ ]
- Loss to consumers from collusion = [ ] + ◺
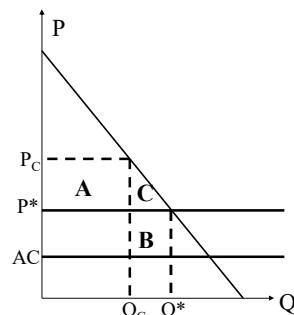
Changes in fines

- Fines used to be very small. Average in all antitrust cases was $368,000 in 1980s.
- Now much larger. Average in all antitrust cases was $4.75 _____ in 1990s.
- Revision of sentencing guidelines in 1991 allowed much higher fines.
- Many recent fines in 100s of millions of dollars!

ANTITRUST LAW ON PRICE FIXING
Page 4

The corporate leniency program

- DOJ began program in 1978 giving lenient treatment to corporations and individuals who fully cooperate with investigation.
- Cooperators avoid criminal prosecution and fines, but not private lawsuits.
- Few applications—about one per *year*.
- Reason: corporations wary because leniency not granted if DOJ could have "reasonably expected" to learn of cartel through other sources.

1993 revised corporate leniency program

- Requires only that DOJ "has not received information about the illegal activity being reported from any other source."
- DOJ may even grant leniency *after* investigation has started.
- Only _____ firm per cartel granted leniency.
- Big increase in applications—more than one per *month*. "Race to courthouse."

https://www.justice.gov/atr/leniency-policy

Defendant	Product	Fine (Million $)
Archer Daniels Midland	Lysine & Citric Acid	$100
Haarmann & Reimer Corp.	Citric Acid	$50
HeereMac v.o.f.	Marine Construction	$49
Showa Denko Carbon, Inc.	Graphite Electrodes	$29
Fujisawa Pharmaceuticals	Sodium Gluconate	$20
Dockwise N.V.	Marine Transportation	$15
F. Hoffmann- LaRoche, Ltd.	Citric Acid	$14
Jungbunzlauer International	Citric Acid	$11
Akzo Nobel Chemicals, BV & Glucona, BV	Sodium Gluconate	$10
ICI Explosives	Explosives	$10
Dyno Nobel	Explosives	$10
Mrs. Baird's Bakeries	Bread	$10
Ajinomoto Co.	Lysine	$10
Kyowa Hakko Kogyo, Ltd.	Lysine	$10

SOURCE: Gary R. Spratling, "Are the recent titanic fines in antitrust cases just the tip of the iceberg?" March 6, 1998, https://www.justice.gov/atr/speech/are-recent-titanic-fines-antitrust-cases-just-tip-iceberg

Success

- In recent years, DOJ has focused on large international cartels.
- To coordinate prosecutions, U.S. has encouraged other countries to adopt similar leniency programs.
- European countries, the EU, Canada, and other countries have already adopted programs.
- Example: P&G and Unilever fined $450 million by EU in 2011 for operating a laundry detergent cartel (Henkel AG cooperated and was not fined).

Conclusions

- Overt price fixing is _____ illegal in the U.S.
- Tacit collusion is sometimes illegal.
- Penalties may include fines, imprisonment, and _____ damages to injured parties.
- Recent changes to sentencing guidelines have increased fines.
- Recent changes to DOJ's corporate leniency program have increased prosecutions.

MEASURES OF INDUSTRY CONCENTRATION
Page 1

MEASURES OF INDUSTRY CONCENTRATION

- What is industry concentration?
- How is it measured?
- Why are some markets more concentrated than others?

Industry concentration: definition

- *An industry is* concentrated *if one or a few firms have large market shares.*

Concentrated industry
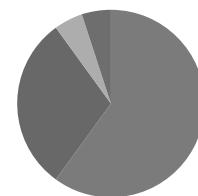
Unconcentrated industry
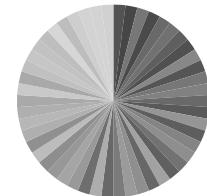
Why industry concentration matters

- If an industry has just a few large firms, they may start to behave less like competitors and more like a Cournot oligopoly or a tacit cartel.
- If an industry has one relatively large firm, it may start to behave like a monopoly.

Why industry concentration matters (cont'd)

- A concentrated industry is likely to raise price _____ MC and create DWL.
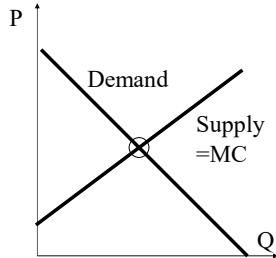
Concentration ratios

- *Concentration ratio* is the total market share of the top firms.
- U.S. Bureau of the Census reports
  - 4-firm concentration ratio = total market share of top 4 firms.
  - 8-firm concentration ratios = total market share of top 8 firms.
  - Also 20-firm and 50-firm concentration ratios.

Examples of concentration ratios in U.S. manufacturing (2022)

Industry	4CR	8CR
Automobiles & light duty vehicles		
Breakfast cereals		
Petroleum refineries		
Apparel		

Source: U.S. Census Bureau. "Selected Sectors: Concentration of Largest Firms for the U.S.: 2022" Economic Census.

MEASURES OF INDUSTRY CONCENTRATION
Page 2

Limitations of concentration ratios

- *n*-firm concentration ratios reveal nothing about concentration *within* the top *n* firms.

- Example 1: Suppose industries A and B each have 6 firms:
  A: 4 with 20% shares, 2 with 10% share.
  B: 1 with 50% share, 5 with 10% shares.

Example 1: Limitations of concentration ratios

- Thus, A's 4CR = B's 4CR = _____%
- But which is really more concentrated?

Industry A   Industry B
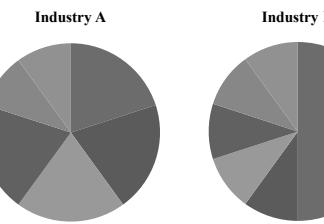
Hirschman-Herfindahl index

- An alternative concentration measure that sums the *squares* of the market shares in percent of *all* firms in the industry.
- Let s_i = market share. Then $100s_i$ = market share in percent.
- $HHI = (100s_1)^2 + (100s_2)^2 + \ldots + (100s_n)^2$.

Hirschman-Herfindahl index: hypothetical examples

Number of firms	HHI formula	Value
1 (monopoly)	100^2	
2 firms, same size	$50^2 + 50^2$	
10 firms, same size	$10^2 \times 10$	
n firms, same size	$(100/n)^2 \times n$	

HHI applied to example 1

- Industry A: HHI =
  $20^2 + 20^2 + 20^2 + 20^2 + 10^2 + 10^2 =$ _____
- Industry B: HHI =
  $50^2 + 10^2 + 10^2 + 10^2 + 10^2 + 10^2 =$ _____
- Which industry is more concentrated according to the HHI? _____
- HHI gives extra weight to large firms.

HHI often computed neglecting small firms

- In U.S. Census publications, HHI is computed using only top 50 firms.
- The error is very small, because…
  - If a firm has less than 1% market share, it contributes less than _____ to the HHI.
  - If a firm has less than 0.1 % market share, it contributes less than _____ to the HHI.

MEASURES OF INDUSTRY CONCENTRATION
Page 3

Examples of HHIs in U.S. manufacturing (2022)

Industry	HHI
Automobiles & light duty vehicles	1185.8
Breakfast cereals	2332.5
Petroleum refineries	853.2
Apparel	31.6

Source: U.S. Census Bureau. "Selected Sectors: Concentration of Largest Firms for the U.S.: 2022" Economic Census.

Lerner index and HHI

- Suppose an industry has n firms of varying sizes.
- Each firm has its own Lerner index, or price-cost margin: $L_i = (P - MC_i)/P$.

Lerner index and HHI (cont'd)

- What is the *industry* Lerner index (L)?
- A weighted average of Lerner indexes for all firms, where weights = market shares s_i.
- Industry Lerner index =
  $L = s_1 L_1 + s_2 L_2 + s_3 L_3 + \ldots + s_n L_n$.

Lerner index and HHI (cont'd)

- If Cournot model describes the industry, then $L_i = s_i / |\varepsilon|$, where ε = market elasticity of demand. So substitute:
- $L = s_1 L_1 + s_2 L_2 + s_3 L_3 + \ldots + s_n L_n$
  $= s_1^2/|\varepsilon| + s_2^2/|\varepsilon| + s_3^2/|\varepsilon| + \ldots + s_n^2/|\varepsilon|$
  $= (s_1^2 + s_2^2 + s_3^2 + \ldots + s_n^2) / |\varepsilon|$.
  $= \underline{\hspace{4cm}}$.

Lerner index and HHI (cont'd)

- If Cournot model describes the industry, then $L_i = s_i / |\varepsilon|$, where ε = market elasticity of demand. So substitute:
- $L = s_1 L_1 + s_2 L_2 + s_3 L_3 + \ldots + s_n L_n$
  $= s_1^2/|\varepsilon| + s_2^2/|\varepsilon| + s_3^2/|\varepsilon| + \ldots + s_n^2/|\varepsilon|$
  $= (s_1^2 + s_2^2 + s_3^2 + \ldots + s_n^2) / |\varepsilon|$.
  $= \underline{\quad (HHI/10{,}000) / |\varepsilon| \quad}$.

Importance of market definition

- All measures of concentration are only accurate if market is defined accurately.
- In many antitrust cases, market definition is key issue.
- If many firms are included, 4CR, 8CR, and HHI will be $\underline{\hspace{2cm}}$.
- If few firms are included, 4CR, 8CR, and HHI will be $\underline{\hspace{2cm}}$.

MEASURES OF INDUSTRY CONCENTRATION
Page 4

Market definition in the Census

- U.S. Census reports concentration by industry, not by market, and includes only production in U.S.
- Example: "Motor vehicles."
- Includes compact cars, luxury cars, sport utility vehicles, and light trucks, etc., so concentration is _____ estimated.
- Excludes imported cars, so concentration is _____ estimated.

Market definition in the Census

- U.S. Census reports concentration by industry, not by market, and includes only production in U.S.
- Example: "Motor vehicles."
- Includes compact cars, luxury cars, sport utility vehicles, and light trucks, etc., so concentration is _____under-_____ estimated.
- Excludes imported cars, so concentration is _____over-_____ estimated.

Ideal market definition

- Should recognize close substitution possibilities in consumption. Examples:
- US automobiles: _____.
- Aluminum siding: _____.
- Cable television: _____.
- Traditional landline telephones: _____.

Why are some markets more concentrated than others?

- Even with imperfect measurement, it is obvious some markets are much more concentrated than others.
- Why?

Industry	HHI
Automobiles & light duty vehicles	1185.8
Breakfast cereals	2332.5
Petroleum refineries	853.2
Apparel	31.6

Source: U.S. Census Bureau. "Selected Sectors: Concentration of Largest Firms for the U.S.: 2022" Economic Census.

Why are some markets more concentrated than others? (cont'd)

- *Differential efficiency:* Some firms are more efficient than others, and they grow large.
- *Limited room:* Scale economies or entry costs mean that industry has room for only a small number of firms.
- *Exclusion:* Incumbent firms can prevent rivals from entering.

Conclusions

- Firms in a *concentrated* industry are _____ likely to act as competitors.
- *Concentration ratios* are crude measures of concentration.
- The *Hirschman-Herfindahl Index,* a better measure, equals the sum of _____ market shares of all firms in an industry.
- In principle, market definition should include close _____.

CONCENTRATION AND PROFITS
Page 1

CONCENTRATION AND PROFITS

•Why are profits high in concentrated industries?

Concentration and profit

- Numerous studies have shown that highly concentrated industries tend to have high price-cost margins.
- Why?
1. Collusion or market power hypothesis
2. Differential efficiency hypothesis

---

(1) Collusion hypothesis

- Claims that concentration *causes* high prices.
- The more concentrated an industry, the more likely the firms in that industry are to act like a tacit _____.

Collusion hypothesis (cont'd)

- Even if they do not collude, the Cournot model predicts that the fewer the firms in an industry, the _____ the Lerner index (or price-cost margin).
  - If all firms have same MC, then $L = 1 / (n \, |\varepsilon|)$.
- If one firm has very large market share, it might act like a _____.

Implications of collusion hypothesis

- Decreasing concentration will increase economic efficiency.
- How can the government decrease concentration?

---

(2) Differential efficiency hypothesis

- Claims that concentration and high price-cost margins are *caused by* a third factor.
- In some industries, some firms have much lower marginal costs than others.
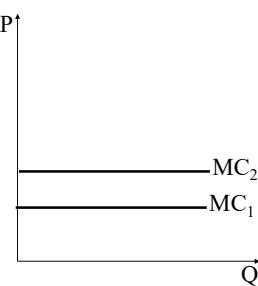
Harold Demsetz, "Industry Structure, Market Rivalry, and Public Policy," *Journal of Law and Economics*, Vol. 16, No. 1 (April 1973), pp. 1-9.

CONCENTRATION AND PROFITS
Page 2

Differential efficiency hypothesis (cont'd)

In those industries, the _____ firms grow large, causing two things:
- Increased concentration.
- Increased *average* price-cost margin, leading to high profits.

P

MC$_2$

MC$_1$

Q
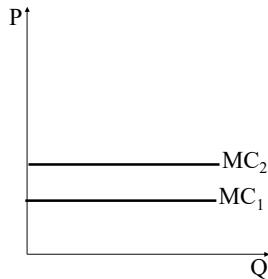
Numerical example

- Suppose Industry A and Industry B each have market demand $P = 10 - (Q/10)$.
- Each industry is served by two firms.
- Same costs in A.
- Differential costs in B.

P

$10

100   Q

Numerical example: costs

P
$10

Industry A

$4   MC$_1$=MC$_2$

100   Q

P
$10

Industry B

$5   MC$_2$
$3   MC$_1$

100   Q
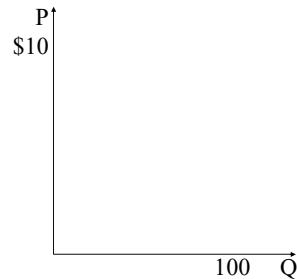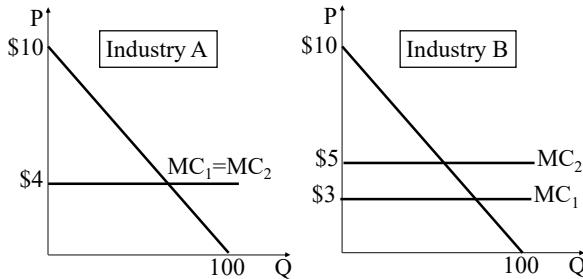
Numerical example: Cournot solutions

Industry A:
symmetric Cournot
- $q_1 = q_2 = 20$.
- $Q = $ _____, $P = $ _____.
- $L = (6-4)/6 = $ _____.
- $HHI = 50^2 + 50^2$ = _____.
- Total profit = _____.

Industry B:
asymmetric Cournot
- $q_1 = 30$, $q_2 = 10$.
- $Q = $ _____, $P = $ _____.
- $L = 0.75 (6-3)/6 + 0.25 (6-5)/6 = $ _____
- $HHI = 75^2 + 25^2$ = _____.
- Total profit = _____.

Numerical example: conclusions

- Both L and HHI are higher in industry B.
- But which industry generates more consumer + producer surplus?
  - Price is the same in both industries ($6).
  - But profit is higher in industry B .
- So industry _____ generates more surplus.

Implications of differential efficiency hypothesis

- Decreasing concentration does _____ necessarily increase economic efficiency.
- Government should _____ necessarily stop mergers (if mergers result in lower costs).
- Government should _____ subsidize small firms or new entrants.
- Government should _____ necessarily break up large firms (if this raises their costs).

CONCENTRATION AND PROFITS
Page 3

Which hypothesis is correct?

- The data generally show that often *differential costs* explain the link between concentration and price-cost margins.
- Message: we need to know _____ industries are concentrated before making policy.

Conclusions

- Why do highly-concentrated industries have higher price-cost margins?
- The _____ hypothesis says highly concentrated industries are less competitive.
- The _____ hypothesis says costs differences across firms cause both high concentration *and* high average price-cost margins.
- We need to know why industries are concentrated before making policy.

SCALE ECONOMIES
Page 1

SCALE ECONOMIES

• What are "scale economies"?

• Do they explain why some industries are highly concentrated?

Explaining concentration

• Why are some industries more concentrated than others?

• One possible explanation: in some industries, available technology favors large-scale production.

• If viable firms must be large relative to total demand, then the industry can hold only a small number of firms.

Economies of scale

• Definition: Falling average cost curve.

• The larger the plant or firm, the _____ the average cost of production.

AC = cost/output

Average cost (vertical axis), Output quantity (horizontal axis)
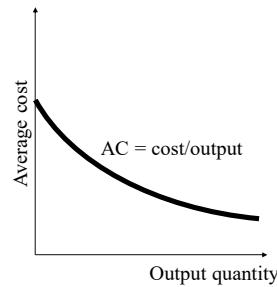
Meaning of economies of scale

• Input requirements increase more _____ than output capacity.

• So, as more is produced, total cost rises more slowly than output.

• So AC decreases.

Average cost (vertical axis), Output quantity (horizontal axis)
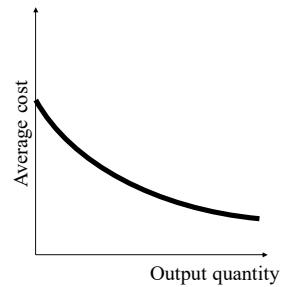
Reasons for economies of scale

Input requirements increase more slowly than output capacity in many situations.

(1) Efficiency from labor specialization.
   • Example: automobile assembly lines.

(2) Engineering factors.

(3) Quasi-fixed (up-front) costs.

(4) Minimum size plant.

---

(2) Economies of scale from engineering factors: example of pipe

• Consider a pipe for oil, gas, water, etc.

• Area of cross section determines output (capacity).

• Circumference determines input (metal) required to make pipe.

• What must happen to input for output to double?

Only increases by factor of

SCALE ECONOMIES
Page 2

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(2) Economies of scale from engineering factors: example of container

- Consider a container (e.g., a box).
- Volume determines output (capacity).
- Surface area determines input (metal) required to make box.
- What must happen to input for output to double?

Only increases by factor of

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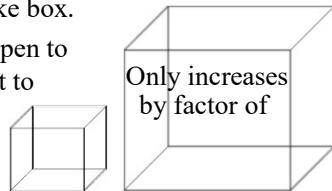
(3) Economies of scale from quasi-fixed costs: example of software

Suppose it costs
- $100 million to develop program.
- $5 per copy to send to customers.

Then AC =

Avg cost

$120
$110
$100
$90
$80
$70
$60
$50
$40
$30
$20
$10
$0

0   20   40   60   80   100
Millions of copies

---
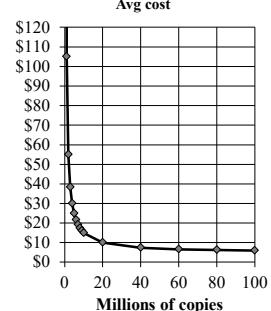
(4) Economies of scale from minimum size plant

Minimum efficient scale (MES) = lowest quantity of output at which minimum average cost is attained.

Average cost

min AC

Minimum efficient scale

Output quantity
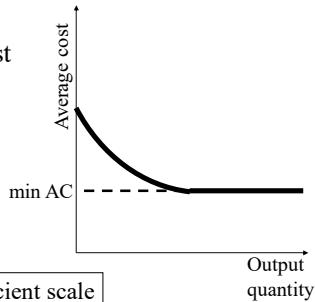
Diseconomies of scale

- Definition: Rising average cost curve.
- Input requirements increase _____ than output capacity.
- The larger the plant or firm, the _____ the average cost of production.

Average cost

Output quantity
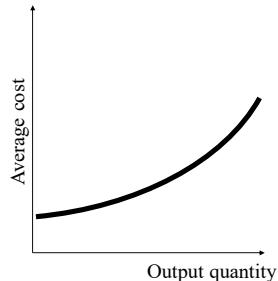
Reasons for diseconomies of scale

(1) Difficulty controlling a large organization.
- Each supervisor has limited "span of control."

---

(1) Diseconomies of scale from "span of control" problems: example

- Suppose every six production workers must have a supervisor, and the organization must have an overall boss.
- Six workers require 1 manager.
- Twelve workers require _____ managers.

Manager

Manager   Manager   Manager
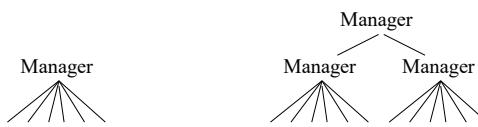
SCALE ECONOMIES
Page 3

Plant versus firm

- Many firms have more than one plant.
- Economies of scale can occur at the firm level or the plant level or both.
- The engineering factors might explain _____-level economies of scale.
- The "loss of control" problem might explain _____-level diseconomies of scale.

Firm economies of scale without plant economies of scale?

- Many firms have multiple plants.
- In some industries it might be the case that the more plants you operate, the more efficient you are at operating each one.

Economies of scale in fact

- Scherer and co-authors* interviewed industry experts to estimate the minimum efficient scale plant and firm in a variety of industries.
- Then compared these estimates to the total market, to see if economies of scale explain concentration.

* Scherer, Beckenstein, Kaufer, and Murphy, *The Economics of Multi-Plant Operations*, Cambridge: Harvard Univ. Press, 1975.

Do scale economies explain concentration?

Industry	MES plant as % of market	MES firm as % of market	4CR
Beer brewing	3.4	10-14	40
Petroleum refining	1.9	4-6	33
Cement	1.7	2	29
Steel works	2.6	3	48
Refrigerators and freezers	14.1	14-20	73

* Scherer, Beckenstein, Kaufer, and Murphy, *The Economics of Multi-Plant Operations*, Cambridge: Harvard Univ. Press, 1975.

Conclusions

- Economies of scale are savings from large-scale operation.
- Economies of scale imply a _____- sloping average cost curve .
- Diseconomies of scale imply an _____- sloping average cost curve.
- But economies of scale do not explain concentration in most industries.

ENTRY COSTS AND EQUILIBRIUM ENTRY
Page 1

ENTRY COSTS AND EQUILIBRIUM ENTRY

• What are "entry costs"?

• Do they explain why some industries are highly concentrated?

Explaining concentration

• Why are some industries more concentrated than others?

• Another possible explanation: in some industries, entry may not be free.

• Firms will enter this industry *only if* they expect sufficient future economic profit to pay for costs of entry.

Willingness-to-pay for entry

• Q: How much would investors be willing to pay to enter an industry?

• A: Present discounted value of expected profit.

• Note: Under price competition, if MC=AC, then profits are always zero. But other market structures yield positive profits.

Present discounted value of profit

• Let π denote annual profit of each firm in industry, which is expected to continue indefinitely into the future.

• Then present discounted value of expected profit = _____.

• Example: If $\pi = \$1,000$ and $r = 5\%$, then $\pi/r = \$$_____.

Profit per firm and the number of firms (n)

• In several models we have studied, n has a _____ effect on π, the profit of each firm.

• As more firms enter industry, price and profit are driven down. Examples:

π negatively related to n

• Suppose for some industry that π is in fact negatively related to n.

• Then $\pi(n)/r$ will also be negatively related to n, for given r.

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ENTRY COSTS AND EQUILIBRIUM ENTRY
Page 2

"Demand for entry"

- Now $\pi(n)/r$ = amount that nth firm is willing to pay to gain entry to the industry.
- So $\pi(n)/r$ = "demand" curve for entry into the industry.

Monopoly profit = $\pi(1)/r$

$\pi(n)/r$

$ per firm

1 2 3 4 5 6 7
n = number of firms

Cost of entry

- Almost every industry has some cost of initial entry. Examples:

- In some industries, the cost of entry is large.

"Supply of entry"

- Let EC = entry cost for each firm.
- Assume it is constant, unrelated to number of firms already in the industry.

$ per firm

EC

1 2 3 4 5 6 7
n = number of firms

How number of firms is determined

- Entry occurs as long as $\pi(n)/r$ greater than or equal to EC.
- In this graph, the equilibrium number of firms is _____.

Monopoly profit = $\pi(1)/r$

$\pi(n)/r$

$ per firm

EC

1 2 3 4 5 6 7
n = number of firms

How number of firms is determined

- The higher the entry cost, the _____ the equilibrium number of firms.
- So higher costs of entry imply a _____ concentrated industry.

Monopoly profit = $\pi(1)/r$

$ per firm

$\pi(n)/r$

High EC

Low EC

1 ② 3 4 ⑤ 6 7
n = number of firms

Example

- Suppose market demand is given by $P = \$8 - (Q/100)$.
- Suppose MC of production = $____.

Price, marginal cost

$8
$7
$6
$5
$4
$3
$2
$1
$0

0 100 200 300 400 500 600 700 800
Quantity

Demand   Marginal cost

ENTRY COSTS AND EQUILIBRIUM ENTRY
Page 3

Example: $\pi(1)/r$ and $\pi(2)/r$

- If a monopoly (n=1), then q = _____, P = _____, and $\pi(1)$ = _____.
- If a Cournot duopoly (n=2), then q_i = _____, Q = _____ P = _____, and $\pi(2)$ = _____.

Example: $\pi(1)/r$ and $\pi(2)/r$

- If a monopoly (n=1), then q = 300, P = $5, and $\pi(1)$ = $900.
- If a Cournot duopoly (n=2), then q_i = _____, Q = _____ P = _____, and $\pi(2)$ = _____.

Example: $\pi(1)/r$ and $\pi(2)/r$

- If a monopoly (n=1), then q = 300, P = $5, and $\pi(1)$ = $900.
- If a Cournot duopoly (n=2), then q_i = 200, Q = 400, P = $4, and $\pi(2)$ = $400.

Example: $\pi(n)/r$

- It can be shown that for this example, if the industry is a Cournot oligopoly with n firms, $\pi(n) = \dfrac{3600}{(n+1)^2}$
- Suppose r = 0.10. Then
$$\pi(n)/r =$$

Example: "demand for entry"

- So
$$\pi(n)/r = \frac{36,000}{(n+1)^2}$$
= amount that the nth firm is willing to pay to gain entry to the industry.

Example: "supply of entry" and equilibrium

- Suppose cost of entry = EC = $500.
- Then n will increase until $\pi(n)/r$ starts to fall below $500.
- Here $\pi(7)/r$ = $563 and $\pi(8)/r$ = $444.
- Thus n* = _____.

ENTRY COSTS AND EQUILIBRIUM ENTRY
Page 4

Example: "supply of entry" and equilibrium (cont'd)

- Alternatively, suppose EC = $1500.
- Then n will increase until $\pi(n)/r$ starts to fall below $1500.
- Here $\pi(3)/r = \$2250$ and $\pi(4)/r = \$1440$.
- Thus $n^* = \_\_\_\_$.

Conclusions

- Even if marginal cost is constant, the number of firms in the industry is determined in equilibrium if
  - profit per firm is _____ related to the number of firms and
  - there is a cost of entry.
- The number of firms will be _____ related to this entry cost.

ENTRY BARRIERS AND CONTESTABLE MARKETS
Page 1

ENTRY BARRIERS AND CONTESTABLE MARKETS

•If scale economies are very large, can they be a barrier to entry?

•Do they result in monopoly pricing?

Explaining concentration

- Why are some industries more concentrated than others?
- Another possible explanation: an incumbent firm that enjoys economies of scale might be able to prevent rivals from entering the market.
- But whether this results in monopoly _____ is controversial.

Falling average costs

- Earlier we said that falling AC creates "natural monopoly."
- Economies of scale can supposedly be a barrier to entry.
- But why?

Scale economies: review

- Scale economies = falling average cost.
- q_{MES} = minimum efficient scale.
- Suppose q_{MES} is large relative to the market.

Two views

- Traditional view ("Harvard School") argues that a firm enjoying very large scale economies can prevent rivals from entering market.
- Alternative view ("Chicago School") argues that scale economies cannot prevent entry. Only defense against entry is to keep price low.

Traditional view: the incumbent firm

- Suppose initially the market is a monopoly.
- Suppose the incumbent firm produces q_I and sets price at P_I.
- Enjoy profit because P_I AC.

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ENTRY BARRIERS AND CONTESTABLE MARKETS
Page 2

Traditional view: the entrant firm

- Suppose another firm with the same AC curve wants to enter the market.
- The entrant would have to enter at a large scale to survive in this market—at least q_E and preferably q_{MES}.

Traditional view: the entrant's problem

- But if the incumbent kept its output at q_I, the market price would fall below min AC.
- Everyone would make losses!

Traditional view: equilibrium

- Anticipating losses, entrant would _____.
- In equilibrium, no one tries to enter market.
- Incumbent sets $P > AC$ and enjoys monopoly profit.

Traditional view: scale economies *are* a barrier to entry

- So scale economies *are* a barrier to entry that keeps prices above average cost.
- But this conclusion rests on assumption that incumbent would keep its output _____ at q_I, the so-called "Bain-Sylos postulate".

Joe S. Bain, *Barriers to New Competition*, Harvard Univ Press, 1956.
Paulo Sylos-Labini, *Oligopoly and Technological Progress*, Harvard Univ Press, 1962.

An alternative view: "contestable markets"

- If the incumbent might _____ its output in response to entry, then a very different outcome might result.
- The model of "contestable markets" assumes incumbent changes its output.

W.J. Baumol, J.C. Panzar, and R.D. Willig, *Contestable Markets and the Theory of Industry Structure*, San Diego: Harcourt Brace Jovanovich, 1982.

Contestable markets: assumptions

- New entrants have same costs as incumbents (like traditional view).
- Any fixed costs of entry can be recovered on exiting the market. Not _____.
- For example, assume a potential entrant could sell off its factory at original price, if it decides to exit.

ENTRY BARRIERS AND CONTESTABLE MARKETS
Page 3

Contestable markets: assumptions (cont'd)

- Incumbent maintains its existing _____ (not quantity) in response to entry, at least for the short run.
- Entrant can begin supplying market _____ incumbent can adjust price.

Contestable-markets: the incumbent firm

- What would happen if the incumbent firm produced q_I and set price at P_I?
- Entrant would set a price just below P_I.

Entrant's price

Contestable-markets: the entrant's threat

- Entrant would capture market in short run, until incumbent adjusts its price.
- This "hit-and-run" attack would steal incumbent's profit.

Contestable-markets: equilibrium

- Only way for incumbent to prevent hit-and-run attacks is to keep price at P_I = min AC.
- Incumbent is thus constrained by _____ competition.

Contestable-markets view: scale economies are _____ a barrier to entry

- In equilibrium, no one tries to enter the market.
- But incumbent does _____ enjoy monopoly profit.

Are assumptions of contestable-markets view reasonable?

- Can fixed costs of entry be recovered?
- Examples of entry costs:
  - _____
  - _____
  - _____
- If not, a brief "hit-and-run" attack might not be profitable.

ENTRY BARRIERS AND CONTESTABLE MARKETS
Page 4

Are assumptions of contestable-markets view reasonable? (cont'd)

- Does it take longer for the incumbent to adjust price than for the entrant to begin production?
- If not, entrant _____ capture market even in short run.

Conclusions

- Whether very large scale economies give an incumbent firm monopoly power is controversial.
- The _____ view assumes incumbent can prevent entry by fixing its quantity and adjusting price. Incumbent can enjoy P > AC.
- The _____ view assumes incumbent must fix price in the short run and is therefore vulnerable to hit-and-run attacks. Incumbent must set P = AC to prevent entry.

PREVENTING ENTRY
Page 1

PREVENTING ENTRY

•Can an incumbent prevent entry,
even if it is similar to new firms?

Explaining concentration

• Why are some industries more concentrated than others?
• As we have seen, scale economies might allow an incumbent to prevent entry.
  • Traditional view: P > AC.
  • Contestable-markets view: P = AC.
• Yet these views are controversial.

Formalizing the debate

• As we have seen, the traditional view claims that an incumbent can prevent entry by threatening to drive price below cost.
• Let's formalize this idea as a _____ game.
• Let's graph the game in *extensive form.*

Incumbent firm — Keep output high → Both firms make losses.

Enter — Reduce output → Both firms make modest profit.

New firm

Do not enter — Keep output high → Incumbent enjoys big monopoly profit, new firm zero.

Reduce output → Incumbent enjoys big monopoly profit, new firm zero.

What is a "credible threat"?

Credible = believable.

• Example 1: Suppose I drive through McDonalds. They threaten not to give me my meal unless I pay first. Credible threat?
• Example 2: Suppose I hire a moving company to haul my goods to California. After arriving in California, they threaten to take my goods back to Iowa unless I pay first. Credible threat?

Traditional view: critique

• If new firm actually enters the market, incumbent must carry out its threat to keep output high and push price below average cost.
• Both firms will make _____.
• But profit-maximizing response will be to cut output and keep price up.
• So this threat is not _____.

PREVENTING ENTRY
Page 2

Committing to threats

- A model where threats are not credible seems iffy.*
- What is needed is a way for the incumbent to _____ to carrying out the threat—to tie its own hands, so to speak.

* In the language of game theory, the proposed equilibrium is not "subgame perfect."

Special situations

- In special situations, incumbent might have advantages that keep it profitable when prices fall, but would cause an entering firm to make losses.
- These would discourage any firms from entering the market and would allow the incumbent to maintain monopoly profit.

Examples of advantages for incumbent in special situations

- _____:
  If production experience leads to lower cost, incumbent might have lower AC than any potential entering firm.
- *Consumer* _____:
  It might be costly for consumers to switch to a new brand.

Committing to high output without special advantages for the incumbent

- In many situations, the incumbent *can* adjust quantities quickly, so the traditional view does not make sense.*
- Can the incumbent still commit itself to maintain high output after entry, as in the traditional view?
- Can the threat to maintain high output and a low price be made _____?

* The incumbent can often adjust prices quickly, too, so the contestable-markets view does not make sense either.

Commitment through prior investment in capacity

- Suppose the incumbent firm first invests in "capacity."
- That is, the incumbent _____ in plant and equipment, lowering its short-run marginal and variable cost, but perhaps raising its total cost.

What if the other firm enters the market?

- If new firm actually enters, then market becomes perhaps Cournot or maybe even price competition.
- But now, incumbent has _____ marginal cost.
- Profit-maximizing choice for incumbent will be to maintain high output even if price is low.

A. Dixit, "The Role of Investment in Entry Deterrence," *Economic Journal*, Vol. 9 (1980), pp. 95-106.

PREVENTING ENTRY
Page 3

A credible threat!

- So the equilibrium after entry will be a very _____ price.
- Incumbent might make small profit.
- Or incumbent might suffer a loss, but fixed costs of capacity are sunk, so incumbent will persist with high output in short run.
- But entering firm will make _____!

A. Dixit, "The Role of Investment in Entry Deterrence," *Economic Journal*, Vol. 9 (1980), pp. 95-106.

Incumbent firm → Invest in capacity → New firm

New firm → Enter: Incumbent enjoys small profit, new firm loses money.

New firm → Do not enter: Incumbent enjoys monopoly profit, new firm zero.

Incumbent firm → Do not invest → Enter: Both firms enjoy small profit.

Do not invest → Do not enter: Incumbent enjoys big monopoly profit, new firm zero.

Investment in capacity can prevent entry

- By investing in advance in capacity that it may never use, an incumbent can discourage a new firm from entering the market.
- Investing in capacity makes the threat to maintain high output a _____ threat.
- This is an example of _____ influencing _____.

A. Dixit, "The Role of Investment in Entry Deterrence," *Economic Journal*, Vol. 9 (1980), pp. 95-106.

Conclusions

- For an incumbent firm to maintain output and suffer losses when a new firm enters the market is not a _____ threat.
- In special situations, learning-by-doing or consumer switching costs could help an incumbent maintain output when a new firm enters.
- Alternatively, prior investment in _____, to be used only if a new firm enters, can make the threat to maintain output credible.

PART 3

Antitrust Policy

Big ideas: Horizontal and vertical mergers have very different effects on prices and economic efficiency, and so are treated differently by the courts. Whether other business practices harm economic efficiency often depends on context, so courts use the "rule of reason."

Famous quote: "Consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to only so far as it may be necessary for promoting that of the consumer."
--Adam Smith, *The Wealth of Nations* (1776).

Another famous quote: "The successful competitor, having been urged to compete, must not be turned upon when he wins."
-- Judge Learned Hand, United States v. Aluminum Co. of America, 148 F 2nd 416 (2d Cir. 1945).

MERGERS
Page 1

MERGERS

• How are mergers classified?
• What have been the historical trends in mergers?

Types of mergers

• Horizontal
• Vertical
• Conglomerate
  • Product extension
  • Market extension
  • Pure (unrelated firms)

Horizontal mergers

• Combine firms in the same market (competitors).
• Greatest threat to competition.
• Examples:

Vertical mergers

• Combine companies that have a buyer-seller relationship.
• Less threat to competition.
• Examples:

Conglomerate mergers

• Combine firms which are neither direct competitors nor buyer-sellers.
• Subcategories
  • Product extension mergers
  • Market extension mergers
  • Pure conglomerate mergers
• May perhaps remove potential competition.

First merger wave: 1890s and 1900s

• Mostly horizontal mergers for monopoly.
• Most striking example: US Steel (1901) gained 65% market share.
• Other examples: General Electric, DuPont, American Tobacco, etc.

MERGERS
Page 2

Early merger cases

- *US v Northern Securities (1904).* Attempt to merge two railroads found illegal under Sherman Act sections 1 and 2.
- *US v Standard Oil (1911).* Broken up under Sherman Act.
- *US v American Tobacco (1911).* Broken up under Sherman Act.

Limitations of Sherman Act

- Sherman Act did not explicitly prohibit mergers—only "restraint of trade" (section 1) and "monopolization" (section 2).
- In cases just cited, the government argued that the merged firm was so large as to *monopolize* market.
- But no law addressed mergers to *oligopoly.*

Clayton Act

- Clayton Act passed in 1914. Section 7 contains explicit ban on acquiring _____ of another corporation if effect is to "lessen competition."
- Loophole: Could still buy _____ (factories, mills, track) of another firm.

Second merger wave: 1920s

- Mostly horizontal mergers for oligopoly.
- Example: _____ purchased Lackawanna Steel in 1922, to become second-largest steel company.

Celler-Kefauver Act

- Celler-Kefauver Act passed in 1950.
- Amended Clayton Act to prohibit purchase of _____ of another corporation if effect is to "lessen competition."
- Result was to prohibit most large horizontal and many vertical mergers.

Recent merger waves

Mostly conglomerate mergers.
- Third wave: 1960s.
- Fourth wave: 1980s. Included many leveraged buyouts.
- Fifth wave: 1990s.
- Sixth wave: early 2000s.

MERGERS
Page 3

Number of mergers reported to Federal Goverment under Hart-Scott-Rodino Act

Note: After 2001, only mergers over $50 million had to be reported.

Source: FTC HSR Annual Report to Congress, various years.

Conclusions

- _____ mergers combine competing firms. Common in late nineteen and early twentieth centuries, but increasingly attacked under antitrust laws.
- _____ mergers combine buyers and sellers.
- _____ mergers combine firms that are not competitors nor buyer-sellers. Still very common.

MOTIVATIONS FOR HORIZONTAL MERGERS
Page 1

MOTIVATIONS FOR HORIZONTAL MERGERS

• What are the good and bad reasons for mergers?

• How should we balance them?

Why do firms merge?

• In most cases, mergers occur because they increase profit. But how?

1. Market price might rise due to increased *market power*.

2. Merging firms' costs might fall due to *efficiencies*.

---

1. Market power

Price might rise after a merger due to

• Unilateral effects: even though each firm continues to act on its own, market price might rise after a merger according to some models.

• Coordinated effects: the chances of collusion might rise after a merger.

Market power: unilateral effects

• Assume the merged firm acts *on its own* to increase profit.

• Will price rise after the merger?

• Will industry quantity fall?

Unilateral effects according to Cournot model

• Under Cournot oligopoly, Lerner index is
$$\frac{P-MC}{P} = \underline{\hspace{2cm}} \quad , \text{ where n = number of firms.}$$

• So if n decreases, price will _____.

• Assuming demand curve is unchanged, market quantity will _____.

Unilateral effects according to Cournot model

• Under Cournot oligopoly, Lerner index is
$$\frac{P-MC}{P} = \frac{1}{n \, |\varepsilon|} \quad , \text{ where n = number of firms.}$$

• So if n decreases, price will __rise__.

• Assuming demand curve is unchanged, market quantity will __fall__.

MOTIVATIONS FOR HORIZONTAL MERGERS
Page 2

Unilateral effects according to Cournot model (cont'd)

- How exactly does market quantity fall?
- The merged firm will decrease its total quantity, which will increase price.
- But this will cause nonmerging firms to _____ their quantity,* partly offsetting the rise in price.
- So a merger might be unprofitable.

* Cournot best reply functions slope down.

Unilateral effects according to Cournot model (cont'd)

- Example: symmetric triopoly with linear demand and constant MC.
- If two firms merge, their combined profit will actually fall.
- (But third firm's profit rises a lot!)

Unilateral effects according to Bertrand model with differentiated products

- Firms produce close substitutes.
- Each firm's demand depends positively on other's price:

$$q_1 = q_1(p_1, p_2) \qquad q_2 = q_2(p_2, p_1)$$

- So if one firm raises price, that increases demand for the other's product.

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$$\quad -\ + \qquad\qquad\quad -\ +$$

- So if one firm raises price, that increases demand for the other's product.

Unilateral effects according to Bertrand model with differentiated products (cont'd)

- As separate firms, they don't care about each others' profit.
- But once merged, they have a greater incentive to raise price.
- This will cause nonmerging firms to _____ their prices,* increasing demand for the merging firms' products.
- So mergers are always profitable.

* Bertrand best reply functions slope up.

Unilateral effects according to Bertrand model with differentiated products (cont'd)

- As separate firms, they don't care about each others' profit.
- But once merged, they have a greater incentive to raise price.
- This will cause nonmerging firms to ___raise___ their prices,* increasing demand for the merging firms' products.
- So mergers are always profitable.

* Bertrand best reply functions slope up.

MOTIVATIONS FOR HORIZONTAL MERGERS
Page 3

Market power: coordinated effects

- Firms are less likely to act on their own when the number of firms is small.
- Easier to collude:
  - Tacit collusion.
  - Formal cartel.

2. Efficiencies

Costs might fall at the merging firm due to
- Economies of scale.
- Rationalization of production.
- Pecuniary economies.

Efficiencies: economies of scale

- *Economies of scale =* savings from large-scale production.
- Take advantage of mass-production technology.
- Allow workers to specialize.
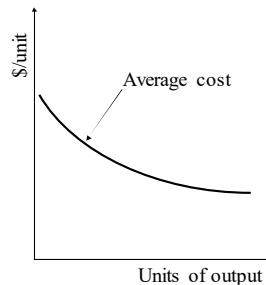
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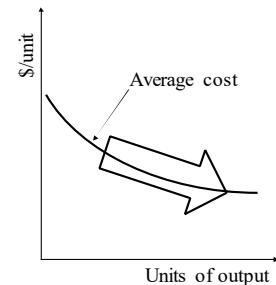
Efficiencies: rationalization of production

- If MCs are unequal, total costs can be lowered by _____ output at firm with lower MC, and _____ output at firm with higher MC.
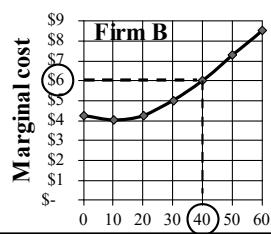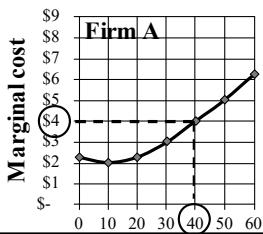
Efficiencies: pecuniary economies

- *Pecuniary economies:* pay less for inputs.
  - Take advantage of volume discounts.
  - Exercise buyer market power in input markets.
- Example:
  - _____

MOTIVATIONS FOR HORIZONTAL MERGERS
Page 4

Multiple effects of horizontal mergers

- A merger may yield *both* a price increase from increased market power, and cost savings.
- Then we face a classic welfare tradeoff.
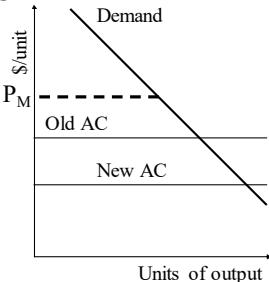
Williamson, Oliver E. "Economies as an Antitrust Defense: The Welfare Tradeoffs." *American Economic Review* 58, no. 1 (1968): 18-36.

Welfare tradeoff between market power and cost savings

- Price increase hurts consumers, causes deadweight loss.
- Cost savings helps new firm owners.
- Correct welfare analysis must include both.
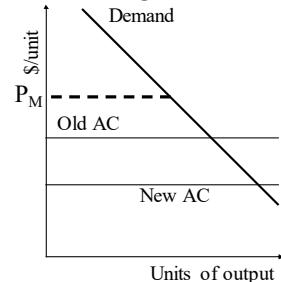
Welfare tradeoff: numerical example

- Suppose an industry has several firms, all with AC = MC = $3.
- Demand: $P = 8 - Q/100$.
- Currently competitive, so price = _____.
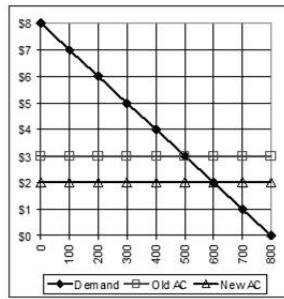
Numerical example: effects of merger on market price and cost

- If merge, monopoly.
- Marginal revenue is MR = _____.
- But suppose monopoly also reduces MC and AC to $2 due to economies of scale.
- So monopolist sets Q=_____, P=_____.
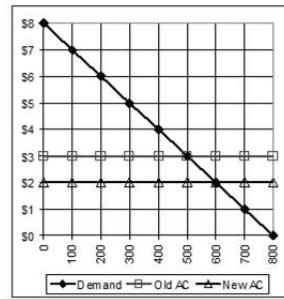
Numerical example: welfare analysis

- Loss of consumer surplus has two parts.
  - (1) is transfer to producers.
  - (2) is deadweight loss.
- In addition, producers enjoy gain from
  - (3) cost savings.
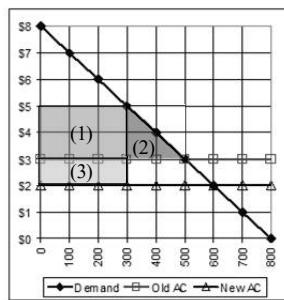
Numerical example: welfare analysis

- In this example, deadweight loss (2) equals _____.
- Cost savings (3) equals _____.
- So net effect of merger is _____ to society of _____.
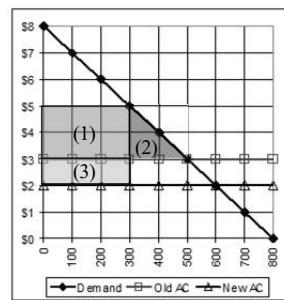
MOTIVATIONS FOR HORIZONTAL MERGERS
Page 5

Tradeoff in practice

- Even a small reduction in AC might offset a large increase in price due to increased market power.
- But cost savings may be difficult for government to measure, because it might have to rely on _____ estimates.

The Staples-Office Depot case

- Staples and Office Depot wanted to merge in 1997.
- Challenged by FTC, which won in court.
- Both sides recognized cost savings and increase in market power, but disagreed on the magnitudes.
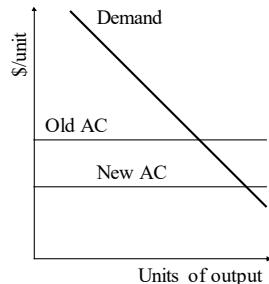
The Staples-Office Depot case (cont'd)

- Companies said cost savings were large enough to result in net _____ in prices.
- Government said there would be a net _____ in prices.
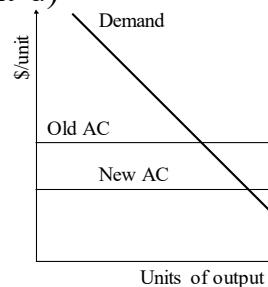
The Staples-Office Depot case (cont'd)

- Moreover, FTC argued that only cost savings that would flow to consumers were relevant.
- That is, only net effect on price was relevant.
- Only _____ surplus counts, according to the FTC!
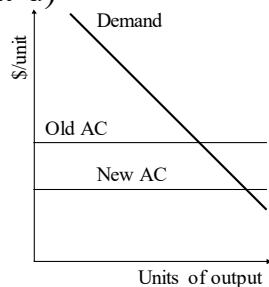
Mergers in airlines

- One study estimated the effect of airline mergers on prices (fares) from 1985-88.
- Mergers could increase price (due to market power) or decrease price (due to cost savings).
- In fact, mergers _____ prices of merging firms by 9.4 %, on average.
- Mergers also prompted nonmerging firms on same route to _____ price.

E. Han Kim and Vijay Singal, "Mergers and Market Power: Evidence from the Airline Industry," *American Economic Review* 83 (June 1993): 549-69.

Effect of mergers on competitors

- If a merger on balance raises price, then _____ competitors also benefit.
- If a merger on balance lowers market price, the competitors are harmed but social welfare increases.
- So if competitors object to a merger, most likely the merger will _____ social welfare!

MOTIVATIONS FOR HORIZONTAL MERGERS
Page 6

Conclusions

- Mergers typically bring both increases in market power and efficiencies.
- In principle, the government should evaluate both and compute the net effect on _____ welfare (=PS+CS).
- In practice, the US government currently considers only the net effect on _____ welfare (=CS).

HISTORIC HORIZONTAL MERGER CASES
Page 1

HISTORIC HORIZONTAL MERGER CASES

•What cases have influenced US merger policy since the Celler-Kefauver Act of 1950?

US v Bethlehem Steel (1958)

- Bethlehem Steel tried to buy Youngstown Sheet & Tube. Would become #2 steel company in US (after US Steel).
- Combined steel ingot capacity would have been 21%. But companies argued that they operated in different regional markets.
- District court disagreed, saying market must be defined on the basis of where *potentially* they could make sales. _____.

Brown Shoe v US (1962)

- Brown Shoe tried to buy G.R. Kinney.
- Both firms made shoes and owned retail shoe stores, each with tiny national market shares.
- Supreme Court found that merger would produce high combined market shares in a few cities.
- But Court disapproved even when merger would produce market share of just 5%! Court wanted to halt a "trend" toward concentration. _____.

US v ALCOA (1964)

- ALCOA, a maker of aluminum electrical cable, wanted to buy Rome Cable, a maker of mostly copper cable, but some aluminum.
- Supreme Court considered many market definitions. Finally chose aluminum cable (excluding copper cable, a close substitute), of which ALCOA had 27.8% and Rome 1.3%.
- Court found combined market share too high. _____.

US v Continental Can (1964)

- Continental Can, 2nd largest maker of tin cans, tried to buy Hazel-Atlas Glass, 3rd largest maker of glass bottles.
- Supreme Court defined market as including both cans and bottles, even though it admitted cross-elasticities were low in short run.
- In this combined market, Continental Can had 22% market share and Hazel-Atlas had 3%.
- _____.

US v Von's Grocery (1966)

- Von's, 3rd largest grocery chain in Los Angeles, tried to buy Shopping Bag Food Stores, 6th largest chain.
- Combined firm had only 7.5% market share in Los Angeles, second to Safeway.
- But Supreme Court said Celler-Kefauver Act was intended "to prevent economic concentration in American economy by keeping a large number of small competitors in business." _____.

HISTORIC HORIZONTAL MERGER CASES
Page 2

Conclusions

- In *Brown Shoe* and *Von's* cases, Supreme Court showed interest in keeping concentration _____.
- In *Bethlehem Steel*, *ALCOA*, and *Continental Can* cases, courts chose somewhat contradictory market definitions in order to enjoin mergers.
- Common thread is that Supreme Court has had a fairly _____ attitude toward horizontal mergers.

HORIZONTAL MERGER ENFORCEMENT TODAY
Page 1

HORIZONTAL MERGER ENFORCEMENT TODAY

•What is the policy of the Department of Justice and the FTC toward horizontal mergers?

https://www.justice.gov/atr/merger-guidelines
https://www.justice.gov/atr/2023-merger-guidelines

Legal authority for policy

Section 7 of Clayton Act (1914) prohibits mergers if "in any line of commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be substantially to lessen competition, or to tend to create a monopoly."

What does "lessen competition" mean?

• In the past, as we have seen, a merger has been viewed as lessening competition if it causes an increase in _____ .

• In recent decades, a merger has been viewed as lessening competition mainly if it causes an increase in _____ .

Procedure under Hart-Scott-Rodino Act of 1976

• Merging companies must give prior notification to FTC and Antitrust Division of U.S. Dept of Justice.

• One agency then reviews merger.

• If not satisfied, may request more information.

• If still not satisfied, may oppose merger.

https://www.ftc.gov/enforcement/premerger-notification-program

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FY 2024 HSR figures

	FTC	Antitrust Division	Total
Notifications received			1973
Preliminary investigations	103	81	184
Second Request investigations	30	29	59
Mergers challenged	18	14	32

Source: Hart-Scott-Rodino Annual Report, Fiscal Year 2024, page 2 and Exhibit A, table I.

What happens if a merger is challenged?

• Companies may _____ anyway, and face a court battle.

• Companies may try to _____ with govt. Typical settlements include
  • Divestiture of facilities in overlapping markets.
  • If merger has vertical component, some agreement to treat in-house and other suppliers equally.

HORIZONTAL MERGER ENFORCEMENT TODAY
Page 2

Example: Dollar Tree + Family Dollar Stores

- Both are discount general-merchandise chain stores.
- Merger challenged by FTC.
- FTC said the chains competed in local markets in 35 states.
- To maintain competition, chains agreed to sell 330 Family Dollar stores to third party.

Source: Hart-Scott-Rodino Annual Report, Fiscal Year 2015, page 2.

Merger guidelines

- FTC and Antitrust Division agreed in 1992 to publish common guidelines for merger review.
  - Based on previous guidelines issued in 1982 by Antitrust Division alone.
- Guidelines updated periodically.
- Most recent Guidelines issued in December 2023.

https://www.justice.gov/atr/merger-guidelines
https://www.justice.gov/atr/2023-merger-guidelines

Possible anticompetitive effects of a merger

- "_____ effects" = elimination of competition between merging firms. Merged firm may have incentive to increase price, reduce output, or slow innovation.
- "_____ effects" = increased risk of explicit or tacit collusion. Entire industry may compete less vigorously.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 6, 8.

How Guidelines define a market

- A horizontal merger is evaluated according to its likely effect on price in a particular _____.
- Guidelines define a market as a group of products and a geographic area which, if monopolized, would give the seller power over _____.
- Choose the smallest such group.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 6, 8.

How Guidelines define a market

- A horizontal merger is evaluated according to its likely effect on price in a particular _____market_____.
- Guidelines define a market as a group of products and a geographic area which, if monopolized, would give the seller power over _____price_____.
- Choose the smallest such group.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 6, 8, 42

"Hypothetical Monopolist Test"

"... whether a hypothetical profit-maximizing firm, not prevented by regulation from worsening terms, that was the only present and future seller of a group of products ("hypothetical monopolist") likely would undertake at least a small but significant and non-transitory increase in price ("_____") or other worsening of terms ("_____") for at least one product in the group.."

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 41.

HORIZONTAL MERGER ENFORCEMENT TODAY
Page 3

Example of product groups

- Suppose consumers view red and blue gumballs as close substitutes, but not green gumballs.
- If all red gumballs were sold by a single seller, that seller could *not* raise price.
- If all red and blue gumballs were sold by a single seller, that seller *could* raise price.
- So the product definition of the market includes only _____ gumballs.

Ⓡ   Ⓑ   Ⓖ

Example of geographic areas

- Suppose consumers are willing to travel between City A and City B for the lowest price for gumballs, but not to City C.
- If all gumballs in City A were sold by a single seller, that seller could *not* raise price.
- If all gumballs in City A and B were sold by a single seller, that seller *could* raise price.
- So the geographic definition of the market includes only _____.

| City A | | City B | | City C |

How big is a "small but significant and nontransitory increase in price"?

- In practice, about 5%.
- Note that a bigger price increase might require a _____ market definition.
- Monopoly would have to control all substitutes to succeed in raising price a lot.

Profitability of increase in price

- Agencies also consider whether the increase in price would increase _____.
- This requires estimating how many sales would be lost at the higher price (demand elasticity), and what profit would otherwise be earned on them.
- Also, possibly, whether lost customers would purchase another of the merged firm's products instead.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 43-44.

Rubuttal evidence

Even if a merger appears anticompetitive, there may be offsetting factors that preserve competition.

- Failing firms.
- Entry and repositioning.
- Procompetitive efficiencies.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 30-33.

Rebuttal: failing firms

- If the acquired firm faces grave probability of failure, with dim or nonexistent prospects, and the acquiring firm is the only available purchaser, then the merger may be allowed.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 30.

HORIZONTAL MERGER ENFORCEMENT TODAY
Page 4

Rebuttal: entry and repositioning

Merger may be allowed if it would induce entry of new firms, provided such entry would be

- rapid enough to replace lost competition,
- likely (no entry barriers), and
- sufficient to prevent lessening of competition.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 31.

Rebuttal: procompetitive efficiencies

Merger may be allowed if cost savings ("efficiencies")

- could not be obtained without merger (e.g., through contracts or partial mergers),
- are verifiable, and
- prevent lessening of competition.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 32-33.

Conclusions

- Under the _____ Act, firms planning to merge must notify the U.S. government.
- Government evaluates "unilateral effects" and "coordinated effects" of merger on a market.
- Government defines a market according to substitution in _____.
- Cost savings are considered only if they lead to lower prices.

CHANGES IN MARKET CONCENTRATION
Page 1

CHANGES IN MARKET CONCENTRATION

•How do Department of Justice and FTC evaluate horizontal mergers?

https://www.justice.gov/atr/merger-guidelines
https://www.justice.gov/atr/2023-merger-guidelines

2023 Merger Guidelines

Guideline 1: Mergers Raise a Presumption of Illegality When They Significantly Increase Concentration in a Highly Concentrated Market.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 2.

Changes in market concentration

"Market concentration is often a useful indicator of a merger's likely effects on competition. The Agencies therefore presume, unless sufficiently disproved or rebutted, that a merger between competitors that significantly increases concentration and creates or further consolidates a highly concentrated market may substantially lessen competition."

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 2.

Dangers of high concentration

• "Unilateral effects" = elimination of competition between merging firms. The fewer the firms in the industry, the higher the price, according to the Cournot model.
• "Coordinated effects" = increased risk of collusion. The fewer the firms, the easier it is to maintain explicit or tacit collusion.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 6 fn. 17, and p. 8.

Market participants

According to the 2023 Merger Guidelines, "market participants" are
• firms currently supplying products in the relevant market.
• firms that have committed to entering the market in the near future.
• firms that could enter the market rapidly if the price were to rise.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 49.

Market shares

• Market shares are computed for all market participants.
• Market share of firm #i is usually computed from *revenues* as $\frac{Firm\ \#i's\ revenue}{Total\ market\ revenue}$.
• Market share sometimes computed from *units sold* or from *production capacity*.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 50.

CHANGES IN MARKET CONCENTRATION
Page 2

Market concentration

- Hirschman-Herfindahl index (HHI) is used.
- Recall HHI = sum of *squares* of market shares in percent of *all* firms in the industry.
- Let s_i = market share. Then $100s_i$ = market share in percent.
- HHI = $(100s_1)^2 + (100s_2)^2 + \dots + (100s_n)^2$.

When are mergers presumed to be illegal according to the 2023 Guidelines?

Indicator	Threshold for Structural Presumption
Post-merger HHI	Market HHI greater than 1,800 AND Change in HHI greater than 100
Merged Firm's Market Share	Share greater than 30% AND Change in HHI greater than 100

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines.* p. 6.

Example using 2023 Guidelines

Firm	A	B	C	D	E	F	G
Market share	20%	20%	20%	10%	10%	10%	10%

- HHI = 1600.

Suppose Firm A merges with Firm D.

- New HHI = _____ .
- ΔHHI = _____ .
- Conclusion: _____
  _____ .

Conclusions

- Government evaluates effects of horizontal mergers on concentration using HHI.
- If merger increases HHI by more than _____ points, and postmerger HHI > _____, merger "presumed to substantially lessen competition."

UPWARD PRICING PRESSURE
Page 1

UPWARD PRICING PRESSURE

•How do Department of Justice and FTC evaluate horizontal mergers?

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. Section 4.2.B.

What is unsatisfactory about the market concentration approach?

- Market concentration approach classifies all firms as in or out of the market.
- More typically, some firms' products compete closely with each other, but others do not.
- Need a more subtle approach to merger evaluation.

Assumptions

- Suppose firms produce _____ _____, not perfect substitutes.
- Also suppose that firms set prices (as in the _____ model of oligopoly).
- How will a merger affect the prices they set?

Assumptions

- Suppose firms produce ___differentiated___ ___products___, not perfect substitutes.
- Also suppose that firms set prices (as in the ___Bertrand___ model of oligopoly).
- How will a merger affect the prices they set?

The "upward pricing pressure" (UPP) approach

- Assumes firms produce differentiated products, so any firm can raise prices by itself without losing all its customers.
- Focuses on "_____" of merger—that is, increased incentives for merged firm to raise prices, without collusion.
- Tries to determine simply _____ prices will rise because of the merger, not how much.

Choosing output and price

- Suppose Firm A faces downward-sloping demand.
- It chooses Q_A such that $MC(Q_A) = MR(Q_A)$.
- Chooses price P_A on demand curve at Q_A.

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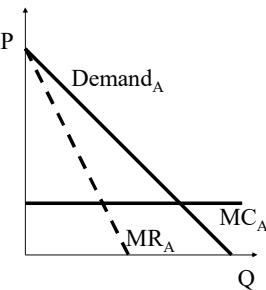
UPWARD PRICING PRESSURE
Page 2

Changes in marginal cost

- If MC rises, then Firm A will choose a lower quantity and a higher price.
- Exactly *how much* price rises depends on shape of demand, of course.
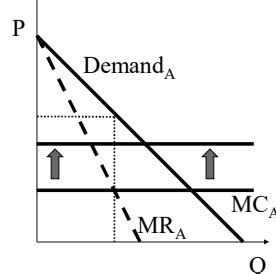
What are included in marginal costs?

- Marginal cost includes production costs, delivery costs, perhaps selling costs, etc. related to selling one more unit.
- Marginal cost does NOT include the impact on _____ firms' profits of Firm A selling one more unit.
- Other firms' profits are external to Firm A.

Impact of Firm A on Firm B's profit

- When Firm A sells more output (e.g., by cutting price), it likely diverts customers from Firm B.
- Let D_{AB} = the number of units lost by Firm B when Firm A sells one more unit.
- Let P_B and MC_B = Firm B's price and marginal cost, assumed held constant.
- Then Firm A sells one more unit, profit at Firm B falls by _____.

Impact of Firm A on Firm B's profit

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- Let D_{AB} = the number of units lost by Firm B when Firm A sells one more unit.
- Let P_B and MC_B = Firm B's price and marginal cost, assumed held constant.
- Then Firm A sells one more unit, profit at Firm B falls by $\mathbf{D_{AB}(P_B - MC_B)}$.

What determines the value of $D_{AB}(P_B - MC_B)$?

- D_{AB} ("diversion ratio") is large if products A and B are close substitutes, but usually less than one.
- $P_B - MC_B$ ("Firm B markup") is large if Firm B's price is much higher than its marginal cost.
- So if A and B are not close substitutes, or Firm B's price is close to its marginal cost, then $D_{AB}(P_B - MC_B)$ will be close to _____.

What if Firms A and B merge?

- Firms become Division A and Division B of single merged firm.
- Division A must now take account of the impact of its sales on Division B's profit ("cannibalization").
- Merger creates the equivalent of an increase in Firm A's marginal cost = $D_{AB}(P_B - MC_B)$.

UPWARD PRICING PRESSURE
Page 3

Merger changes incentives

- Merger causes Division A to internalize its impact on Division B.
- Equivalent to an increase in MC_A of $D_{AB}(P_B-MC_B)$.
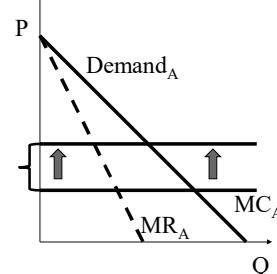
Effects of merger on price

- So merger causes Division A to choose a lower quantity and a higher price.
- Exactly *how much* price rises depends on shape of demand, of course.
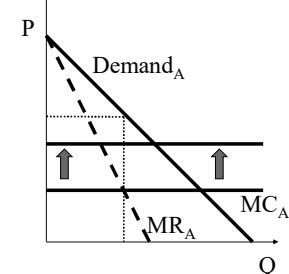
Merger efficiencies

- Merging firms usually claim that merger will also decrease marginal costs.
- Real cost savings = economies of scale or scope, rationalization of production.
- Pecuniary cost savings = paying less for inputs by negotiating better prices, buying in bulk, etc.

Offsetting efficiencies

- Let E_A = decrease in MC_A due to efficiencies.
- Net change in virtual MC is called "upward pricing pressure"
  $= UPP_A$
  $= D_{AB}(P_B-MC_B) - E_A$.

Positive UPP

If $D_{AB}(P_B-MC_B) > E_A$, then
- $UPP_A > 0$
- P_A will _____ after merger.
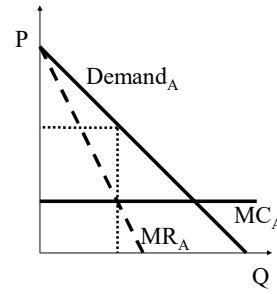
Negative UPP

If $D_{AB}(P_B-MC_B) < E_A$, then
- $UPP_A < 0$
- P_A will _____ after merger.
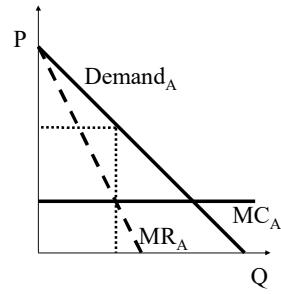
UPWARD PRICING PRESSURE
Page 4

Computing UPP_A $= D_{AB}(P_B\text{-}MC_B) - E_A$.

- P_B and MC_B are typically obtained directly from merging companies' HSR filing.
- Diversion ratio D_{AB} is obtained from
  - Surveys of customers.
  - Runner-up bids from procurement auctions.
  - Very rough estimate from market shares.

Numerical example

- Suppose Firm A has 40% market share and Firm B has 20% market share.
  - Then if Firm A gains customers from its rivals, roughly $\frac{20\%}{100\%-40\%} = \frac{1}{3}$ of those will be from Firm B.
  - So very rough estimate of D_{AB} = _____.

Numerical example (cont'd)

- Further suppose P_B = $10 and MC_B= $4.
- So $D_{AB}(P_B\text{-}MC_B)$ = (1/3) ($10-$4) = $2.
- If E_A = -ΔMC_A = $2 (a 33% drop) then $UPP_A = D_{AB}(P_B\text{-}MC_B) - E_A$ = _____.
- If efficiencies from the merger were any less, then UPP_A > 0 and P_A would _____.

Example: U.S. v. Electrolux & GE (2014)

- Electrolux tried to buy GE's home appliance business: ranges, cooktops, and wall ovens.

Example: U.S. v. Electrolux & GE (2014)

- Economist Michael Whinston computed estimates of $D_{AB}(P_B\text{-}MC_B)$, as percent of MC.
- Much higher than merging companies' claimed efficiencies, so UPP was clearly positive.
- Parties dropped merger.

$D_{AB}(P_B\text{-}MC_B)$	Electrolux	GE
Ranges	16%	15%
Cook-tops	47%	13%
Wall ovens	33%	17%

Conclusions

- Government sometimes evaluates unilateral effects of a horizontal merger by computing "_____" to determine if merger will increase or decrease price.
- This method assumes firms produce differentiated products in a price-setting (Bertrand) market.
- Same method can be used to compute hypothetical reduction in MC required to keep price constant.

OTHER WAYS TO EVALUATE MERGERS
Page 1

OTHER WAYS TO EVALUATE MERGERS

•How do Department of Justice and FTC evaluate horizontal mergers?

Effects on prices

- The FTC and DOJ have used a variety of methods to estimate the effect of mergers on prices, depending on circumstances and available data.
- Here, two are described:

(1) Auction bids (unilateral effects)

(2) Comparisons across markets (unilateral and coordinated effects)

---

(1) Auction bids

- In many industries, firms compete in auctions to supply products.
- If two firms frequently bid against each other, they can potentially raise price by merging.

Example

- Suppose Firms A, B, and C are bidding to supply a product.
- Likely winner will be Firm _____ and runner-up Firm _____.
- Likely winning price will be slightly below $_____.

Firm	Average cost
A	$12
B	$15
C	$20

Example (cont'd)

- Now suppose Firms A and B merge.
- Now likely winner will be Firm _____.
- Now likely winning price will be slightly below $_____.

Firm	Average cost
A	$12
B	$15
C	$20

Example: effect of merger

- Increase in price = gap between Firms B and C = $_____.

Firm	Average cost
A	$12
B	$15
C	$20

OTHER WAYS TO EVALUATE MERGERS
Page 2

Case: milk suppliers

- Four milk suppliers to schools in Wisconsin and neighboring areas: Dean Foods, Foremost, Kemps, and Prairie Farms.
- Dean and Foremost were often winner and runner-up, especially in northern Wisconsin.
- DOJ Antitrust Division therefore argued the merger would raise prices.

Baye, M. R., Hunter, G., & Walden, E. (2018). Case 7: Under the Radar: The Dean Foods-Foremost Farms Consummated Merger (2011) p. 147. In J. E. Kwoka, Jr. & L. J. White (Eds.), *The antitrust revolution: economics, competition, and policy* (7 ed., pp. 147-164). New York: Oxford University Press.

(2) Comparisons across markets

- Suppose merging firms compete in some regions but not others.
- One can predict the effects of a merger by comparing prices charged in regions where they compete with prices where they do not.

Case: office superstores in the 1990s

- In mid-1990s, there were three large chains of office superstores: Staples, Office Depot, and Office Max.
- Each operated hundreds of stores.
- In 1996, Office Depot proposed to merge with Staples.
- FTC computed Staples prices in various markets.

Case: office superstores in the 1990s

Benchmark market	Comparison market	Price reduction
Staples only	Staples, Office Depot	11.6%
Staples, Office Max	All 3 chains	4.9%
Office Depot only	Staples, Office Depot	8.6%
Office Depot, Office Max	All 3 chains	2.5%

Dalkir, S., & Warren-Boulton, F. R. (2018). Case 9: Prices, Market Definition and the Effects of Merger: Staples, Office Depot, and Office Max (1997, 2015, and 2016). In J. E. Kwoka, Jr. & L. J. White (Eds.), *The antitrust revolution: economics, competition, and policy (7 ed., pp. 189-210)*. New York: Oxford University Press. Table 9-2, p. 196.

Conclusions

- FTC and DOJ use a variety of methods to estimate the likely price increase resulting from a merger.
- Where merging firms frequently bid against each other, it can be estimated as the price gap between the _____ and other suppliers.
- Where merging firms compete against each other in some markets but not others, it can be estimated as the price difference _____ markets.

CONGLOMERATE MERGERS
Page 1

CONGLOMERATE MERGERS

- Why do firms engage in conglomerate mergers?
- When can conglomerate mergers harm competition?

What are conglomerate mergers?

- Combine firms which are neither direct competitors nor buyer-sellers.
- Subcategories
  - Market extension mergers
  - Product extension mergers
  - Pure conglomerate mergers

Market extension mergers

- Firms produce similar products in different markets.
- Possible motivation: *economies of scale,* cost savings from large scale production. (Similar to horizontal mergers.)
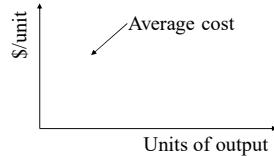
Examples of market extension mergers

- Bank of America and NationsBank (1998).
- Exxon and Mobil (1999)
- AT&T and BellSouth (2006).
- Delta Airlines and Northwest Airlines (2008).

Product extension mergers

- Firms produce related products that might be produced or marketed together.
- Possible motivation: *economies of scope,* cost savings from producing or marketing products together instead of separately.

Toothpaste only	Toothpaste and toothbrushes together	Toothbrushes only
$30 million		$30 million

Examples of product extension mergers

- Pepsico and Pizza Hut (1977).
- Travelers Group and Citicorp (1998).
- DuPont and Pioneer (1999).
- Pepsico and Quaker Oats (which owned Gatorade) (2001).

CONGLOMERATE MERGERS
Page 2

Pure conglomerate mergers

- Firms have no obvious relationship.
- Possible motivations:
1. *Better allocation of capital.* Internal management may have better information than external capital markets.
2. *Replace inefficient management* at acquired firm. Acquiring firm can replace board of directors and inefficient top management.

Example of pure conglomerate mergers

International Telephone & Telegraph (IT&T).
- Began as a telecommunication equipment manufacturer and telephone system operator.
- Acquired Hartford Fire Insurance, Continental Baking, Sheraton Hotels, etc.
- Has since spun off most businesses.

Example of pure conglomerate mergers (cont'd)

Berkshire Hathaway Inc.
- Began textile manufacturer.
- Acquired See's Candies, Nebraska Furniture Mart, Brown Shoe Group, GEICO, Dairy Queen, NetJets, MidAmerican Energy, Benjamine Moore Paint, Fruit of the Loom, Pampered Chef, etc.

Anticompetitive effects of conglomerate mergers

- Possibly facilitate anticompetitive practices such as reciprocal dealing and predatory pricing (to be discussed later in course).
- Possibly eliminate potential competition in an already highly concentrated market.
  - Threat of potential competition (new entry) may be only force keeping price low.

FTC v Procter and Gamble (1967)

- P&G was largest producer of soaps and detergents but did not produce bleach.
- Clorox was largest producer of household liquid beach.
  - 49% market share.
  - HHI > _____.
- P&G tried to acquire Clorox.

Why the Supreme Court ruled against the merger

- Said P&G could easily have entered the bleach market without acquiring Clorox.
- Found evidence that P&G's management had even considered doing so.
- Said few firms other than P&G could have challenged Clorox.
- Concluded that threat of entry by P&G was helping to keep Clorox's prices down in the highly concentrated bleach market. _____.

CONGLOMERATE MERGERS
Page 3

2023 Merger Guidelines

Guideline 4: Mergers Can Violate the Law When They Eliminate a Potential Entrant in a Concentrated Market.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 10.

Merger with potential entrant may be challenged

- "A merger that eliminates a potential entrant into a concentrated market can substantially lessen competition or tend to create a monopoly."
- "In general, expansion into a concentrated market via internal growth rather than via acquisition benefits competition."

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 10-11.

Conclusions

- Conglomerate mergers may be motivated by economies of scale or _____, better allocation of capital, or replacement of inefficient management.
- The main anticompetitive effect, as stated in the P&G case and the "Merger Guidelines," is elimination of _____ competition in a highly concentrated industry.

VERTICAL MERGERS AND TRANSACTION COSTS
Page 1

VERTICAL MERGERS AND TRANSACTION COSTS

•What is a "vertical" merger?
•Does it hurt or help society?

What is a vertical merger?

• Merger of firms in buyer-seller relationship.
• Also called "vertical integration."
• Buyer firm is called "_____ firm."
• Seller firm is called "_____ firm."
• After merger, market transactions are replaced by internal transactions.

Examples of vertical mergers

Coal mining company	Spark-plug manufacturer	Shoe manufacturer
+	+	+
Electric power company	Automobile manufacturer	Shoe retailer
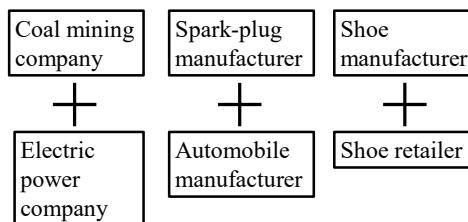
Key questions about vertical mergers

• Does the vertical merger increase profit?
• Does it decrease social welfare?
• Only if answers to both questions are _____ should we worry.

Why would a vertical merger be profitable?

As with horizontal mergers, there are two possibilities.
1. Production efficiencies.
2. Increased market power through anticompetitive unilateral effects or coordinated effects.

1. How could a vertical merger create production efficiencies?

• A downstream firm will merge with an upstream firm if it prefers to _____ (in-house) the supplies it needs, rather than _____ them on the open market ("outsourcing").
• If the merger merely lowers costs, then it also _____ social welfare.

VERTICAL MERGERS AND TRANSACTION COSTS
Page 2

Make or buy?

- Should an auto company make its own parts, or simply buy and assemble them?
- Should a supermarket chain own vegetable farms or simply buy vegetables on the open market?
- Should a university own and maintain its photocopy machines, or simply pay another firm to supply photocopying services?

Advantages of *buying*

- Lower supervision costs.
- Better _____. Each firm keeps profits from its efforts.
- For downstream (buying) firm, _____ may work to keep costs low.
- For upstream firm, opportunity to enjoy _____, selling to many firms.

Advantages of *making*

- Direct control.
- Fewer _____: no need for contract negotiation.
- Greater _____: don't need to keep to the contract if conditions change.

Another advantage of *making*: spreading risk

- Spread risk of failure.
  - If both firms engage in risky projects (such as research and development) then combining the firms spreads risk.
- Spread risk from price fluctuation.
  - If price of the product increases, seller firm _____ and buyer firm _____.
  - If price decreases, seller firm _____ and buyer firm _____.
  - If merged, no risk from price fluctuation.

Yet another advantage of *making*

- If both upstream and downstream firms are monopolies, final output price will be set too _____, above the monopoly price an integrated firm would choose.
- Bad for both producers and consumers.
- Problem is called "successive monopolies" or "double marginalization."

2. How could a vertical merger have anticompetitive effects?

Unilateral effects
- *Foreclosure,* that is, vertical merger for the purpose of harming or excluding rival firms.

Coordinated effects
- Vertical merger to facilitate *tacit collusion* through information-sharing.

VERTICAL MERGERS AND TRANSACTION COSTS
Page 3

Evolution of economic analysis

- *Traditional view:* Vertical mergers assumed to be anticompetitive and thus harmful to social welfare, without rigorous analysis.
- *Chicago School:* Rigorous analysis showed that under simple assumptions vertical mergers were either unprofitable or harmless to welfare.
- *Post-Chicago view:* Vertical mergers might be profitable and harmful to welfare under alternative assumptions.

Conclusions

- A vertical merger unites a _____ and a _____. After merger, some trade bypasses the market.
- Vertical mergers can sometimes reduce cost or eliminate successive monopolies—good for both _____.
- But vertical mergers might also have anticompetitive effects.

SUCCESSIVE MONOPOLIES AND DOUBLE MARGINALIZATION
Page 1

SUCCESSIVE MONOPOLIES AND DOUBLE MARGINALIZATION

- Suppose both upstream and downstream markets are monopolies.
- Does a vertical merger harm social welfare?

What are "successive monopolies"?

Successive monopolies = upstream firm (seller) and downstream firm (buyer) which are each monopolies in their output markets.

	Successive monopolies
Upstream market	Monopoly
Downstream market	Monopoly

Key questions about vertical merger of successive monopolies

- Does vertical merger of successive monopolies increase profit?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

Which is worse: two monopolies or one?

	Successive monopolies	Vertical integration
Upstream market	Monopoly	Monopoly
Downstream market	Monopoly	

A model of successive monopolies

Assumptions
- Upstream firm (seller) and downstream firm (buyer) are *both monopolies* in their output markets.
- Downstream firm uses upstream firm's product in *fixed proportion* with other inputs.

Implications of the model

- When monopolies sell to monopolies, final output price is too high to maximize profit: "double marginalization."
- We will show by example that profit can be increased *and* final price reduced with vertical merger.
- Problem first identified by Augustin Cournot (1838).

Cournot, A. A. (1838). *Recherches sur les principes mathématiques de la théorie des richesses*. Paris: Hachette. Chapitre IX «Du concours des producteurs».

SUCCESSIVE MONOPOLIES AND DOUBLE MARGINALIZATION
Page 2

Example: upstream firm

- Suppose a chip producer enjoys a monopoly for a special type of electronic chip.
- Assume average cost equals marginal cost = $MC_C = \$40$.
- Being a monopoly, however, the chip producer sets price at P_C _____ $40.

Downstream firm

- A downstream firm uses this chip to produce an electronic device for which it also enjoys a monopoly.
- Suppose each device requires one chip, plus other components costing $20 (including assembly).
- Thus marginal cost of device is
  $MC_D =$ _____.

Downstream firm's demand

- Suppose downstream firm faces demand of $P_D = 120 - (Q/1000)$.
- Implies MR_D

  = _____.
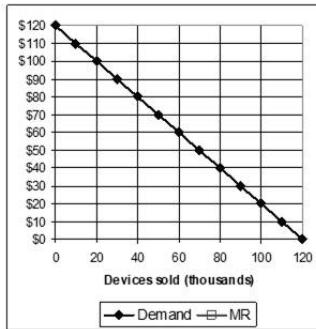
Downstream firm's output choice

- To maximize profit, downstream firm chooses Q so that $MC_D = MR_D$.
- So $P_C + 20 = 120 - (Q/500)$.

- Solve to get $Q =$ _____.

Upstream firm's demand

- This becomes upstream firm's demand curve:
  $Q = (100 - P_C) \, 500$.
- Solve for $P_C = 100 - (Q/500)$.
- Implies MR_C

  = _____.
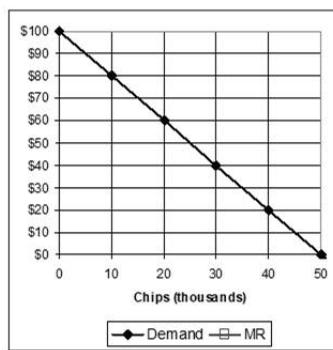
Upstream firm's output choice

- Set $MC_C = MR_C$
- So $40 = 100 - (Q/250)$.
- Solve to get
  $Q =$ _____.
- Substitute in demand to get $P_C =$ _____.
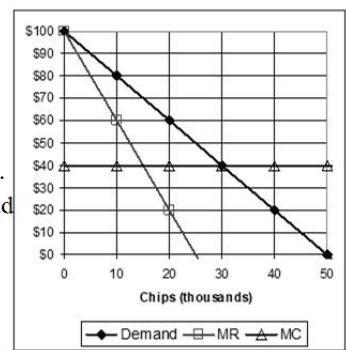
SUCCESSIVE MONOPOLIES AND DOUBLE MARGINALIZATION
Page 3

Downstream quantity and price with double marginalization

- Substitute Q=15,000 into demand for device
- $P_D = 120 - (Q/1000)$ = \$_____.
- Note that downstream firm's MC_D
  = $P_C + 20$
  = $70 + 20 =$ _____.
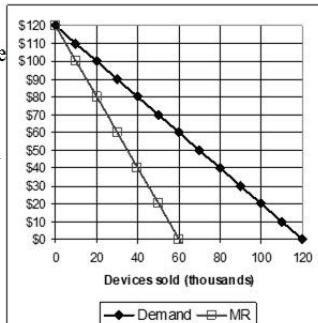
Profits with double marginalization

- Profit for upstream firm
  = (P_C-40) 15,000 = \$450,000.
- Profit for downstream firm
  = (P_D-P_C-20) 15,000 = \$225,000.
- Total profit both firms = \$_____.

Vertical integration

- Single firm now produces chip and device.
- Downstream demand and MR are still $P_D = 120 - (Q/1000)$,
  $MR_D =$
  _____.
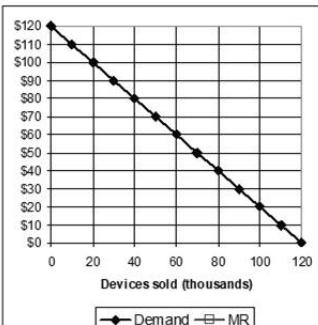
Vertical integration

- Single firm now produces chip and device.
- Downstream demand and MR are still $P_D = 120 - (Q/1000)$,
  $MR_D =$
  $120 - (Q/500)$ _____.
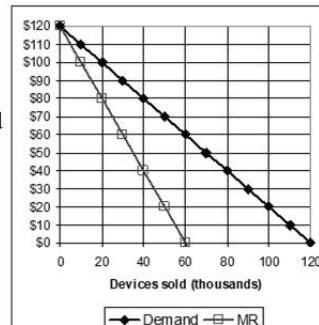
Vertically-integrated firm's output choice

- But now, MC_D
  = $40 + 20 =$ _____.
- Set $MC_D = MR_D$ or
  $60 = 120 - (Q/500)$.
- Solve to get
  Q = _____.
- Substitute in demand to get $P_D =$ _____.
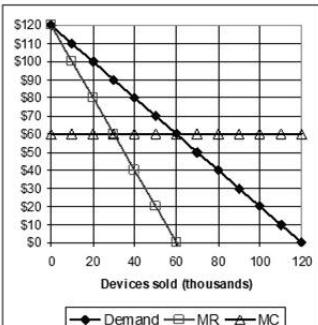
Profits and welfare with vertical integration

- Profit for vertically integrated firm
  = (P_D-60) 30,000 = _____.
- Firms are better off if they merge!
- Consumers are also better off: price of device is lower and quantity is higher!
- Since everyone is better off, vertical integration _____ social welfare.

SUCCESSIVE MONOPOLIES AND DOUBLE MARGINALIZATION
Page 4

Which is worse: two monopolies or one?

	Successive monopolies	Vertical integration
Upstream market	Monopoly	Monopoly
Downstream market	Monopoly	

Alternatives to vertical integration

- Special contractual arrangements might accomplish the same result.
- Upstream firm might lower its price to P_C=$40 and then charge an additional fixed annual fee to the downstream firm.
- Or upstream firm might impose some sort of maximum price P_D=$90 on downstream firm.

Conclusions

- Double marginalization occurs when both upstream and downstream firms enjoy market power (successive monopolies).
- Result is that final output price is too _____ to maximize total profits.
- If successive monopolies vertically integrate,
  - price _____, benefiting consumers,
  - profits _____, benefiting producers.

FORECLOSURE FOR MONOPOLY EXTENSION
Page 1

FORECLOSURE FOR MONOPOLY EXTENSION

- Suppose upstream market is a monopoly but downstream market is competitive.
- Can a vertical merger hurt society?

What is "foreclosure"?

- *Foreclosure* = vertical merger for the purpose of harming or excluding rival firms.
- Historically, this is the most frequent complaint against vertical mergers.
- The most extreme form of foreclosure is sometimes called "monopoly extension."

What is "monopoly extension"?

Monopoly extension = vertical merger for the purpose of using an existing monopoly in an upstream market to create a monopoly in a downstream market.

Upstream market	Monopoly		
Downstream market	Competitor	Competitor	Competitor

Key questions about vertical merger for monopoly extension

- Does extension of a monopoly through vertical merger increase monopoly profit?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

Which is worse?

	Upstream monopoly only	Monopoly extension
Upstream market	Monopoly	Vertically-integrated monopoly
Downstream market	Competition	

Alternative assumptions for analyzing monopoly extension

1. _____-proportions production in downstream industry.

2. _____-proportions production in downstream industry.
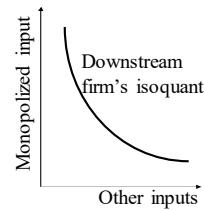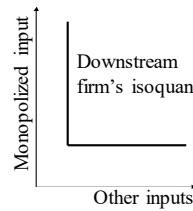
FORECLOSURE FOR MONOPOLY EXTENSION
Page 2

The fixed-proportions assumption

- Suppose upstream monopolist's output is used in *fixed* proportion with other inputs by downstream competitive firms.
- Must use a fixed amount of monopolist's product in each unit of output.
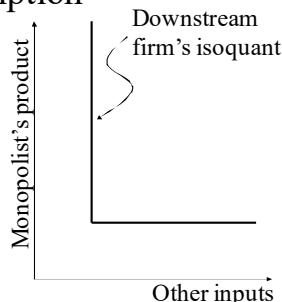
Examples of fixed-proportions production in downstream industries

- Upstream product = operating system, downstream product = _____.
- Upstream product = transmissions, downstream product = _____.
- Upstream firm = manufacturer, downstream firm = _____.

Implications of fixed-proportions assumption

- It can be shown that profit would *not* increase after monopoly extension.
- Monopoly in the upstream firm is sufficient to maximize profit—no need to monopolize downstream market.
- Numerical example follows.

Fixed-proportions: example

- Consider again the example of upstream chip-maker and downstream device makers.
- Chip-maker's marginal cost is $40.
- Device-maker's $MC_D = \$20 + P_C$ as before.
- This time, assume this time that downstream market is *competitive*, so $P_D = MC_D = $ _____.

Downstream demand

- As before, let downstream demand: $P_D = 120 - (Q/1000)$.
- Since downstream market is competitive, $P_D = MC_D = \$20 + P_C = 120 - (Q/1000)$.
- Solving gives $P_C = $ _____.

Upstream demand and marginal revenue

- Upstream demand is thus $P_C = 100 - (Q/1000)$.
- Upstream MR is thus $MR_C = $ _____.
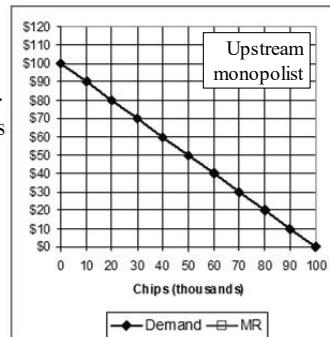
FORECLOSURE FOR MONOPOLY EXTENSION
Page 3

Upstream monopolist's output choice

- Set $MC_C = 40$
  $= MR_C$
  $= 100 - (Q/500)$.
- Solve to get $Q =$ _____.
- Substitute into demand equation to get $P_C =$ _____.
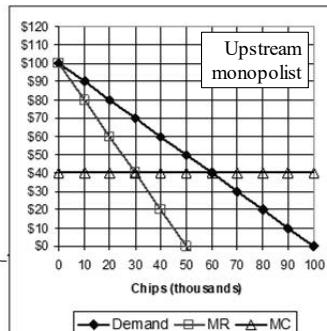
Profits under upstream monopoly only

- Profit $= (P_C - 40)\, 30{,}000$
  $= (70 - 40)\, 30{,}000 =$ _____.
- But this is the *same* profit we computed for the vertically-integrated firm in previous slideshow.
- Conclude monopoly extension does _____ increase profit or decrease social welfare in fixed-proportions case.

The variable-proportions assumption

- Suppose the upstream firm's product is used in *variable* proportion by the downstream industry.
- Downstream firms may substitute other inputs for the monopolized input and vice versa.
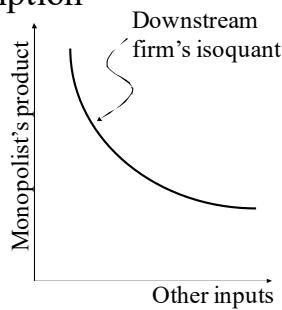
Examples of variable-proportions production in downstream industries

- Upstream product = aluminum, downstream product = _____.
- Upstream product = nylon thread, downstream product = _____.
- Upstream product = copier machines, downstream product = _____.

Inefficiency in the variable-proportions case

- Because upstream monopolist raises price, the downstream industry may substitute other inputs for the monopolized input.
- Price distortion causes inefficient input mix.
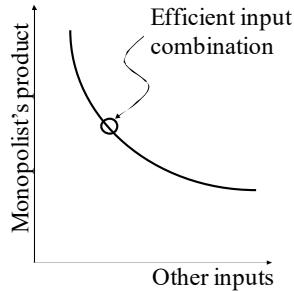
Price *may* rise in variable-proportions case

- Input proportions can be made efficient again by vertical merger.
- What about downstream price?
- No general results can be proven.
- However, in most plausible case, downstream price will _____.

FORECLOSURE FOR MONOPOLY EXTENSION
Page 4

Welfare tradeoff in variable-proportions case

- If price rises, we face classic tradeoff.
- Merger lowers cost, raises price.
- Must balance the two.

$/unit

Downstream demand

Old AC

New AC

Units of output
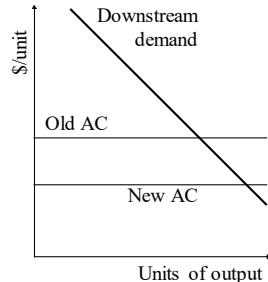
Which is worse?
Depends on downstream _____

	Upstream monopoly only	Monopoly extension
Upstream market	Monopoly	Vertically-integrated monopoly
Downstream market	Competition	

Conclusions

- Monopoly extension has no effect if the upstream firm's product is used in _____ proportion by the downstream industry.
- However, monopoly extension *may* be anticompetitive in the _____-proportions case.

OTHER KINDS OF FORECLOSURE
Page 1

OTHER KINDS OF FORECLOSURE

- Can vertical mergers be used to harm or exclude rival firms?
- Do such mergers harm society as a whole?

What is "foreclosure"?

- *Foreclosure* = vertical merger for the purpose of harming or excluding rival firms.
- We now consider less extreme foreclosure, when neither market is initially a monopoly.

Upstream market	Competitor	Competitor	Competitor
Downstream market	Competitor	Competitor	Competitor

Key questions about foreclosure through vertical merger

- Does foreclosure of downstream markets through vertical merger raise the profit of the acquiring firm?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

How might foreclosure be profitable *and* decrease welfare?

Unilateral effects
- Excluding rival firms.
- Raising rival firms' costs.

Coordinated effects
- Facilitating collusion through exchange of information. (Not covered here.)

Possible settings for foreclosure

1. Many upstream and downstream firms.
2. Complete foreclosure in one market.
3. Few upstream firms.
4. Vertical merger by all firms in both markets.
5. Merger of complements.
6. Diagonal merger.

1. Many upstream and downstream firms

Many firms in both industries, which are perfectly competitive.

Example:
- Upstream industry is furniture makers.
- Downstream industry is furniture retailers.

Upstream
Firm #1   Firm #2
Firm #3
Firm #4   Firm #5
Firm #6

Downstream
Firm A   Firm B   Firm F
Firm C
Firm E   Firm D
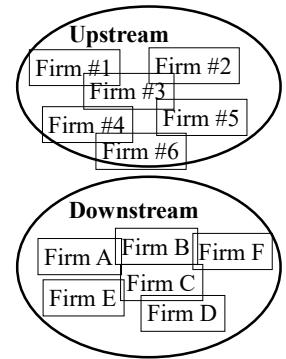
OTHER KINDS OF FORECLOSURE
Page 2

Many upstream and downstream firms (cont'd)

- Now suppose there is a vertical merger of a furniture maker and a furniture retailer.
- These firms now deal only with each other.
- Remaining market still competitive.

Upstream
Firm #1 Firm #2
Firm #3
Firm #4 Firm #5
Firm #6

Downstream
Firm A Firm B Firm F
Firm E Firm C
Firm D
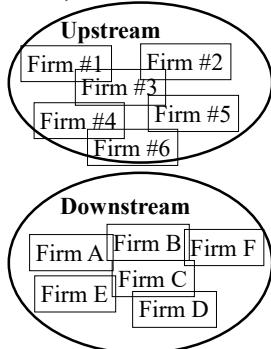
Many upstream and downstream firms: effects

- Demand and supply both shift left by the same amount.
- No change in price.
- No change in total quantity (including merged firm).

Demand by downstream firms

P

Supply by upstream firms

Q
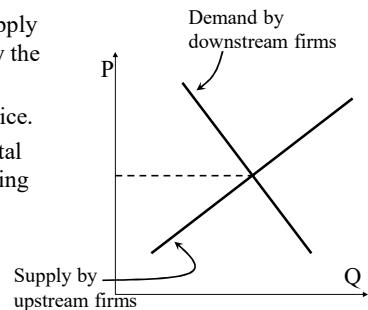
Should we worry about foreclosure if both markets remain competitive?

- Is it profitable?

- Does it decrease social welfare?

2. Complete foreclosure in one market

Again assume both industries initially are competitive.

Example:

- Upstream industry is orange growers.
- Downstream industry is orange juice producers.

Upstream
Firm #1 Firm #2
Firm #4 Firm #3

Downstream
Firm A Firm B Firm F
Firm E Firm C
Firm D
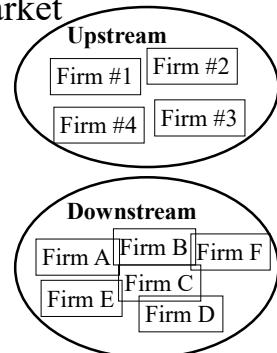
Complete foreclosure in one market (cont'd)

- Suppose one orange grower (#3) acquired ALL downstream orange juice makers (A-F).
- Result would be downstream _____.

Upstream
Firm #1 Firm #2
Firm #4 Firm #3

Downstream
Firm A Firm B Firm F
Firm E Firm C
Firm D
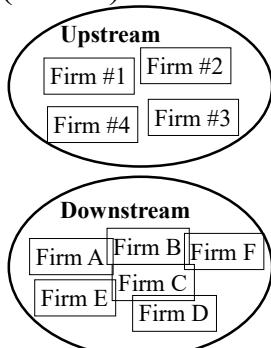
Should we worry about complete foreclosure?

- Is it profitable?
- Does it decrease social welfare?
- But even an unrelated firm could acquire all downstream firms to create a monopoly this way. The vertical component is irrelevant.
- In a sense, this is really a _____ merger.

OTHER KINDS OF FORECLOSURE
Page 3

3. Few upstream firms

Suppose upstream industry is not perfectly competitive, perhaps a Cournot oligopoly.

Example:
- Upstream industry is battery makers.
- Downstream industry is laptop computer makers.

Upstream
Firm #1   Firm #2   Firm #3

Downstream
Firm A   Firm B   Firm F
Firm E   Firm C
Firm D
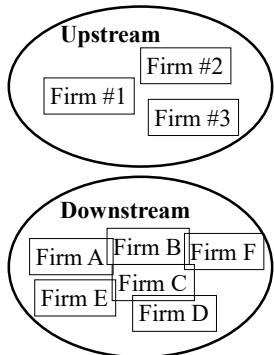
Few upstream firms (cont'd)

- Now suppose a computer maker (F) merges with a battery maker (3).
- This would _____ the number of remaining battery makers in the upstream industry.

Upstream
Firm #1   Firm #2   *Firm #3*

Downstream
Firm A   Firm B   *Firm F*
Firm E   Firm C
Firm D
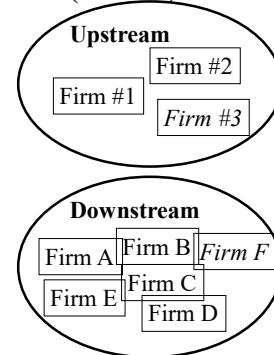
Raising rivals' costs

- Competition in the upstream battery industry would be further reduced.
- This would raise price of batteries.
- And thus raise _____ for the downstream firm's rivals A-E.

Upstream
Firm #1   Firm #2   *Firm #3*

Downstream
Firm A   Firm B   *Firm F*
Firm E   Firm C
Firm D
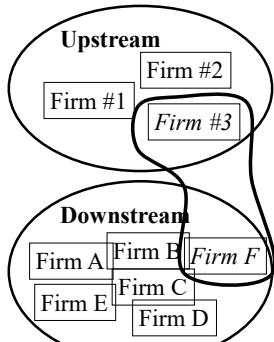
Few upstream firms: downstream product price

- Therefore, equilibrium price of computers will also _____.
- Integrated firm (#3+F) now has advantage in downstream computer market.

Upstream
Firm #1   Firm #2   *Firm #3*

Downstream
Firm A   Firm B   *Firm F*
Firm E   Firm C
Firm D
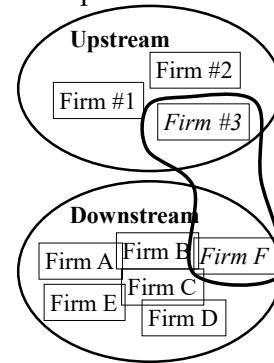
Should we worry about foreclosure with few upstream firms?

- Is it profitable?
- Does it decrease social welfare?

- But integrated firm's costs are reduced so it will likely _____.
- Also, remaining firms might also vertically integrate, _____ problem of imperfect competition in upstream market.

4. Vertical merger by all firms

Suppose roughly equal number of firms in both industries.

Example:
- Upstream industry is tire makers.
- Downstream industry is automobile makers.

Upstream
Firm #1   Firm #3
Firm #2

Downstream
Firm A   Firm C
Firm B
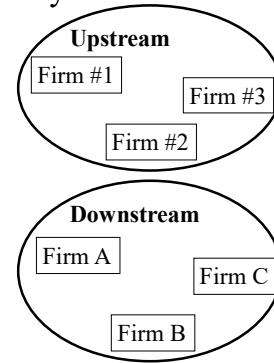
OTHER KINDS OF FORECLOSURE
Page 4

Vertical merger by all firms (cont'd)

- Suppose all firms in both upstream and downstream markets become vertically integrated and supply tires to themselves.

Upstream
Firm #1
Firm #3
Firm #2

Downstream
Firm A
Firm C
Firm B
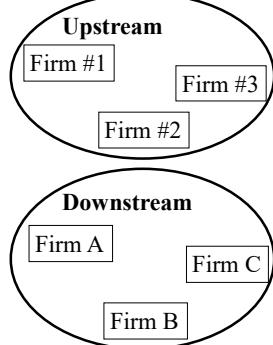
Should we worry about foreclosure through vertical merger by all firms?

- Then any new entrant would have to enter _____ tire and automobile industries simultaneously.
- Capital requirements would be larger, so might be a _____ to entry.
- Effect of merger might be to exclude potential rival firms.

---

5. Merger of complements

Suppose two upstream industries both supply a downstream industry.
Example:
- Upstream industry #1 is buttons.
- Upstream industry #2 is thread.
- Downstream industry is garments.

Upstream #1
Firm #1

Upstream #2
Firm #2
Firm #3

Downstream
Firm A
Firm C
Firm B
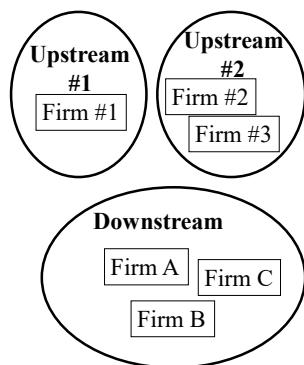
Merger of complements (cont'd)

- Suppose a button maker merges with a thread maker.
- Merged firm might offer discounted "package" price for buttons and thread to garment makers.

Upstream #1
Firm #1

Upstream #2
Firm #2
Firm #3

Downstream
Firm A
Firm C
Firm B
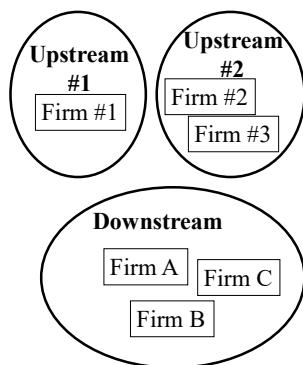
Should we worry about merger of firms producing complements?

- Merged firm might try to _____ unmerged upstream firms (here, #3).
- But if neither upstream industry was competitive before, then merged firm would have incentive to _____ each price to boost demand for the other product.
  - Situation is similar to successive monopolies.

---

6. Diagonal merger

Consider two substitute products and suppliers.
Example:
- Downstream industry #1 is leaf blowers.
- Downstream industry #2 is rakes.
- Upstream industry #1 makes critical part for leaf blowers.

Upstream #1
Firm #1

Downstream #1
Firm A
Firm B

Downstream #2
Firm C
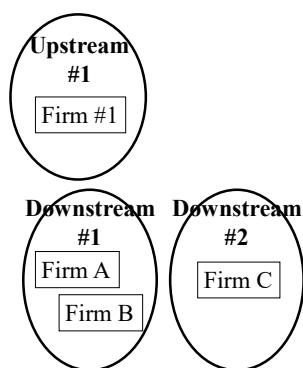
OTHER KINDS OF FORECLOSURE
Page 5

Diagonal merger (cont'd)

- Suppose Firm C (rakes) buys Firm #1 (leaf blower parts).
- Firm C has no use for output of Firm #1, so not a true vertical merger.

Upstream #1
Firm #1

Downstream #1
Firm A
Firm B

Downstream #2
Firm C
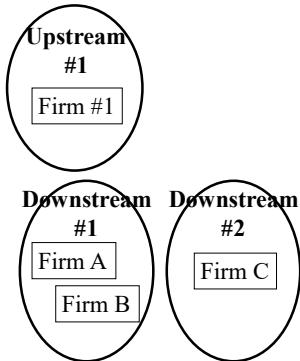
Should we worry about diagonal merger?

- Since not a true vertical merger, this merger cannot alleviate double marginalization.
- But to boost demand for its rakes, merged firm might try to _____ price of leaf blower parts, raising cost of leaf blowers.
- So might be profitable and decrease welfare.

Conclusions

- Vertical mergers can sometimes be profitable *and* decrease social welfare if they _____ rivals or _____ their costs.
- Effects on welfare can be complex and depend on details, especially
  - initial degree of competition,
  - production (fixed proportions or not).

LAW AND POLICY ON VERTICAL MERGERS
Page 1

LAW AND POLICY ON VERTICAL MERGERS

- What has been past policy on vertical mergers?
- What is current policy?

Law on vertical mergers

- As with horizontal mergers, key law is Clayton Act (1914) as amended by Celler-Kefauver Act (1950), which prohibits mergers whose effect is to "lessen competition."

Policy until late 1970s

- Courts attacked vertical mergers even when merging firms had fairly small market shares.
- Reflected traditional negative view of vertical mergers, without careful economic analysis.
- *Brown Shoe Co. v US*: Supreme Court prevented merger with Kinney, a shoe retailer (1962).
- *Ford Motor Co. v US*: Supreme Court prevented merger with Electric Autolite, a spark plug maker (1972).

Policy in 1980s and early 1990s

- DOJ and FTC became extremely lenient on vertical mergers.
- Reflected Chicago School view that vertical mergers were _____ or _____, based on simple models (successive monopolies, monopoly extension).
- Only one vertical merger stopped in 12 years of Reagan and Bush Administrations.

Current policy

- In between: less aggressive than 1960s but slightly more aggressive than 1980s.
- Reflects subtle models of post-Chicago view (exclusion, raising rivals' cost).
- Does not reject concept of double marginalization, but recognizes other forces at work.

https://www.justice.gov/atr/merger-enforcement

Example: Time Warner and Turner Broadcasting System (1995)

- Merger with important vertical component.
- Turner: producer of programming.
- Time Warner: 2nd largest cable television system operator (and producer of some programming).

Program producer

+

Cable television system operator
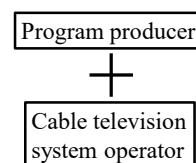
LAW AND POLICY ON VERTICAL MERGERS
Page 2

TCI, a third company, also involved in merger

- TCI: largest cable television system operator (and producer of some programming).
- TCI already owned 7.5% of Turner Broadcasting, and so would own part of merged company.
- Together, Time Warner and TCI would have 40% market share of programming and 44% market share of cable systems.

Time Warner and Turner Broadcasting System: outcome

- FTC feared that TCI and Time Warner together would foreclose market for programming.
- In fact, research shows vertically integrated cable companies offer fewer programming channels and favor their own.*
- So FTC required merged company to purchase more outside programming.

* Chipty, T. (2001). Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry. *American Economic Review, 91*(3), 428-453.

2023 Merger Guidelines

Guideline 5: Mergers Can Violate the Law When They Create a Firm that May Limit Access to Products or Services That Its Rivals Use to Compete.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 13.

Foreclosure

- 2023 Guidelines are mostly concerned about foreclosure for monopoly extension.
- Whether vertical integration might be used to exclude rivals entirely from the market, or just raise rivals' costs.

Upstream market	Monopoly		
Downstream market	Competitor	Competitor	Competitor

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. pp. 13-15.

Barriers to entry

- 2023 Guidelines also concerned whether vertical integration might create barriers to entry.
- Entrants might have to enter both markets simultaneously.

Upstream
Firm #1
Firm #3
Firm #2

Downstream
Firm A
Firm C
Firm B
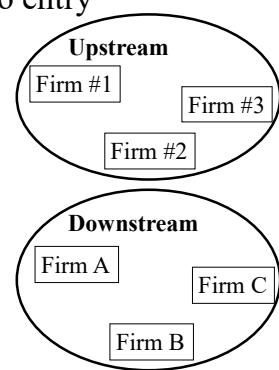
Merger guidelines. p. 15.

Lessening of competition

- 2023 Guidelines also concerned whether vertical integration might facilitate coordination in either upstream or downstream market.
- Upstream division might be able to observe downstream rivals more closely.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines*. p. 17.

LAW AND POLICY ON VERTICAL MERGERS
Page 3

Efficiencies

- 2023 Guidelines recognize that vertical mergers can benefit consumers by eliminating double _____.
- But DOJ and FTC consider whether contracts short of merger could accomplish same thing.

Source: U.S. Department of Justice, & U.S. Federal Trade Commission. (2023). *Merger guidelines.* p. 16.

Conclusions

- Until the late 1970s, courts aggressively opposed vertical mergers with little economic analysis.
- In the 1980s and early 1990s, vertical mergers were treated very leniently, inspired by Chicago School view.
- Today, vertical mergers may be challenged if they allow merged firm to _____ rivals, raise rivals' _____, create _____ to entry, or facilitate _____.

VERTICAL RESTRAINTS
Page 1

VERTICAL RESTRAINTS

- What are "vertical restraints"?
- Why do firms impose them on their customers?
- Are they illegal?

What are vertical restraints?

- *Vertical restraints* = restrictions imposed on downstream firms (usually _____) by an upstream firm (usually a _____) as a condition of doing business.
- Vertical restraints are a rough substitute for vertical mergers. Upstream firm exerts partial, not complete control over downstream firm.

Upstream market	Competitor	Competitor	Competitor
Downstream market	Competitor	Competitor	Competitor

Types of vertical restraints

1. _____: manufacturer requires retailers to sell at particular price.
2. _____: manufacturer assigns exclusive territories to retailers.
3. _____: retailers required to buy all supplies from same manufacturer.
4. _____: downstream firms purchasing one item from manufacturer are required to purchase other items as well.

---

1. Resale price maintenance (RPM), also called "Fair Trade"

- RPM can in principle be either a minimum price or maximum price.
- *Maximum* retail price easy to understand: manufacturer …
  - wants to sell as many units as possible.
  - may fear "_____ monopolies," so may compel retailers to keep price low.
  - But NOT focus of law and policy.

RPM: the minimum price case

- *Minimum* retail price harder to understand. Wouldn't it *reduce* sales?
- Possible explanations:
  - Marketing and promotion by retailers.
  - Quality certification by retailers (similar).
  - Cartel forced on manufacturer by retailers.

RPM: marketing and promotion explanation

- If manufacturer imposes a minimum price above cost, then retailers are forced to compete on dimensions other than price.
- Retailers will offer attractive showrooms, test models, attentive and informed sales personnel, etc. which will _____ total sales.

Lester Telser, "Why should manufacturers want fair trade?" *Journal of Law and Economics*, Vol 3 (October 1960), pp. 86-105.

VERTICAL RESTRAINTS
Page 2

RPM: marketing and promotion explanation (cont'd)

- Without RPM, some retailers would offer only basic service.
- Customers would visit showroom retailers for information, then turn to barebones discount retailers or online stores for purchase.
- Basic discount retailers would thus "_____" on showroom retailers.

RPM: quality-certification explanation

- High-quality retailers certify to consumers the quality and stylishness of the brands they carry (e.g., Lenox brand china).
- Manufacturers wishing to enter a market with a high-end product use RPM to entice high-quality retailers to carry their brand.

Howard P. Marvel and Stephen McCafferty, "Resale price maintenance and quality certification," *The RAND Journal of Economics*, Vol. 15, No. 3 (Autumn 1984), pp. 346-359.

RPM: cartel explanation

- Retailers somehow force RPM on manufacturer.
- RPM is really a device for maintaining a cartel at the retail level.
- But does this explanation make sense?
  - Why would the manufacturer agree?
  - How can the cartel stave off competition from other brands?

Legal status of RPM

- RPM *per se* illegal from *Dr. Miles v. Dohn D. Park & Sons* (1911) case until 2007.
- However, there had to be explicit _____ between manufacturer and retailers.
  - Courts still permitted manufacturers to unilaterally stop doing business with retailers who set prices too low.*
- In 1937, Miller-Tydings Act permitted states to legalize RPM if they passed "Fair Trade" laws.

*U.S. v. Colgate & Co., 250 U.S. 300 (199).

Later developments in RPM

- Congress repealed Miller-Tydings Act in 1975, effectively making RPM *per se* illegal in all states.
- Then Supreme Court reversed *Dr. Miles* in *Leegin v. PSKS Inc.* (2007).
- RPM now judged under _____.

2. Territorial restraints

- Manufacturer assigns territories to retailers, protecting them from competition from other retailers of the same brand.
- Common in auto industry.

VERTICAL RESTRAINTS
Page 3

Territorial restraints: explanations

- Benefits to manufacturer may be similar to RPM—encourage marketing and promotion.
- Another possible benefit is to allow retailers to enjoy economies of scale.
- Alleged anticompetitive effect also similar to RPM—device for maintaining a cartel at the retail level.

Legal status of territorial restraints

- _____ applies.
- Key case is *Continental TV Inc. v. GTE Sylvania* (1977).
- Generally permitted.

---

3. Exclusive dealing

- Buyer and seller sign contract requiring buyer to purchase all supplies from that same seller.
- Buyer usually receives a payment or discount in return.
- Buyer may pay a penalty for purchases from other sellers.

Key questions about exclusive dealing

- Does the exclusive dealing contract increase profit of both buyer and seller?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

Possible motivations for exclusive dealing

- Motivation may be same as vertical integration: better coordination of product design, etc.
- Motivation may also be to foreclose rivals.
- Whether social welfare increases depends on which motivation is more important.

Exclusive dealing as foreclosure

- In signing exclusive-dealing contract, buyer essentially agrees to a monopoly.
- But loss of buyer surplus > gain in monopoly profit.
- Puzzle: why sign contract if net benefit is negative?
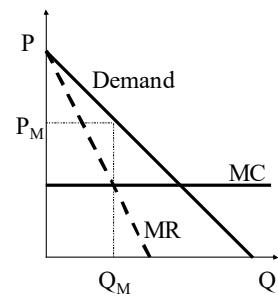
VERTICAL RESTRAINTS
Page 4

Chicago School's skeptical view of exclusive dealing

- Net benefit is negative UNLESS the exclusive-dealing contract provides some other benefit, such as coordination.
- The value of that coordination must greater than the deadweight loss, or there is no room for a deal.
- But if that value is greater than deadweight loss, the contract _____ social welfare.

Post-Chicago view of exclusive dealing

- In many markets, new firms must pay fixed costs to enter a market.
- So entrants need a minimum market share to survive.
- Economic models incorporating fixed entry costs show that exclusive-dealing contracts can be acceptable to both parties AND forestall entry AND reduce social welfare.

Law on exclusive dealing

Clayton Act (1914) section 3:

"It shall be unlawful … to lease or make a sale or contract for sale of goods … on condition … that the lessee or purchaser thereof shall not use or deal in the goods … of a competitor … where the effect … may be to substantially lessen competition or tend to create a monopoly."

https://www.law.cornell.edu/uscode/text/15/14

Courts' treatment of exclusive dealing

- In early cases, courts automatically viewed most exclusive-dealing contracts as anti-competitive.
- In later cases, courts made exceptions if contracts affected only small fractions of the total market.
- Now courts require clear evidence that seller has _____, and that contract lessens competition.

Important cases: U.S. v. Visa (1999)

Facts:
- Visa and Mastercard combined market share was about 73%.
- Visa and Mastercard prohibited member banks from issuing cards of certain competitors, including American Express and Discover.

Outcome:
- Visa and Mastercard were required to eliminate prohibition from contracts.

EU v. Intel (2009) U.S. v. Intel (2010)

Facts:
- In market for CPUs, Intel's market share > 80% and AMD's market share < 15%.
- Intel offered rebates to OEMs (IBM, Dell, HP, etc.) if they bought > 95% of their CPUs from Intel.

Outcome:
- Intel was ordered to stop rebates, and not retaliate if OEMs bought from AMD, and pay $2 billion in fines and damages to AMD.

VERTICAL RESTRAINTS
Page 5

> ## Conclusions
>
> - Vertical restraints are restrictions placed on downstream (buyer) firms by an upstream (seller) firm.
> - Both positive and negative effects on social welfare have been claimed.
> - Formerly RPM was _____ illegal.
> - Now RPM, like territorial restraints, is judged under _____.
> - Exclusive dealing is _____ if seller has market power.

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TYING
Page 1

TYING

- What is "tying"?
- Why do firms tie their products?
- How have courts treated tying?

What is "tying"?

- *Tying* = downstream firms that purchase one item from manufacturer are required to also purchase other items as well.
- Purchases of one item are *tied* to purchases of other items.
- Synonym: _____.

Types of tying: examples

- *Variable proportions:* If you buy our machine (the _____ product) you must also buy our supplies for that machine (the _____ product).
- *Fixed proportions:* If you (a theatre) book one of our movies, you must simultaneously book another movie—the movies are a tied package or _____.

Explanations of tying

1. Competitive markets
   1A. Efficient distribution
   1B. Quality control
   1C. Evasion of price controls
2. Tying product is monopolized
   2A. Price discrimination—variable proportions
   2B. Price discrimination—fixed proportions
   2C. Extension of monopoly

Explanations of tying: 1A. Efficient distribution

- Some products are less costly to sell as a package.
- Almost everyone wants both items, so transaction costs are reduced by tying.
  - Cars are sold with _____.
  - Computers are sold with _____.
  - Left shoes are sold with _____.

Explanations of tying: 1B. Quality control

- Suppose an upstream firm sells a machine (the _____ product).
- Upstream firm believes that if poor-quality supplies are used, machine will perform poorly.
- Customers might blame machine. This would harm reputation ("goodwill") of upstream firm.
- So upstream firm requires customers to also buy supplies (the _____ product) from it.

TYING
Page 2

Explanations of tying:
1C. Evasion of price controls

- Suppose tying product's price is controlled by law.
- Upstream firm could exploit excess demand by requiring customers to also purchase an overpriced tied product.
- Example: Suppose there is a price ceiling on gasoline, causing excess demand. Gasoline station requires customers who want to buy gasoline to also buy an expensive drink.

What is "price discrimination"?

- *Price discrimination* = monopolist charges _____ prices to different customers, according to willingness to pay.
- Some customers get higher prices than with ordinary monopoly.
- Other customers may get lower prices.
- Effect on social welfare is uncertain.

Explanations of tying:
2A. Price discrimination—variable-proportions

- Suppose heavy users of a machine are willing to pay more for the machine than light users.
- Monopolist can set higher price for heavy users than for light users by requiring all users to purchase supplies from monopolist.
- Simply set price of supplies _____ cost.
- Then heavy users effectively pay _____ for machine.

Explanations of tying:
2B. Price discrimination—fixed-proportions

- Suppose willingness-to-pay for goods A and B is negatively correlated.
- Some customers are willing to pay a lot for good A, but little for good B.
- Other customers are willing to pay a lot for good B, but little for good A.

George Stigler, "A Note on Block Booking," in Stigler, *The Organization of Industry*, Chicago: University of Chicago Press, 1968, pp. 165-170.

Price discrimination in the fixed-proportions case: example

- Suppose two theatres are willing to pay the following for movies. Assume MC=0.
- If film distributor (upstream firm) must price them separately, it will price action movie at _____ and romantic comedy at _____, for total revenue of _____.

Willingness to pay	Action movie	Romantic comedy
Downtown theatre	$100	$50
Suburban theatre	$70	$120

Price discrimination in the fixed-proportions case: example (cont'd)

- If the film distributor can price them as a bundle, it will set the bundle price at _____, for total revenue of _____.

Willingness to pay	Action movie	Romantic comedy	Bundle
Downtown theatre	$100	$50	
Suburban theatre	$70	$120	

TYING
Page 3

Explanations of tying:
2C. Extension of monopoly

- Suppose market for product A is a monopoly, but market for product B is competitive.
- Monopolist might tie product A to product B, hoping to gain a monopoly for product B.
- Tying can exclude competitors from market for product B.

Legal status of tying

- Supreme Court said tying was *per se* illegal in 1958, under Section 1 of Sherman Act.
- Since then, Court has become more lenient.
- Tying is now usually illegal, but may be judged legal if firm has no _____ in tying product.
- *Quality control* has sometimes been used as a successful defense.

Conclusions

- Most common motivations for tying are probably efficiency, quality control, and price discrimination.
  - _____ serious threats to social welfare.
- But tying could be used for monopoly extension.
- Courts have found that tying is _____ illegal, with a few exceptions.

LAW ON MONOPOLIZATION
Page 1

LAW ON MONOPOLIZATION

• What exactly does the Sherman Act Section 2 forbid?

Sherman Act Section 2

• "Every person who shall monopolize, or attempt to monopolize ... any part of the trade or commerce among the several states, or with foreign nations … shall be deemed guilty of a felony."
• Note that "monopolizing" is forbidden, but being a _____ is not.

Awkward problem for enforcement

• How to distinguish socially-harmful "monopolization" from socially-beneficial competition?
• "The successful competitor, having been urged to compete, must not be turned upon when he wins."*

*United States v. Aluminum Co. of America, 148 F 2nd 416 (2d Cir. 1945).

Distinguishing "monopolization"

Rule of reason is used by courts to detect "monopolization."
In general, courts use two-part test.
1. *Possession of market power*: power to raise price.
2. *Intentional acquisition*: actions taken to exclude rivals.

Standard Oil Co. of New Jersey v. United States, 221 U.S. 1 (1911).
United States v. Grinnell Corps., 384 U.S. 563 (1966).

1. Ways to determine possession of market power: market share

• Courts traditionally focus on this.
• First define the market.
• Then determine firm's market share.
• If market share is above some threshold, then conclude firm has market power.

How to define the "market"

• In principle market should include *all products and firms that a hypothetical cartel would need to control, in order to raise price permanently.*
• "Market" should include close substitutes in _____.
• Should also consider _____-side substitution, too. What firms would supply the market if price where raised?

LAW ON MONOPOLIZATION
Page 2

Misplaced focus?

- In real world, market boundaries not sharp.
- But determining which products and firms are in the market may be wrong approach.
- Question is not *whether* a firm faces close substitutes, but *how* close they are.
- Question is not *whether* a firm has potential rivals, but *how quickly* they could respond to a price increase by increasing their output.

Ways to determine possession of market power: Lerner index

- Let ε = the _____ long-run demand elasticity.
- Then $L = (P-MC)/P = 1/|\varepsilon|$, measures firm's market power.
- Most reliable measure of market power, if ε can be estimated.
- For competitive firm, $\varepsilon = -\infty$, so $L =$ ____.

2. Ways to determine intent to monopolize

Infer intent from exclusionary practices, such as
- *Predatory pricing.*
  - But must somehow distinguish this from vigorous competitive pricing!
- *Refusal to deal*.
- *Other practices* tending to exclude rivals.

Conclusions

- Sherman act forbids "monopolizing," not being a monopoly.
- Courts use a two-part test:
  1. _____ of monopoly power, traditionally measured by _____.
  2. _____ to acquire monopoly—actions taken to exclude rivals.

HISTORIC MONOPOLIZATION CASES
Page 1

HISTORIC MONOPOLIZATION CASES

- How have the courts treat monopolization cases?
- What evidence has been necessary to show intent to monopolize?

Evolution of policy

- 1890-1940. Courts required evidence of both large market share and abusive or predatory conduct showing intent to monopolize.
- 1940-1970. Market share important. Evidence of abusive or predatory acts not required to show intent.
- 1970-present. Courts more lenient, more skeptical of intent.

Standard Oil v. US (1911)

- Standard Oil grew from 1872 to 1899 to control 90% of US refining capacity by acquiring more than 120 rivals.
- Accused of predatory pricing, buying up pipelines, industrial espionage, etc.
- Supreme Court found that these tactics demonstrated intent to monopolize.
- Standard Oil found guilty and dissolved into 34 separate companies.

Standard Oil Co. of New Jersey v United States, 221 U.S. 1 (1911)

US v. United States Steel (1920)

- US Steel formed through chain of mergers in 1901, giving it 65% share of steel output.
- Judge E H Gary, Chairman of US Steel, held dinners with other steel leaders to create goodwill and stabilize prices.
- Falling market share and lack of predatory behavior led Supreme Court to acquit in 1920.
- "… the law does not make mere size an offense…"

United States v. United States Steel Corp., 251 U.S. 417 (1920).

US v. Alcoa (1945)

- Alcoa dominated primary aluminum ingot sales in US due to
  - patents on production process (through 1909)
  - ownership of key bauxite reserves,
  - economies of scale in extracting alumina from bauxite.
- 2nd Circuit Court was designated court of last resort due to lack of quorum on Supreme Court.
- Opinion written by Judge Learned Hand.

United States v. Aluminum Co. of America, 148 F. 2d 416 (2d Cir. 1945).

US v. Alcoa (1945): Stages of production

- As competition to Alcoa, "secondary" producers produced ingots from scrap aluminum.
- Fabricators bought aluminum from Alcoa to make into aluminum products.
- Alcoa produced some ingots for internal use in its own fabrication plants.

Bauxite mining

↓

Alumina extraction from bauxite

↓

Primary aluminum ingot production from alumina

↓

Fabrication of ingots into aluminum products
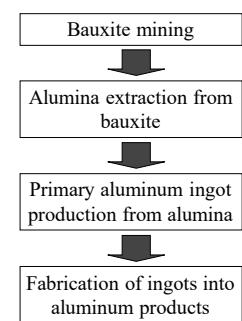
HISTORIC MONOPOLIZATION CASES
Page 2

US v. Alcoa (1945): How to measure Alcoa's market share?

Alcoa's rivals

Alcoa

Bauxite mining

Imports of aluminum ingots

Secondary ingot producers from scrap aluminum

Alumina extraction from bauxite

Primary aluminum ingot production from alumina

Rival fabricators making aluminum products

Fabrication of ingots into aluminum products
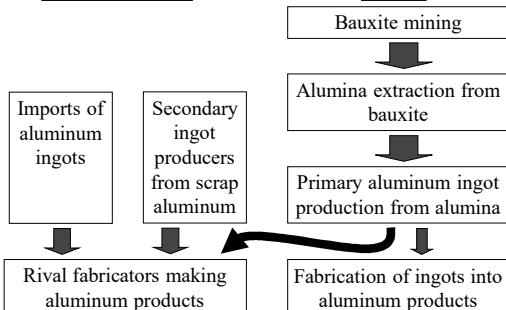
US v. Alcoa (1945): market definition and market share

Judge Hand considered three alternatives.

$$\frac{\text{Alcoa's ingot sales}}{\text{Total primary} + \text{Secondary} + \text{Imports}} =$$

$$\frac{\text{Alcoa's ingot sales} + \text{Internal use}}{\text{Total primary} + \text{Secondary} + \text{Imports}} =$$

$$\frac{\text{Alcoa's ingot sales} + \text{Internal use}}{\text{Total primary} + \text{Imports}} =$$

US v. Alcoa (1945): judgment

- Judge Hand chose the last market definition, implying a _____ market share.
- Moreover, Judge Hand found intent was shown simply by Alcoa's pattern of building capacity ahead of demand. Evidence of predation was unnecessary.
- Alcoa found guilty but not dissolved. Instead, government sold its own wartime aluminum plants to new entrants.

US v. United Shoe Machinery (1953)

- United Shoe held 75% to 85% market share of shoe manufacturing machinery.
- Company held extensive patents.
- Company never sold its machines, but leased them for 10 years with some restrictions. Provided free repairs. Required that lessees had to use its machinery if work was available.

United States v. United Shoe Machinery Corp., 110 F. Supp. 295 (D. Mass. 1953).

US v. United Shoe Machinery (1953): judgment

- Court admitted that "United's power does not rest on predatory practices," but still criticized its leasing policies.
- United found guilty, ordered to sell as well as lease its machines, modify terms of leases, and divest some assets.
- However, unclear whether United Shoe's leases really were anticompetitive.

Berkey Photo v. Kodak (1979)

- Eastman Kodak made cameras, film, and provided photofinishing services. Had 60%-90% shares of most segments.
- Berkey, a photofinisher, claimed that Kodak exploited its vertical integration to hurt its rivals in film and photofinishing.
- Cited Kodak's surprise introduction of the 110 compact camera system, which required new Kodacolor II film.
- Berkey said Kodak should have disclosed information to rivals before introduction.

Berkey Photo, Inc. v. Eastman Kodak Co., 603 F. 2d 263 (2d Cir. 1979).

HISTORIC MONOPOLIZATION CASES
Page 3

Berkey Photo v. Kodak (1979): sharing information

- Circuit court decided Kodak did _____ have a duty to predisclose information acquired through its own investment in research and development.
- A vertically-integrated firm does not "offend the Sherman Act whenever one of its departments benefits from association with a division possessing a monopoly in its own market."

Berkey Photo v. Kodak (1979): competing aggressively

- Retreated from Alcoa standard, admitted right of dominant firm to "compete aggressively."
- Case decided in favor of Kodak. Supreme Court declined to review.

US v. IBM

- Dept of Justice filed case in 1969.
- Enormous resources expended before case dismissed in 1982.
- IBM was unquestionably the dominant firm in computers, but government and IBM disagreed about market definition.

US v. IBM (cont'd)

- Government alleged IBM's practices were intended to exclude rivals.
- Included leasing, bundling, selling special low-priced "fighting machines," tying products, etc.
- However, in 1982 government decided it could not win.

Conclusions

- Early government victories against Standard Oil (and American Tobacco) were based on both market share and _____.
- Mid-century victories against Alcoa and United Shoe required _____ evidence of abusive conduct to prove intent.
- In recent cases, courts have required more evidence of intent.

PREDATORY PRICING
Page 1

PREDATORY PRICING

- What is "predatory pricing"?
- Why is it controversial?

Example

- In 1994, Frontier Airlines entered the Billings-Denver route with a fare of about $100.
- Incumbent United Airlines had been charging about $200, but lowered its fare to about $100. A year later, Frontier withdrew from the route.
- United Airlines raised its fare within 6 months to over $200.
- Is this vigorous competition or anti-competitive behavior?

Average One-Way Fares for Selected Carriers: Billings (BIL) - Denver (DEN)
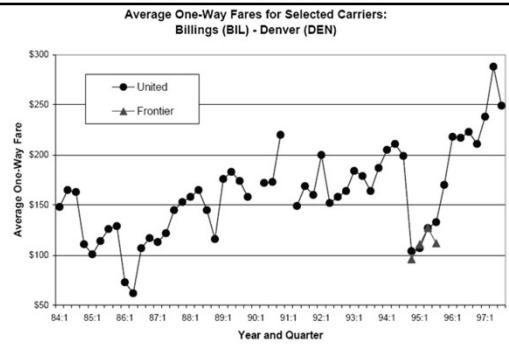
Source: Author's calculations using fare data in U.S. Department of Transportation, Data Bank 1A.

Steven A. Morrison, "New Entrants, Dominated Hubs, and Predatory Behavior," statement before Subcommittee on Aviation, Committee on Commerce, Science, and Transportation, United States Senate, April 23, 1998.
http://www.economics.neu.edu/morrison/research/senate980423.pdf .

What is "predatory pricing"?

- *Predatory pricing* = increasing quantity and cutting prices in order to
  - force rival firms to exit or merge.
  - deter entry by making an example.
  - discipline uncooperative firms in a cartel or tacit cartel.

Predatory pricing similar to dumping

- Predatory pricing is similar to "dumping" in international trade.
- "Dumping" means exporting a product at a price below cost, in order to drive out rival producers in the importing country.

Pricing below cost need not be predatory

- Companies often offer new products at "promotional pricing" or give away free samples to build demand.
- Two-sided networks (newspapers, Facebook) offer access below cost or for free, but charge for advertising.
- Purpose is obviously not to force exit or deter entry.

PREDATORY PRICING
Page 2

Key questions about predatory pricing

- Is predatory pricing profitable?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

Predatory pricing is costly

- Predator must set price below profit-maximizing level.
- Makes losses (or at least reduced profit) until rival exits.
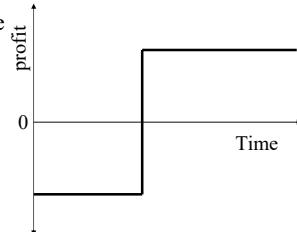
Importance of recoupment

- Predation is profitable *only if* price can later be raised to yield monopoly profits.
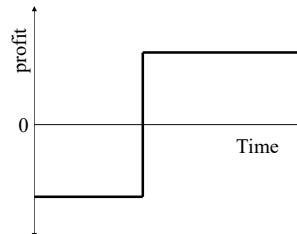
McGee's critique of predatory pricing

- McGee (1958), in famous study of the Standard Oil case of 1911, questioned whether company really engaged in predatory pricing.
- Argued that predatory pricing would have been too _____ to be profitable for the following reasons.

John S. McGee, "Predatory Price Cutting: The *Standard Oil* (N.J.) Case," *Journal of Law and Economics*, Vol. 1 (October 1958): 137-69.

McGee's critique of predatory pricing (cont'd)

1. *Cost:* Predator usually has larger output than victim. Thus losses are _____ for predator than for victim.
   - Predator must have a "deep pocket" to finance losses for an extended period.
   - If target firm is truly more efficient, capital markets should provide necessary financing to resist predator.

McGee's critique of predatory pricing (cont'd)

2. *Effectiveness:* Predator must prevent victim from re-entering (or another rival from entering) the market when price is finally raised.
3. *Alternatives:* Cheaper to buy out the target firm (though this would not deter entry by other firms).

PREDATORY PRICING
Page 3

Impact of McGee's critique

- For many years after McGee, most economists were skeptical of predatory pricing.
- Predatory pricing did not seem to be both _____ and _____.

Post-Chicago responses to McGee

1. *Cost:* Capital markets may not be efficient enough to finance target firm's resistance.
   - Potential lenders (banks, investors) may not have enough information to evaluate target firm's management.
   - May not be able to determine whether losses are due to predation attempt, or some long-term problem.

Post-Chicago responses to McGee (cont'd)

2. *Effectiveness:* Reputation models can explain why re-entry is deterred (see next slideshow).
3. *Alternatives:* Predatory pricing may have reduced Standard Oil's cost of acquiring target firms. (Of course, such mergers would probably be challenged today.)

Conclusions

- Predatory pricing means increasing quantity and lowering price to drive out a rival or deter entry.
- To be profitable, predation must be followed by a period of _____.
- McGee (1958) argued that predation is too costly to be in the predator's interest.
- But recent game-theory models show that predatory pricing can be both _____ and _____.

REPUTATION MODELS OF PREDATORY PRICING
Page 1

REPUTATION MODELS OF PREDATORY PRICING

•When might predatory pricing be both profitable and bad for social welfare?

Definition of predatory pricing

• Increasing quantity and cutting prices in order to
  • force rival firms to exit or merge.
  • deter entry by making an example.
  • discipline uncooperative firms in a cartel or tacit cartel.

Asymmetric information

• Definition: Information known by some but not all economic agents.
• Beginning in the 1970s, asymmetric information was shown to cause a variety of market imperfections.
• _____-Chicago asymmetric information models show that predatory pricing may be profitable if incumbent firm's costs are not known to entering firm.

How asymmetric information models of predatory pricing work

• Incumbent firm increases quantity and lowers price beyond its ordinary profit-maximizing point.
• Tries to make entrant think it has low costs.
• Purpose is to drive out entrant, or prevent entry in another market, by cultivating a _____ for low cost.

A simple model

• Market A: _____ market.
  Incumbent uses this market to try to convince entrant it is a tough competitor.
• Market B: _____ market.
  If incumbent succeeds in deterring entry, enjoys monopoly profit.
• Entrant in market B can be same firm as in market A, or a different firm.
• Market B can be same market, different product or different location.

Timeline of predatory pricing model

| Entrant enters market A | Firms set quantities in market A | Entrant decides whether to enter market B | Firm(s) set quantities in market B |

• Key idea: incumbent sets price (or quantity) in market A to _____ entry into market B.
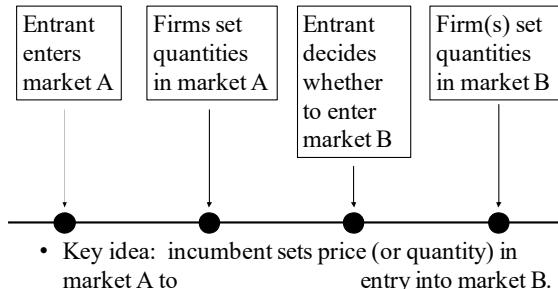
REPUTATION MODELS OF PREDATORY PRICING
Page 2

Assumptions: production cost

- Assume AC = MC for both firms.
- Incumbent's marginal cost MC_1 is known to incumbent but not to entrant.
- Entrant believes that incumbent's marginal cost is either $MC_1 = \$1$ or $MC_1 = \$4$, and attaches a 50% chance to each.
- Entrant's marginal cost = $MC_2 = \$1$ is known to everyone.

Assumptions: entry cost

- Entrant pays an entry cost of $150 if it enters market B.
- Entry cost includes advertising and other costs required when a market is first entered.
- Incumbent has no entry cost.

Assumptions: demand

- Suppose each market (A and B) has same demand curve: $P = 10 - (Q/10)$.
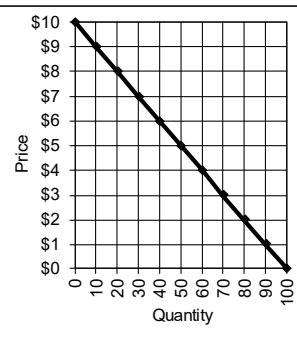
Symmetric Cournot duopoly

If $MC_1 = MC_2 = \$1$, then it is easy to show that:

- $q_1 = q_2 = 30$,
- $P = \$4$,
- Each firm's profit = $90.
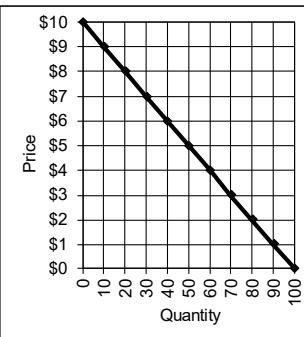
Asymmetric Cournot duopoly

If $MC_1 = \$4$ and $MC_2 = \$1$, then one can show that

- $q_1 = 10$, $q_2 = 40$,
- $P = \$5$,
- Incumbent's profit = $10.
- Entrant's profit = $160.
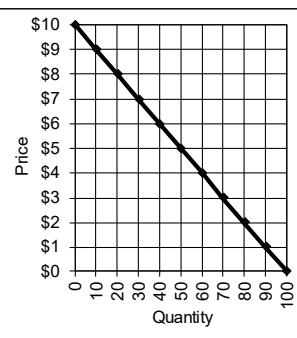
Entrant's expected profit in market B

- If entrant knows that incumbent's $MC_1 = \$4$, its expected profit = $160.
- If entrant knows that incumbent's $MC_1 = \$1$, its expected profit = $90.
- But if entrant is uncertain whether incumbent has $MC_1 = \$1$ or $4, its expected profit = $0.5(\$90) + 0.5(\$160) =$ _____.

REPUTATION MODELS OF PREDATORY PRICING
Page 3

Should the entrant also enter market B?

- If entrant *knows* that incumbent has $MC_1 = \$4$, then entrant should enter market B because
  profit = \$160 > entry cost = _____.
- But if entrant is *uncertain* whether $MC_1 = \$1$ or \$4, then entrant should stay out because
  expected profit = \$125 < entry cost = _____.

Why incumbent wants entrant to stay out of market B

- If entrant stays out, market B is monopoly for incumbent.
- If a monopoly, then MR = _____.
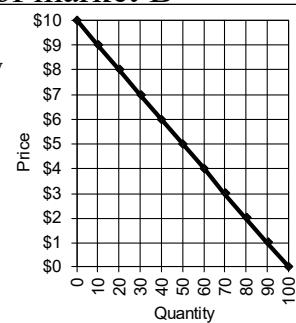
Why incumbent wants entrant to stay out of market B (cont'd)

- If incumbent has $MC_1 = \$4$, it sets P = \$7 and enjoys profit = \$90.
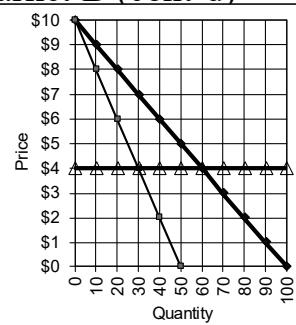
Influencing entrant's decision

- If incumbent *accommodates* entrant in market A, producing $q_1 = 10$, entrant learns it has $MC_1 = \$4$ and _____ market B.
- If incumbent *predates* in market A, producing $q_1 = 30$, entrant remains unsure about MC_1 and _____ of market B.
- Which strategy is more profitable for incumbent?

Should incumbent predate in market A if $MC_1 = \$4$?

	Accommodate	Predate
Profit in market A	\$10	\$0
Profit in market B	\$10	\$90
Total profit		

Is predatory pricing profitable in this example?

- In this example, predator makes \$0 profit in market A (instead of \$10).
- But predator makes \$90 in market B (instead of \$10).
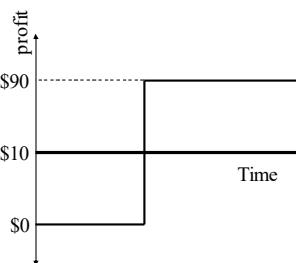
REPUTATION MODELS OF PREDATORY PRICING
Page 4

Does predatory pricing decrease social welfare in this example?

- Clearly, strategy of producing $q_1=30$ in market A pays off for incumbent even if it has high marginal cost ($MC_1=\$4$).
- But does predation reduce welfare?
- Must sum producer and consumer surplus.
- Here, producer surplus = net profit.

Social welfare comparison

	Accommodate	Predate
Incumbent's profit in market A	$10	$0
Incumbent's profit in market B	$10	$90
Entrant's profit in market A	$160	$90
Entrant's net profit in market B	$10	$0
Consumer surplus in market A	$125	$180
Consumer surplus in market B	$125	$45
Total social welfare		

Conclusions

- Predatory pricing means increasing _____ and lowering _____ to drive out a rival or deter entry.
- It can be profitable and welfare-reducing if entrants are unsure of incumbent's cost.
- Incumbent cultivates a _____ for having low cost by increasing quantity and lowering price, beyond its ordinary profit-maximizing point, to deter entry.

LAW AND POLICY ON PREDATORY PRICING
Page 1

LAW AND POLICY ON PREDATORY PRICING

• What is the legal status of predatory pricing?

• How can predatory pricing be detected?

Legal status of predatory pricing

• In principle, predatory pricing is _____ under the Sherman Act Section 2 and Clayton Act.

• In practice, it is difficult to distinguish predatory pricing from vigorous price competition.

Identifying predatory pricing

• Need a test that identifies predatory pricing in the real world.

• Also need to screen out false claims. Firms harmed by falling market prices are often quick to accuse their rivals of predatory pricing.

Marginal cost

• Competitive firms set price = MC.

• A predator might set price ___ MC in the short run.

• However MC is difficult to measure precisely in practice.

• Easier to measure short-run fixed, variable, and total cost.

Two kinds of inputs in the short run (review)

• *Variable inputs* = inputs that can be adjusted in the short run.
  • Examples: _____
• *Fixed inputs* = inputs that cannot be adjusted in the short run. Levels are dictated by past decisions.
  • Examples: _____

Two kinds of cost in the short run (review)

• *Short-run variable cost (SVC)* = payments for variable inputs.
  • Examples: _____
• *Short-run fixed cost (SFC)* = payments for fixed inputs.
  • Examples: _____
• *Short-run total cost (STC)* = SVC + SFC.

LAW AND POLICY ON PREDATORY PRICING
Page 2

Short-run average costs (review)

- *Short-run average fixed cost (SAFC)* = fixed cost per unit of output = SFC / q.
- *Short-run average variable cost (SAVC)* = variable cost per unit of output = SVC / q.
- *Short-run average total cost (SATC)* = short-run total cost per unit of output = STC / q = SAFC + SAVC.

Shutdown price versus breakeven price (review)

- If price < min SATC, firm makes losses, but it does not necessarily shut down.
- min SATC = *breakeven price*.
- If price < min SAVC, firm will shut down.
- min SAVC = *shutdown price*.
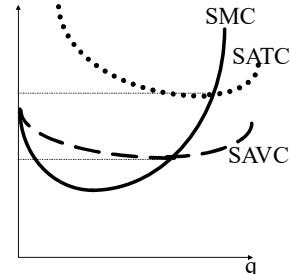
Short-run supply by a competitive firm (review)

- If price > min SAVC, firm chooses output using SMC curve.
- If price < min SAVC, firm shuts down.
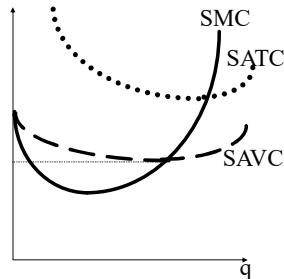
Areeda-Turner AVC Rule

- A competitive firm *might* produce when P < SATC, but *never* when P < _____.
- Areeda and Turner (1975) therefore suggest that predation be assumed whenever price is less than average variable cost.
- Areeda-Turner rule has been adopted in a number of court cases.

P. Areeda and D.F. Turner, "Predatory pricing and related practices under Section 2 of the Sherman Act," *Harvard Law Review*, Vol. 88 (Feb. 1975): 697-733.

The ATC rule

Greer (1983) and others believe the Areeda-Turner rule is too lenient.

He suggested that predation be assumed whenever two conditions hold:

1. price is less than average total cost, and
2. there is evidence of _____ to harm rivals.

Williamson's output-restriction rule

- Williamson (1977) suggested a rule that does not require information on cost.
- Focus is on predation to deter entry.
- He proposed that predation be assumed if the incumbent firm _____ in response to entry.

O.E. Williamson, "Predatory pricing: a strategic and welfare analysis," *Yale Law Journal*, Vol. 87 (Dec 1977): 284-334.

LAW AND POLICY ON PREDATORY PRICING
Page 3

Williamson's output-restriction rule (cont'd)

- Unlike other rules, Williamson's output rule encourages the incumbent to maintain a high level of output *before* entry.
- This leads to lower prices and greater social welfare *before* entry.

[Graph: axes labeled "Price, unit cost" (vertical) and "Output" (horizontal), showing Demand line, MR line, and MC line]
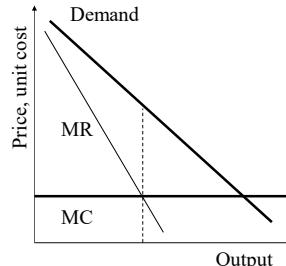
Two-tier rules

- To recoup monopoly profits, the predator must keep rivals out afterwards.
- Joskow and Klevorick (1979) therefore proposed that *barriers to entry* be demonstrated before any cost or price rule is applied.

P.L. Joskow and A.K. Klevorik, "A Framework for Analyzing Predatory Pricing Policy," *Yale Law Journal*, Vol. 89 (December 1979): 213-270.

Matsushita v. Zenith (1986) and Brooke Group v. Brown & Williamson Tobacco (1993)

- In these two cases, the Supreme Court applied a two-tier rule.
- Not only must prices be _____ cost, but predators must be able to _____ profits lost during predation. Recoupment requires market concentration and entry barriers.
- Now much more difficult to prove predatory pricing.

Matsushita Electric Industrial Co. v. Zenith Radio, 475 U.S. 574, 589 (1986).
Liggett Group Inc. v. Brown & Williamson Tobacco Corp., 509 U.S. 209 (1993).

Spirit Airlines v. Northwest Airlines (2005)

- Northwest Airlines dominated routes between Detroit and Philadelphia (DTW-PHL).
- December 1995: Spirit Airlines entered market at much lower fare (price).
- June 1996: Northwest decreased fare and added flights and seats.
- August-September 1996: Spirit left market.

Spirit Airliness, Inc. v. Northwest Airlines, Inc., 431 F.3d 917 (6th Cir. 2005).

Spirit Airlines v. Northwest Airlines (2005): the arguments

- Spirit sued Northwest in 2000. Said
  - Northwest's prices < cost.
  - There were entry barriers because no gates were available at airport in Detroit.
  - Northwest could recoup its losses.
- Northwest's defense:
  - Its low price > average variable cost.
  - No entry barriers: gates could be leased from other airlines at Detroit.

Spirit Airlines v. Northwest Airlines (2005): the outcome

- District Court decided for Northwest in 2005 on summary judgement.
- Spirit appealed.
- Court of Appeals noted Northwest's large market share and barriers to entry. Returned case back to District Court for full trial.
- Northwest Airlines filed for bankruptcy.
- Spirit dropped the case.
- Spirit re-entered market in 2016.

LAW AND POLICY ON PREDATORY PRICING
Page 4

Anti-dumping laws: a related issue

- Anti-dumping laws in international trade compare price that goods are sold in U.S. with price they are sold in home (exporting) country.
- Assumption is that retail price in home country is approximately equal to product's true MC.
- But in fact, some countries' home retail markets are much less competitive than U.S., so retail price in home country could be much greater than MC.

Policy lags behind theory

- Note that lost profits need not be recouped in the _____ market according to reputation theories.
- These theories argue that predatory pricing functions to deter entry in _____ markets.
- But courts have been slow to recognize and apply reputation theories.

Conclusions

- In practice it is difficult to distinguish predatory pricing from vigorous competition.
- The Areeda-Turner _____ rule is widely used to identify predatory prices.
- In recent decisions, courts have also required evidence of _____ and _____.
- Courts have been slow to recognize and apply reputation theories of predation.

REFUSAL TO DEAL
Page 1

REFUSAL TO DEAL

• Is it legal for a firm to refuse to deal with other firms?

• What is the "essential facilities doctrine"?

Definition of refusal to deal

• *Refusal to deal* = A firm refuses to supply a complementary product, an input, or valuable information to a rival firm.

• Can be a violation of Sherman Act Section 2 ("monopolization") if intent is anticompetitive.

Aspen Skiing Co v. Aspen Highlands Skiing (1985)

• Aspen Skiing Co dropped out of a ski pass program allowing skiers to use both companies' ski areas.

• Aspen Highlands lost market share as result.

• Supreme Court found Aspen Skiing Co's refusal to deal to be _____ in intent.

• However, decision remains controversial.

Aspen Skiing Company v. Aspen Highlands Skiing Corporation, 472 U.S. 585 (1985)

US v. Terminal Railroad (1912)

• Certain railroads acquired bridges, terminals and other rail approaches to St. Louis.

• Same railroads then denied access to competing railroads.

• Supreme Court decided this was _____ and required that access be given to competing railroads.

United States v. Terminal Railroad Ass'n. 224 U.S. 383 (1912).

MCI v. AT&T (1982)

• MCI competed with AT&T in long-distance telephone service.

• However, MCI needed to interconnect with local network, which AT&T had blocked.

• Seventh Circuit Court of Appeals agreed with MCI and required AT&T to interconnect with all competing long-distance carriers.

MCI Communications Co. v. AT&T, 708 F.2d 1081 (7th Cir. 1982).

"Essential facilities" doctrine

According to Court of Appeals, to show antitrust liability one must show

1. Monopolist _____ facility.
2. Competitor cannot _____ facility.
3. Monopolist has _____ facility to competitor.
4. It is _____ for monopolist to provide facility to competitors

MCI Communications Co. v. AT&T, 708 F.2d 1081 (7th Cir. 1982).

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REFUSAL TO DEAL
Page 2

Networks are most likely to be viewed as "essential facilities"

Examples of networks:

Limitations of "essential facilities" doctrine

- "Essential facilities" doctrine was never explicitly endorsed by Supreme Court.
- Recently, Supreme Court ruled that if an industry is already regulated to promote competition (in this case, the telecommunications industry), then courts need not act.

Verizon Communications, Inc. v. Law Offices of Curtis V. Trinko LLP, 02-682 540 U.S. 398 (2004).

Intellectual property rights

- "The Court has held many times that power gained through some natural or legal advantage such as a patent, copyright or business acumen can give rise to [antitrust] liability if a seller exploits his dominant position in one market to expand his empire into the next."

Eastman Kodak Co. v. Image Technical Services, Inc., 504 U.S. 451 (1992).

Intergraph v. Intel (1999)

- Intergraph, a maker of computer workstations, was a customer of Intel, a maker of microprocessors.
- Intergraph sued Intel for patent infringement.
- In response, Intel withheld proprietary technical information needed by Intergraph.
- FTC charged Intel with antitrust violation.
- FTC and Intel settled, but Intergraph continued suit.

Intergraph Corp. v. Intel Corp., 195 F. 3d (Fed. Cir. 1999).

Intergraph v. Intel (1999): decision

- Third Circuit Court of Appeals sided with _____ because Intel did not directly compete with Intergraph.
- Intel's action was _____ anticompetitive because it did not create or maintain a monopoly.

Intergraph Corp. v. Intel Corp., 195 F. 3d (Fed. Cir. 1999).

Kodak v. Image Technical Services (1992)

- Kodak sold photocopiers.
- "Aftermarket" consisted of service and repair, in which Kodak and independent firms competed.
- After a price war, Kodak refused to sell parts, protected by patents, to independents, who then sued Kodak.

Eastman Kodak Co. v. Image Technical Services, Inc., 504 U.S. 451 (1992).

REFUSAL TO DEAL
Page 3

Kodak v. Image Technical Services (1992): decision

- Case took 10 years to resolve.
- Kodak finally found _____ of monopolization, ordered to pay damages, and required to sell parts to independents at nondiscriminatory prices.
- Case has implications for other aftermarkets: computers and software, etc.

Conclusions

- "Refusal to deal" (in a complementary product, an input, or valuable information) violates the Sherman Act Section 2 if the effect is _____.
- _____ that cannot be duplicated by competitors are an example, important for networks.
- Another important example is _____ property, important for aftermarkets.

MONOPOLY PRICE DISCRIMINATION
Page 1

MONOPOLY PRICE DISCRIMINATION

- What is "price discrimination"?
- What are its impacts on individual consumers and social welfare?

Price discrimination: general definition

- *Charging multiple prices (for reasons unrelated to costs) in order to increase profits.*
- Types of price discrimination (PD):
  1st-degree (perfect PD)
  2nd-degree (self-selecting PD or multipart prices)
  3rd-degree (market-segmenting PD)

Why price-discriminate?

- Ordinary monopolist must charge same price to all customers.
- Therefore, must cut price on all customers to increase sales.
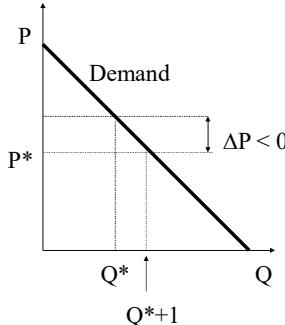
What if you could charge different prices to each customer?

- You would NOT have to cut price on all customers to increase sales.
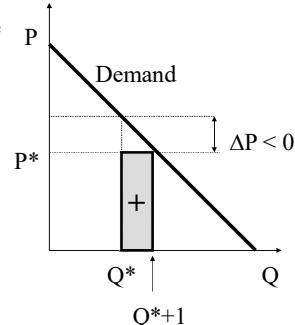
Example: What price could you charge each customer?
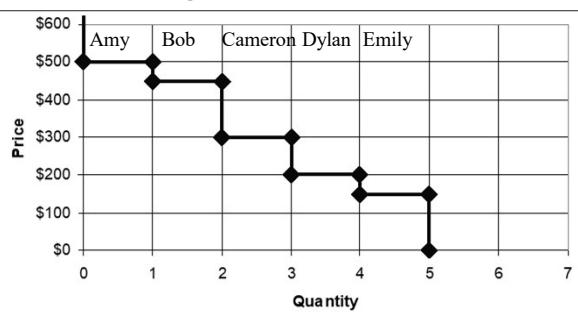
Price discrimination: general requirements

(1) *Market power* (power over price).
   - Why important:

(2) Ability to *prevent arbitrage* between customers.
   - Why important:

MONOPOLY PRICE DISCRIMINATION
Page 2

Key questions about price discrimination

- Does price discrimination increase monopoly profit?
- Does it decrease social welfare?
- Only if answers to both questions are _____ should we worry.

(1) Perfect price discrimination

- Monopolist charges a different price for every unit sold.
- Each unit is charged the consumer's willingness-to-pay.
- Marginal revenue curve = _____ _____
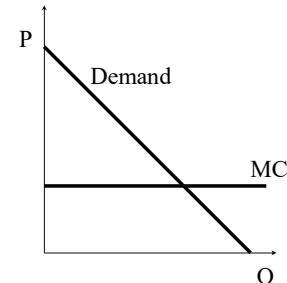
Perfect price discrimination: how much is sold?

- Serves all customers willing to pay at least the marginal cost of production.
- Entire gains from trade captured by monopolist.
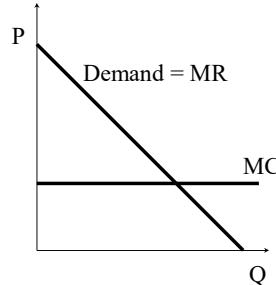
Pricing with perfect price discrimination: example

- Suppose this monopolist could charge everyone a different price.
- Quantity sold = _____
- Highest price = _____
- Lowest price = _____
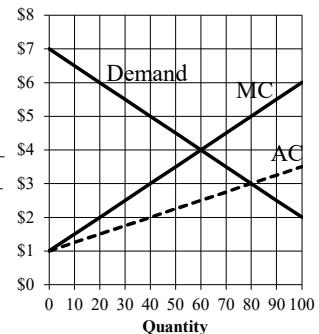
Revenue and profit with perfect price discrimination: example

- Revenue = area under demand curve = $_____.
- Total cost = = output × AC = $_____.
- Profit = revenue – total cost = $_____.
- Consumer surplus = $_____.
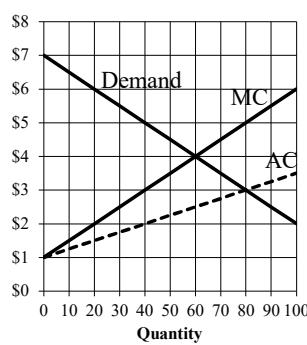
Welfare analysis of perfect price discrimination

- Monopolist serves all customers willing to pay at least the marginal cost of production.
- Thus there is *no deadweight loss!*
  - Output is _____ as under competition.
- But distribution of gains from trade is very different from competition.
  - Consumer surplus is _____.

MONOPOLY PRICE DISCRIMINATION
Page 3

But perfect price discrimination is impractical

- Monopolist must know how much each buyer is willing to pay for each unit.
- Are buyers likely to reveal this information?

- The most that monopolist knows (usually) is the price-sensitivity (elasticity) of different market *segments*.

(2) Self-selecting price discrimination

- Also called "multipart prices."
- Monopolist offers a *price schedule* or *multipart tariff*.
- Consumers choose their own average prices.
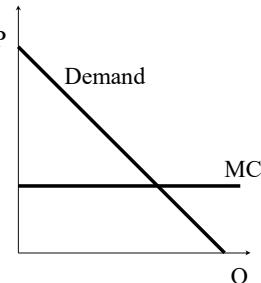
Examples of self-selecting price discrimination

- Examples: quantity discounts, volume discounts, "membership" fees, monthly service fees, etc.
- Average price (buyer's bill/quantity) thus varies depending on quantity purchased.
- Widely used in public utilities.
- Will be discussed in "Regulation" section of course.

(3) Market segmentation

- *Charging a different price to each market segment.*
- Will be discussed in next slideshow.
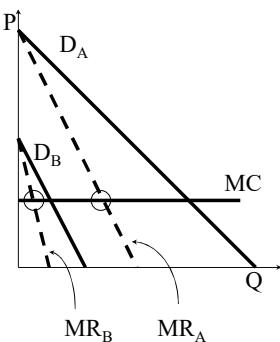
Conclusions

- *Price discrimination* means charging multiple prices to maximize profits.
- Types include
  - _____-degree, or perfect price discrimination.
  - _____-degree, or self-selecting price discrimination.
  - _____-degree, or market-segmenting price discrimination.

MARKET-SEGMENTING PRICE DISCRIMINATION
Page 1

MARKET-SEGMENTING PRICE DISCRIMINATION

• How are prices for each segment set?
• Which segment gets the lower price?
• How does market-segmenting price discrimination affect consumer welfare?

Market segmentation: definition

• *Charging a different price to each market segment.*
• Suppose elasticities differ across segments.
• To maximize profits, set each segment's price so that its own $MR_i = MC_i$.
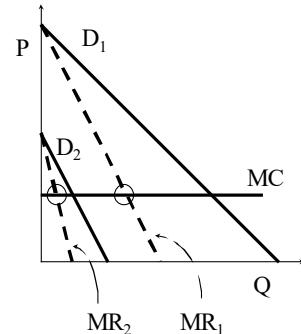
Pricing and elasticity

• We previously showed that for any monopolist, $MR = P\left(1 + \frac{1}{\varepsilon}\right)$.

• Setting MR=MC gives $MC = P\left(1 + \frac{1}{\varepsilon}\right)$.

• Solving for P gives a rule for monopoly pricing: $P =$

Different elasticities → different prices

• Suppose different market segments have different elasticities of demand (ε).
• To maximize profit, monopolist should set different prices according to ε, even if MC is the same.
• Market segment with most elastic demand should get _____ price.

Market segmentation: example

• Consider a symphony orchestra or a theatre.
• Suppose MC of seat = $10, general public's $\varepsilon = -2$, and students' $\varepsilon = -5$.
• To maximize profits, should set:

  • Price for general public $= \frac{10}{\left(1 + \frac{1}{-2}\right)} = \$_____$.

  • Price for students $= \frac{10}{\left(1 + \frac{1}{-5}\right)} = \$_____$.

Why market-segmenting price discrimination works

• Customers with more elastic demand typically are more sensitive to price, perhaps because have close substitutes available. They get _____ price.
• Customers with less elastic demand are less sensitive to price, perhaps because have no close substitutes. They get _____ price.

MARKET-SEGMENTING PRICE DISCRIMINATION
Page 2

Market-segmenting price discrimination in the real world

- Movie theaters and performing arts:

- Airlines:

- Supermarket products:

Welfare effects of market-segmenting price discrimination

- Is price discrimination (PD) good or bad for society?
- Depends on the shapes of the market segment demand curves.
- But we can show that if PD does not increase total output, then welfare _____.

Suppose total output is fixed
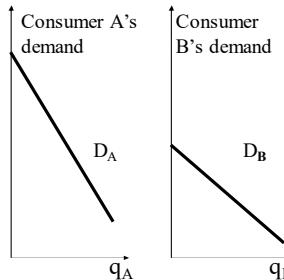
How should a fixed quantity of output be allocated across consumers to maximize total welfare?

Suppose total output is fixed (cont'd)
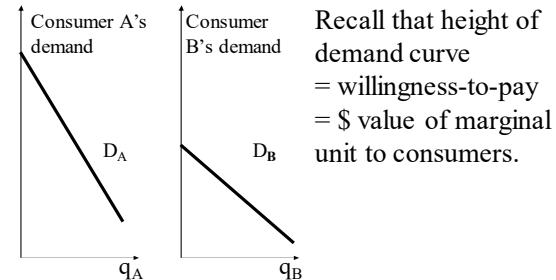
Recall that height of demand curve
= willingness-to-pay
= $ value of marginal unit to consumers.

Total welfare is _____ maximized if heights of demand curves are unequal

- If $D_A > D_B$, then consumer A is willing to pay more for the last unit than consumer B is.
- Output should be shifted to consumer _____ from consumer _____ to increase welfare.
- Example: If $D_A = \$6$ and $D_B = \$4$, then shifting one unit of output from consumer A to consumer B increases social welfare by $2.
- Similarly, if $D_A < D_B$, then output should be shifted to consumer _____ from consumer ____.

Fixed-output case: graphical example
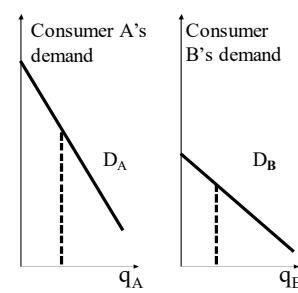
- Here, $D_A > D_B$.
- Can increase total welfare, without changing total output, by _____ q_A and _____ q_B.

MARKET-SEGMENTING PRICE DISCRIMINATION
Page 3

Output should be allocated so that heights of demand curves are _____

- Total welfare is maximized only when $D_A = D_B$.
- If a single price is offered to all consumers, this condition will hold automatically.
- Thus if PD does not increase output, it will cause a _____ in welfare.

The case of linear demand curves

- If demand curves are straight lines in both market segments, and both markets are actually served at the single price, it can be shown that total output will not increase.
- Therefore PD _____ welfare in this case.

The case of linear demand curves when one segment is excluded

- Suppose one segment's demand curve is so low that it is excluded from the market completely under the single price.
- PD _____ welfare in this case.
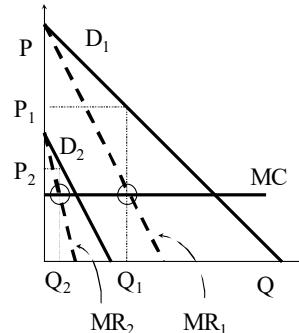
The case of nonlinear demand curves

- With nonlinear demand curves, total output *can* increase under PD.
- Welfare can increase or decrease.
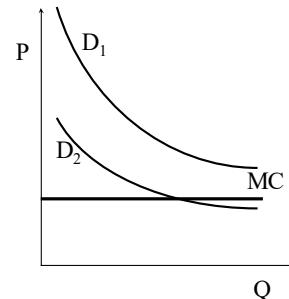
Conclusions

- 3rd-degree price discrimination (PD) means setting different prices for different market segments.
- The market segment with the lowest elasticity of demand gets the _____ price.
- If total quantity does not increase, social welfare _____ with PD.
- But social welfare can increase with PD, particularly if one segment was excluded under the single-price regime.

LAW AND POLICY ON PRICE DISCRIMINATION
Page 1

LAW AND POLICY ON PRICE DISCRIMINATION

- What law governs price discrimination?
- How have the courts interpreted it?

Law on price discrimination

- Clayton Act (1914) prohibited price discrimination where it substantially lessened competition.
- Robinson-Patman Act (1936) strengthened the Clayton Act.

D. Daniel Sokol, "Analyzing Robinson-Patman," *George Washington University Law Review*, Vol. 83, No. 6 (November 2015), pp. 2064-2100.

Motivation for Robinson-Patman Act

- Passed during Great Depression largely to protect small independent retailers from emerging chain stores.

Producer
Wholesaler or broker
Retailers

Producer
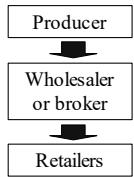
Motivation for Robinson-Patman Act (cont'd)

- Act outlawed brokerage fees unless an independent broker is involved.
- Efficiency gains or cost differences from chain stores was irrelevant.

Types of illegal discrimination under Robinson-Patman Act

- *Primary-line discrimination:* injury to rival firms. (Mild form of predatory pricing.) Example is _____ case.
- *Secondary-line discrimination:* injury to (high-price) customers. Example is _____ case.

Possible defenses under Robinson Patman Act

- Different prices are due to cost differences. This defense is permitted under the law in principle, but very difficult in practice.
- Prices were reduced in some markets but not others to meet competition.

LAW AND POLICY ON PRICE DISCRIMINATION
Page 2

Utah Pie case (1967)

- Utah Pie faced rivals Continental Baking, Carnation, and Pet Milk.
- Rivals had manufacturing plants in <u>California</u> but not <u>Utah</u>.
- Thus Utah Pie had significant cost advantage.

Utah Pie v. Continental Baking, 386 U.S. 685 (1967).

Utah Pie case (1967) (cont'd)

- Rivals cut prices, and Utah Pie's market share fell from 66.5% in 1958 to 45.3% in 1961.
- Rivals charged lower prices in Utah than elsewhere.
- Utah Pie sued its rivals, alleging *primary-line discrimination*.

Utah Pie v. Continental Baking, 386 U.S. 685 (1967).

Utah Pie case (1967): judgment

- Utah Pie _____ the case, despite its still-large market share.
- Another instance where Supreme Court made the mistake of "protecting competitors, instead of competition" (Justice Potter Stewart).

Morton Salt case (1948)

- Morton Salt offered quantity and volume discounts to wholesalers and chain stores.
- However, only very large chains could qualify for the lowest discounts.
- FTC sued Morton Salt, alleging *secondary-line discrimination.*
- Court decided _____ Morton Salt.

Federal Trade Commission v. Morton Salt Co., 334 U.S. 37 (1948).

Conclusions

- Robinson-Patman Act governs price discrimination.
- Often used to protect small firms, rather than to promote _____.
- Not vigorously enforced in recent years.

NETWORK EFFECTS
Page 1

NETWORK EFFECTS

- What are network effects?
- Why do they transform "competition in the market" into "competition for the market"?

Key features of "new economy"

- Cost: economies of scale
- Demand: network effects
- Technical change: rapid and disruptive innovation

Cost economics in the "new economy"

Products like
- Computer software
- Informational websites
- Social media
- Search engines

require very _____ up-front or fixed costs to develop, but near-_____ incremental cost per customer.

Economies of scale (review)

Consequently, they are characterized by high fixed cost, low MC, and falling AC.

Extreme economies of scale.

May need large number of customers to be profitable.

AC

MC

q
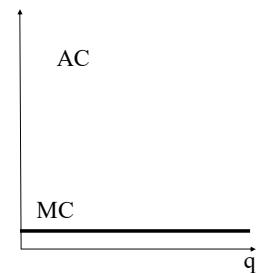
Scale and quality improvement

- Firms in new economy can easily collect information on customer behavior.
- Can be used to improve service—more efficient searches, more relevant ads, fewer errors, etc.
- "Big data" allows larger firm to improve faster—another source of _____.

Demand economics in the "new economy"

For some products, the value of the product to each user depends on the number of _____ users who consume the product.

Examples:

NETWORK EFFECTS
Page 2

Willingness-to-pay depends on q

- The amount any individual user is willing to pay to access these products = _____ if there are no other users.
- increases with the number of other users.

P, WTP(q), q
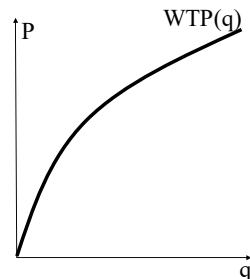
Willingness-to-pay varies across users

As with other products, like tomatoes and toasters, some people are willing to pay more than others.

Here are WTP curves for a high-intensity user and a low-intensity user.

P, WTP$_H(q)$, WTP$_L(q)$, q
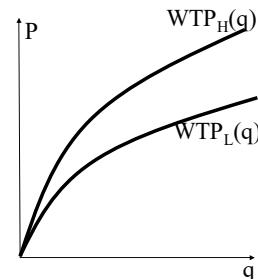
Equilibrium

Suppose there are 50 users of each type.

What would an equilibrium look like?

Depends partly on users' expectations about how many others will buy.

P, WTP$_H(q)$, WTP$_L(q)$, 50, 100, q
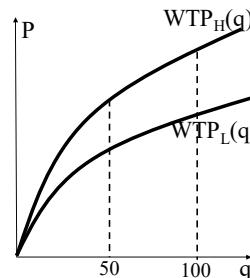
One possible equilibrium (undesirable)

Suppose each user expects no one else to buy the product.

Then no one is willing to pay for the product at any $P > 0$, so
$q^* = $ _____.
Self-fulfilling prophesy.

P, WTP$_H(q)$, WTP$_L(q)$, 50, 100, q
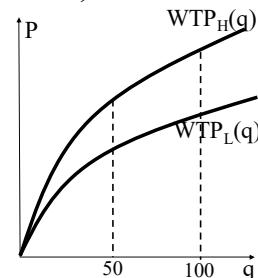
Another possible equilibrium (ideal)

Suppose each user expects everyone else to buy the product.

Then if $P < \$10$, everyone is willing to pay for the product, so
$q^* = $ _____.
Self-fulfilling prophesy.

P, WTP$_H(q)$, $\$10$, WTP$_L(q)$, 50, 100, q
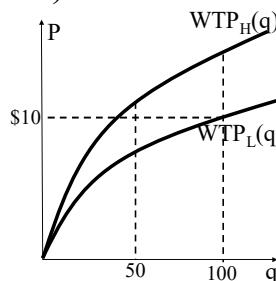
Yet another possible equilibrium (stepping stone?)

Suppose everyone expects only high-intensity users to buy the product.

Then if $\$7 < P < \$12$, 50 users are willing to pay for the product, so
$q^* = $ _____.
Self-fulfilling prophesy.

P, WTP$_H(q)$, $\$12$, $\$7$, WTP$_L(q)$, 50, 100, q
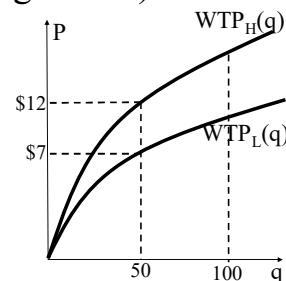
NETWORK EFFECTS
Page 3

Multiple equilibria

Several different combinations of P and q are stable.

Problem for firm is to try to move to ideal high-volume equilibrium.
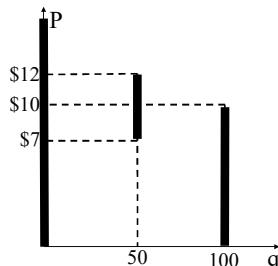
Coping with network effects

Users' expectations affect demand.

Achieving a critical mass of users can determine profitability.

- Keep quality high and price low to grow.
- Might even price below MC at first.

"Tipping"—once a critical mass is reached, more and more users join.

Markets with network effects

Dominant firm becomes highly profitable due to economies of scale.

Competition to *become* dominant firm (that is, competition _____ the market) leads to low price, at least at first.

Having dominant firm _____ consumers, even if firm eventually raises price, because consumers value product more if there are many other users.

Antitrust issues with network effects

Dominance is normal and often beneficial outcome.

Abuse of dominance—lessening of competition for the market—is potential problem.

Conclusions

- Network effects occur in markets where users' willingness to pay is greater, the _____ other users choose the product.
- Network effects lead to competition _____ the market, tipping, and eventual market dominance.
- Dominance by itself is good for consumers because they value the product _____ if there are many users.
- Antitrust problems occur when dominance is abused to thwart competition for the market.

MICROSOFT CASES
Page 1

MICROSOFT CASES

- Why was Microsoft accused of monopolization?
- What familiar issues did these cases raise?
- What new issues did they raise?
- What did the courts decide?

Background: Microsoft's lines of business in 1990s

- Operating systems (OSs): DOS, Windows.
  - Very high market share—over 90% by most measures.
- Applications: _____
- Web browsers: _____

Why Microsoft products enjoyed network effects

- Applications—because people share documents and spreadsheets.
- Operating systems—because software developers prefer to write applications for operating systems with many users.
  - _____-sided platform.

Why application developers prefer to write for popular OSs

Economies of scale:
- Large up-front development costs for each OS.
- Near-zero costs of producing one more copy of software for same OS.
- But major costs of "porting" applications between OSs!
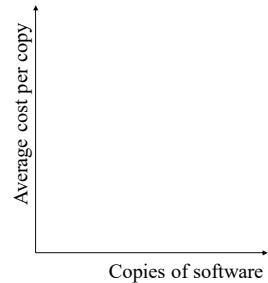
Implications of network effects

- A _____ of consumers is necessary for product success.
- Consumers' demand depends on expectations— what product they think everyone else will choose.
- "Tipping" leads to market dominance. (Like economies of scale but from consumer side.)
- Difficult to dislodge incumbent with large market share—even with a better, cheaper product.

Familiar and new antitrust issues for markets with network externalities

- Dominance is almost inevitable because of economies of scale and network effects.
- But once dominant, firm can create further _____ through
  - exclusionary vertical restraints (exclusive dealing, tying),
  - predatory pricing, or
  - refusal to deal.

MICROSOFT CASES
Page 2

"Microsoft I" case: exclusion

Early 1990s: government alleged Microsoft used exclusionary vertical restraints.

- PC manufacturers required to pay a fee *per computer sold*, regardless of whether Windows was actually installed.
- Thus customers who want another operating system (e.g., IBM's OS/2, or Linux) effectively pay for _____.

1995 Consent Decree: restrictions on Microsoft's conduct

- Microsoft agreed to stop charging manufacturers per computer sold.
- Also:
  "Microsoft shall not enter into any License Agreement in which the terms of that agreement are expressly or impliedly conditioned upon: (i) the licensing of any other Covered Product, Operating System Software product or other product (provided, however, that this provision in and of itself shall not be construed to prohibit Microsoft from developing integrated products)…"
  In other words, no _____!

"Microsoft II" case: tying

1996: Microsoft bundled Internet Explorer (IE) browser with Windows. Tying or not?

- Microsoft claimed IE should be part of Windows for technical reasons for better user experience.
- DOJ disagreed and sought injunction.
- 1997: District Court ordered Microsoft to offer IE and Windows separately.
- 1998: Appeals Court reversed decision, saying DOJ had not refuted technical argument.

"Microsoft III" case: monopolization

1998: DOJ accused Microsoft of

- Exclusive dealing.
- Tying IE browser to Windows 95 and 98.
- Maintenance of monopoly for operating systems.
- Attempting to monopolize market for web browsers.

Background: JAVA versus Windows

- JAVA was an interpretive language bundled with browsers like Netscape or IE.
- Permitted application developers to write for JAVA rather than a particular operating system like Windows, Mac OS, or Linux.
- Internal memos show Microsoft feared that Netscape + JAVA would "commoditize the underlying operating system."

"Microsoft III" case: monopolization

- Microsoft engaged in contracts with computer manufacturers and internet service providers to favor Internet Explorer (IE) over other browsers. Monopolization or not?
- DOJ said yes and District Court agreed.
- But Appeals Court reversed decision, saying DOJ had not defined the relevant market nor shown there were barriers to further entry.

MICROSOFT CASES
Page 3

Power and intent

Recall that to convict someone of monopolization, need to show

1. _____ of monopoly power, traditionally measured by _____.
2. _____ to acquire monopoly—actions taken to exclude rivals.

Power and intent

Recall that to convict someone of monopolization, need to show

1. ___Possession___ of monopoly power, traditionally measured by ___market share___.
2. ___Intent___ to acquire monopoly—actions taken to exclude rivals.

Did Microsoft have large market share?

What was the market for Windows?

- According to DOJ: OSs on Intel or Intel-compatible computers.
- According to Microsoft: "platforms" including other OSs, JAVA, etc.

Pricing of Windows and market share

- Microsoft's price for Windows was lower than one might expect for a dominant firm. Why?
- Microsoft witness said Microsoft was not a genuine monopolist and faced competition from other "platforms."
- Government witnesses said price was low to promote complementary Microsoft products and discourage software piracy.

Did Microsoft intend to monopolize the market for browsers?

- Microsoft had agreements with computer manufacturers, website developers, and internet service providers to favor IE over other browsers. Why?
- Was Microsoft raising its rivals costs?
- Or simply reducing transactions costs?

Did Microsoft intend to monopolize the market for browsers? (cont'd)

- Microsoft gave IE away for free.*
- This looks like classic _____ _____.
- But Microsoft never raised the price to recoup the cost of development.
- There must be another explanation.

*This forced Netscape to give away its own browser for free, and eventually forced Netscape out of business.

MICROSOFT CASES
Page 4

Did Microsoft intend to monopolize the market for browsers? (cont'd)

- Why did Microsoft give IE away for free?
- Since most customers need both an operating system and a web browser, this *may* be a response to a problem with "_____."
- But does not explain why Microsoft wanted manufacturers and others to *favor* IE over other browsers.

Did Microsoft intend to monopolize the market for browsers? (cont'd)

- Why did Microsoft give IE away for free?
- Since most customers need both an operating system and a web browser, this *may* be a response to a problem with "_____successive monopolies_____."
- But does not explain why Microsoft wanted manufacturers and others to *favor* IE over other browsers.

Did Microsoft intend to monopolize the market for operating systems?

- After SUN* released JAVA, a new computer language designed for internet applications, Microsoft released its own nonstandard version of JAVA.
- Programs written for MS JAVA would not run properly on SUN's standard JAVA, and vice versa.
- Government viewed this as predatory because Microsoft was incurring costs to undermine a competitive threat.

*SUN is now part of Oracle Corporation.

Monopolization or not?

- Giving away IE by Microsoft might be defended as *improving* consumer welfare.
- But other actions taken by Microsoft to *penalize rival* browser maker Netscape were harder to defend.
- And Microsoft's nonstandard JAVA was suspicious.

Initial District Court decision (2000)

- District Court Judge Jackson found Microsoft not guilty of exclusive dealing but guilty of other charges.
- Accepted government's proposed remedies
  - restrictions on Microsoft's conduct
  - dissolution of Microsoft into two separate companies (one with OS, one with applications)
- But stayed implementation pending appeal.

Appeals Court decision (2001)

- Upheld maintenance of monopoly, reversed decision on monopolization, and remanded decision on tying to District Court.
- Also remanded remedy.
- Judge Jackson was replaced by Judge Kollar-Kotelly due to improper conduct.

MICROSOFT CASES
Page 5

Settlement (2001)

DOJ decided to abandon push for Microsoft breakup but keep restrictions on Microsoft's conduct:

- Must offer same prices to all manufacturers—no retaliation for dealing with competitors.
- Must release more technical information for interoperability with Windows.
- Must allow manufacturers to change appearance of desktop and to automatically boot non-Microsoft products.

Ongoing monopolization issues for Microsoft

- Microsoft is continually accused of tying and "refusal to deal."
- A case in Europe involved
  - tying Media Player to Windows
  - refusal to provide free information on protocols used to connect servers to Windows computers.

"Microsoft loss in Europe raises American fears," *Wall Street Journal*, September 18, 2007, pp. A1, A10.

Conclusions

- The Microsoft cases included familiar issues of market definition, exclusion, predation, and tying.
- The case also introduced new issues of _____ externalities and extreme economies of scale, typical of software industries.
- The government originally asked for breakup of Microsoft, but the settlement of 2001 included only restrictions on _____.

TWO-SIDED PLATFORMS
Page 1

TWO-SIDED PLATFORMS

- What is a two-sided platform?
- What special pricing issues arise?

Two-sided networks or platforms

- Many platforms have two groups of users who interact with each other through the platforms.

User group → Plat-form ← User group

Two-sided platforms in the old economy

	User group 1	User group 2
Credit cards	Consumers	
Newspapers	Readers	
Temporary employment agencies	Workers	
Nightclubs	Women	
Consignment shops	Buyers	

Two-sided platforms in the new economy

	User group 1	User group 2
eBay, auction sites	Buyers	
Search engines	Users	
Operating systems	Computer owners	
Uber, Lyft	Travelers	
Airbnb, Booking.com	Travelers	

Conventional wisdom on pricing (Does it apply?)

- Efficiency requires price close to marginal cost.
- High price-cost margin reflects market power.
- Price below marginal cost is not profit-maximizing, and is evidence of predatory pricing.

Network effects of two-sided platforms

- Typically, willingness to pay is *positively* related to number of users on _____ side.
- Might be *negatively* related to number on same side: "_____."

$WTP_1(q)$

q_2
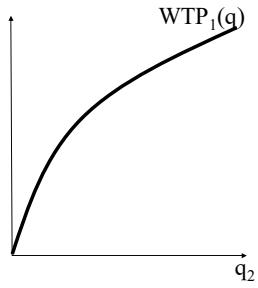
TWO-SIDED PLATFORMS
Page 2

Pricing schemes at a two-sided platform

- Platforms can charge users on either side in different ways.
  - Charge for access.
  - Charge for transactions (purchases or clicks).
- Or of course, platform can be free.
- Ignore these complications and let p_1 = price for user group 1, and p_2 = price for user group 2.

Demand for access by group 1

- Number of people in each user group who want to access the platform
  $$q_1 = q_1(p_1, q_2)$$
- p_1 has negative effect on q_1.
- q_2 has _____ effect on q_1
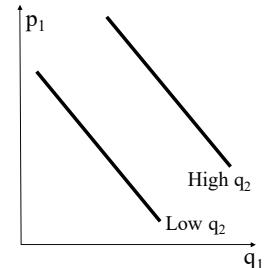
Marginal revenue with network effect

- Suppose q_2 has a positive effect on demand by user group 1, but q_1 has no effect on demand by user group 2.
- TR = $p_1 q_1 + p_2 q_2 = p_1 q_1(p_1, q_2) + p_2 q_2$.
- Holding p_1 constant, MR for group 2
 = $p_1 \, \partial q_1 / \partial q_2 + (p_2 + dp_2/dq_2 \, q_2)$.

Pricing to maximize profit

- The network effect creates "downward pricing pressure" on price for group 2.
- Platform will choose a lower price for user group 2 than without network effects.
  - p_2 maybe < MC_2.
  - p_2 maybe = _____.

Pricing to maximize profit (cont'd)

- Platform may succeed in attracting many people of user group 2, raising demand by user group 1.
- Demand by user group 1 may become less elastic.
- Then $p_1 \gg MC_1$.

Conventional wisdom on pricing does NOT apply to two-sided platforms

- Efficiency requires price close to marginal cost. Or _____ .
- High price-cost margin reflects market power. Or _____ .
- Price below marginal cost is not profit-maximizing, and is evidence of predatory pricing. Or _____

_____ .

TWO-SIDED PLATFORMS
Page 3

Conclusions

- Two-sided platforms connect users from different groups.
- Network effects occur *across* groups: demand and WTP by group 1 may depend on number of users in group _____.
- Network effects cause two-sided platforms to price differently from a conventional monopolist.

GOOGLE CASES
Page 1

GOOGLE CASES (2012-16)

- What antitrust violations was Google accused of in 2012-16?

Relevant Google businesses

- Google operates a broad, general-purpose search engine, which is dominant in many countries.
- Google also operates narrower shopping search engine, "Google Shopping," that competes with many other "vertical" search engines.

Monopolization in vertical search?

- Google accused of abusing dominance in general search to benefit Google Shopping.
- EC* said Google Search placed links to its own Google Shopping ahead of links to other "vertical" search engines.
- FTC staff agreed that this practice harmed Google's rivals.

*European Commission, Directorate-General for Competition.

Impact on consumers

- But were *consumers* harmed by Google's conduct?
- EC concluded that Google's conduct prevented consumers from receiving most relevant search results, and stifled innovation by Google's rivals.
- FTC was not sure.

Monopolization in managing ads?

- Firms placing ads on Google Search (or any platform) use software to access the search platform.
- Google prevented advertisers from using same software to manage ads simultaneously on Google Search and rival platforms.

Impact on customers

- Firms placing ads would clearly find Google's restriction to be an inconvenience.
- Raising rivals' costs: Google's restriction raised cost for its customers of dealing with its rivals.
- FTC found this to be monopolization, got Google to remove this restriction.

GOOGLE CASES
Page 2

Tying and exclusive dealing with Android?

- Android is dominant mobile OS in Europe.
- As a condition of installing Android and the Google Play Store, Google required phone manufacturers to install the Chrome browser and Google Search.
- Gave financial incentives to manufacturers that exclusively installed Google Search.

Familiar situation

- These practices remind us of Microsoft, which tied IE to Windows and penalized customers who bought rivals' products.
- Similar issues will likely arise in many antitrust cases to come.
- Authorities must balance potential benefits to consumers of products and practices with potential harm from stifling challengers.

Dominance in the new economy

- Microsoft and Google cases typify issues.
- Dominance is _____, due to extreme economies of scale and network effects.
- Dominance brings _____ to consumers due to same network effects.
- But dominance can be _____.

Rapid and disruptive innovation in new economy

- In addition, new economy features rapid and disruptive innovation.
- New technologies bring benefits to consumers.
- New technologies launch new firms, creating competition *for* the market.

Antitrust policy in the new economy

Antitrust policy must simultaneously

- _____ by incumbents by excessively restricting their conduct.
- _____ from exclusionary practices by incumbents, which also slow innovation.

Conclusions

- Google has been accused of extending its monopolies in general search and mobile operating systems to other markets.
- Google and Microsoft cases typify challenges for antitrust in the new economy: encouraging vigorous competition *for* the market.

COMPETITION POLICY IN THE EUROPEAN UNION
Page 1

COMPETITION POLICY IN THE EUROPEAN UNION

- What are TFEU Articles 101 and 102?
- What do they prohibit?
- How are they enforced?

Competition Policy

"Competition policy" promotes economic efficiency in markets by encouraging competition and preventing monopolies.

In all countries, it has 3 broad goals:

1. Control horizontal mergers that increase concentration substantially.
2. Stop collusion (price-fixing, cartels).
3. Stop monopolization (including abuse of dominant market position).

Law in the European Union (E.U.)

Treaty on the Functioning of the European Union
- Article 101 – agreements between firms.
- Article 102 – abuse of dominant position.
- Articles 103-109 – enforcement authority.

Also, European Council Regulation 139 – control of mergers.

Article 101

- Prohibits **agreements** between two or more independent firms that restrict competition.
- Covers both horizontal agreements (between competitors) and vertical agreements (between buyers and sellers).
- Similar to U.S. policy prohibiting "contracts in restraint of trade"

Article 101 (cont'd)

Specifically prohibited are **agreements** that
- fix prices
- limit production
- divide markets
- "apply dissimilar conditions to equivalent transactions."
- "make the conclusion of contracts subject to … supplementary conditions."

Leniency policy on cartels

- Policy encourages companies to hand over inside evidence of cartels to the European Commission.
- _____ company in any cartel to cooperate with authorities will not have to pay a fine. Second and third companies pay reduced fines.
- Most cartels found by the European Commission have been detected through this leniency policy.

COMPETITION POLICY IN THE EUROPEAN UNION
Page 2

Article 102

- Prohibits a firm from abusing a dominant position.
- Similar to U.S. policy against "monopolizing any part of trade"

Article 102 (cont'd)

Specifically prohibited are actions such as
- charging unfair prices
- limiting production
- "applying dissimilar conditions to equivalent transactions."
- "making the conclusion of contracts subject to … supplementary conditions."

European Council Regulation 139

- Mergers that impede competition are illegal under Regulation 139.
- All mergers above a certain size must be reported to the European Commission, which must examine them.
- _____ mergers are the main focus of policy.

European Council Regulation 139 (cont'd)

Mergers may be either
- approved without conditions,
- approved with conditions, such as divesting part of the business or licensing certain technology, or
- prohibited.

EC horizontal merger guidelines

European Commission's "Horizontal Merger Guidelines" (2004) covers many of same issues as U.S. 2010 "Guidelines," including
- market definition, market shares, and HHI.
- "non-coordinated effects" and "coordinated effects."
- barriers to entry and failing firms.
- efficiencies (cost savings) from merger if they benefit consumers.

EC non-horizontal merger guidelines

- European Commission's "Non-Horizontal Merger Guidelines" (2008) similar to U.S. "Vertical Merger Guidelines" document.
- Admits that "non-horizontal mergers are generally less likely to significantly impede effective competition than horizontal mergers."

COMPETITION POLICY IN THE EUROPEAN UNION
Page 3

Enforcement of the law: the European Commission

- Investigates whether firms violate E.U. rules.
- Can
  - Prohibit certain conduct.
  - Require remedial action.
  - Impose fines.
- Decisions can be appealed to European General Court, and then to European Court of Justice.

Commissioner for Competition

- European Commission includes 28 Commissioners, one from each E.U. country.
- Responsibilities of each Commissioner are assigned by the E.U. President (currently Ursula von der Leyen).
- Commissioner for Competition is currently Margrethe Vestager.
  - Citizen of Denmark.

Directorate-General for Competition

- DG Competition develops and carries out the Commission's policies on competition.
- Works under guidance of Commissioner for Competition.
- Includes legal and economic experts.

Enforcement of the law: member states

- By the 1990s, the DG Competition was overwhelmed by its workload.
- European Union Council Regulation 1 (2003) allowed and encouraged competition authorities and courts in member states to enforce articles 101 and 102.

Similarities to U.S. antitrust policy

- Both E.U. law and U.S. law prohibit collusion, monopolization, and mergers that lessen competition.
- Stated purpose of law is to protect _____ and consumers, not firms.
- E.U. has a formal leniency program for firms that admit to participation in a cartel (price-fixing).
- Regulation 139 requires prior notification of mergers.

Differences from U.S. antitrust policy

- Until 20 years ago, competition policy was less vigorously enforced in E.U. than in U.S.
- E.U. policy goals of fairness and European integration were sometimes more important than promoting competition.
- So E.U. competition policy sometimes protected firms as well as consumers.

COMPETITION POLICY IN THE EUROPEAN UNION
Page 4

Differences from U.S. antitrust policy (cont'd)

- New differences have appeared recently, especially on abuse of dominant position (monopolization).
- In evaluating whether a firm's actions are competitive or anticompetitive
  - E.U. policy focuses on their "object" (or intent).
  - U.S. policy focuses on their economic effects.
- In some recent cases, E.U. authorities decided that firms' actions were anticompetitive, while U.S. authorities decided they were not.

Conclusions

- Competition policy in the E.U. is governed by Articles 101 and 102, and Regulation 139.
- They prohibit _____ that restrict competition, _____ of dominant market position, and _____ that impede competition—same concerns as U.S. antitrust policy.
- Enforcement is responsibility of the European Commission and the DG for Competition.
- Enforcement was formerly less vigorous in the E.U. than in the U.S., but now sometimes more vigorous.

COMPETITION POLICY IN CHINA
Page 1

COMPETITION POLICY IN CHINA

- What is the AML?
- What does it prohibit?
- How is it enforced?

Anti-Monopoly Law (AML) of the People's Republic of China

- Drafting of law began in 1993, consulting authorities in the E.U. and the U.S.
- First draft presented in 1997.
- Final draft adopted at 29th Meeting of Standing Committee of Tenth National People's Congress on August 30, 2007.
- AML effective August 1, 2008.
- AML does not say what agencies are responsible for enforcement.

Enforcement of AML

- At first, enforcement was divided among 3 agencies:
  - NDRC = National Development and Reform Commission
  - SAIC = State Administration for Industry and Commerce
  - MOFCOM = Ministry of Commerce
- In 2018, enforcement was centralized in the Anti-Monopoly Bureau of the State Administration for Market Regulation (SAMR) (国家市场管理总局).
- SAMR also has responsibility for intellectual property, food and product safety, etc.

Scope of AML

Chapter I "General Provisions"

Article 2: "This Law is applicable to monopolistic conducts in economic activities within the territory of the People's Republic of China; and it is applicable to monopolistic conducts outside the territory of the People's Republic of China, which serve to eliminate or restrict competition on the domestic market of China."

What the AML allows

Chapter I "General Provisions"

Article 5: Businesses may become large "through fair competition and voluntary association."

Similar to U.S. court decisions:
"… the law does not make mere size an offense…"

What the AML prohibits

Chapter I "General Provisions"

Article 3: "For the purposes of this Law, monopolistic conducts include:

1) monopoly agreements reached between undertakings;
2) abuse of dominant market position by undertakings; and
3) concentration of undertakings that lead, or may lead to elimination or restriction of competition."

COMPETITION POLICY IN CHINA
Page 2

AML prohibits "monopoly agreements"

Chapter II "Monopoly Agreements"

Article 13: Prohibits horizontal agreements between competing firms.

Article 14: Prohibits vertical restraints, including resale price maintenance.

Article 46: A firm that voluntarily reports a monopoly agreement may be given reduced punishment.

AML prohibits "abuse of dominant position"

Chapter III "Abuse of Dominant Market Position"

Article 17: Prohibits

• predatory pricing,

• refusal to deal,

• exclusive dealing,

• tying,

• price discrimination.

… "without justifiable reason."

AML regulates mergers

Chapter IV "Concentration of Undertakings"

Articles 20-27: Requires prior notification of mergers and review by authorities, if merged company would have large market share.

Article 28: Authorities may prohibit a merger.

Article 29: Authorities may impose conditions on a merger.

Enforcement of the AML

Enforcement authorities may

• order businesses or trade associations to change practices,

• confiscate "unlawful gains,"

• impose fines,

• order divestiture of assets.

If a business volunteers information about a "monopoly agreement," the authorities may grant _____.

Role of courts in China

A firm may appeal the decision of the SAMR to the courts.

• In practice appeals are unusual, because courts usually defer to enforcement authorities.

Also, firms may sue other firms in court for violating AML. However,

• Only actual damages can be recovered, not treble (_____) damages as in U.S.

• Decisions are made by judges only, no juries.

Role of courts in China

A firm may appeal the decision of the SAMR to the courts.

• In practice appeals are unusual, because courts usually defer to enforcement authorities.

Also, firms may sue other firms in court for violating AML. However,

• Only actual damages can be recovered, not treble (___times 3___) damages as in U.S.

• Decisions are made by judges only, no juries.

COMPETITION POLICY IN CHINA
Page 3

Similarities to U.S. antitrust policy

- Both China's AML and U.S. law prohibit collusion, monopolization, and mergers.
- Stated purpose of AML is "protecting fair market competition, enhancing economic efficiency, safeguarding the interests of consumers" (Article 1).
- AML allows leniency for firms that admit to participation in a cartel (price-fixing).
- AML requires prior notification of mergers.

Differences from U.S. antitrust policy

- AML is clearer and more detailed than U.S. laws.
- However, purpose of AML also includes broader goals: "promoting the healthy development of socialist market economy" (Article 1).
- AML also restricts *government agencies* from limiting competition (Chapter V).

Differences from U.S. antitrust policy (cont'd)

- Cases proceed more quickly than in U.S.
- Cases are rarely settled. That is, parties rarely reach agreement before final decision.
- No criminal prosecutions for antitrust violations.
- Fewer appeals: courts tend to defer to enforcement authorities.

Conclusions

- Competition policy in China is governed by the Anti-Monopoly Law (_____), effective 2008.
- The AML prohibits "monopoly agreements," "abuse of dominant market position," and mergers that may "eliminate competition"—same concerns as U.S. antitrust policy.
- Enforcement is responsibility of the Anti-Monopoly Bureau of the State Administration for Market Regulation (SAMR).

PART 4

Economic Regulation

Big ideas: When monopoly is inevitable, regulatory agencies often set prices. To maximize economic efficiency, they should set prices equal to marginal cost, but sometimes they can't or won't.

Famous quote: "I can't tell one plane from the other. To me, they're all just marginal costs with wings."
--Alfred Kahn

BRIEF HISTORY OF REGULATION IN THE U.S.
Page 1

BRIEF HISTORY OF REGULATION IN U.S.

- What Supreme Court cases laid the foundation for regulation?
- What have been the trends in regulation?
- How does regulation work?

What U.S. Constitution says about regulation

- "Congress shall have the power ... to regulate Commerce ... among the several states" (Article 1 Section 8).
- "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people" (10th Amendment).
- " ... nor shall any State deprive any person of life, liberty, or property, without due process of law" (14th Amendment, Section 1).

Munn v. Illinois (1877)

- Grain elevator operator challenged state regulation of grain-elevator rates, appealing to due-process clause of 14th Amendment.
- Supreme Court decided against operator.
- "when private property is affected with a public interest, it ceases to be *juris privati* only" and becomes fair game for state or federal regulation.

Munn v. Illinois, 94 U.S. 113 (1877).

Questions unanswered by Munn v. Illinois decision

- What industries are "affected with a public interest"? Public utilities only?
- In fact, many states had already regulated natural gas, electricity, water, transportation, banks, and insurance.
- Also, can states set any prices they want in industries they regulate?
- Unclear in Munn v. Illinois.

Smyth v. Ames (1898)

- Nebraska passed law in 1893 limiting railroad freight rates.
- Challenged by 4 railroads, again appealing to due-process clause of 14th Amendment.
- Railroads claimed law forced them to operate at a loss.
- U.S. Supreme Court agreed.

Smyth v. Ames (1898): the decision

- "…the basis for all calculations as to the reasonableness of rates ... must be the fair value of the property being used ...
- "What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience."
- "On the other hand, what the public is entitled to demand is that no more be extracted from it .. than the services rendered by it are reasonably worth."

Smyth v. Ames, 169 U.S. 466 (1898).

BRIEF HISTORY OF REGULATION IN THE U.S.
Page 2

Questions answered by Smyth v. Ames decision

- Regulated prices must permit a

  _____

  on investment.
- Seems to imply prices must be set equal to long-run _____ cost.

Nebbia v. New York (1934)

- Grocer challenged regulation of milk prices by New York's Milk Control Board.
- Argued that milk industry was competitive, not a public utility.
- Supreme Court agreed that milk was not a public utility, but said regulation could extend beyond public utilities.

Nebbia v. New York, 291 U.S 502 (1934).

Questions answered by Nebbia v. New York decision

- According to Nebbia v. New York, "there is no closed class or category of business affected with a public interest ..."
- Rather, "a state is free to adopt whatever economic policy may reasonably be deemed to promote public welfare, and to enforce that policy by legislation adopted to its purpose."

Interstate Commerce Act (1887)

- Response to turbulence in railroads-- alternating periods of stability and price wars.
- Railroads demanded price stability.
- Consumers, especially farmers, demanded end to price discrimination.
- Interstate Commerce Commission (ICC) created.

Wave of federal regulation in 1930s

- Securities Exchange Act (_____) established Securities and Exchange Commission to regulate stock sales and stock exchanges.
- Communications Act (_____) established Federal Communications Commission to regulate radio and telephone service.
- Motor Carrier Act (_____) charged ICC with regulating trucking.

Wave of federal regulation in 1930s (cont'd)

- Public Utility Act (_____) established Federal Power Commission to regulate interstate transmission of natural gas and electricity.
- Civil Aeronautics Act (_____) established Civil Aeronautics Board to regulate airlines.

BRIEF HISTORY OF REGULATION IN THE U.S.
Page 3

Slow growth of regulation in 1940s through the 1960s

- FPC begins regulating natural gas prices at wellhead in _____.
- FCC begins regulating cable television in _____.
- Oil prices regulated beginning in _____.

Deregulation in 1970s

- SEC abolishes fixed broker fees in _____.
- Airline Deregulation Act of _____ deregulates airlines and abolishes CAB.
- Staggers Act of _____ partially deregulates railroads.
- Motor Carrier Act of _____ deregulates trucking.

More deregulation in 1980s

- Bus Regulatory Reform Act of _____ deregulates intercity passenger buses.
- Gradual deregulation of long-distance landline telephone service by FCC after 1984 antitrust judgment.
- Oil prices deregulated in _____.
- Natural gas prices deregulated in _____.

More deregulation in 1990s

- Energy Policy Act of _____ encouraged competition in wholesale market for electric power.
- Interstate Banking and Branching Efficiency Act of _____ eliminated restrictions on interstate branch banking.
- ICC Termination Act of _____ abolished Interstate Commerce Commission.

Recent trends

- Telecommunications Act of _____ contained elements of regulation and deregulation.
- Federal Energy Regulatory Commission, in a series of orders, took steps to build competitive wholesale electricity markets.
- Gramm-Leach-Bliley Act of _____ repealed restrictions on mixing banking with insurance and securities.

How does regulation begin?

Legislation
- creates new agency or extends power of existing agency.
- sets powers of agency.
- specifies policy objectives.

BRIEF HISTORY OF REGULATION IN THE U.S.
Page 4

Who regulates?

- Some regulatory functions are performed by *agencies*, whose heads serve at the pleasure of the president (or governor).
- Some regulatory functions are performed by *independent commissions*.
- Federal commissioners are appointed for fixed term, cannot be removed.
- State commissioners are sometimes appointed, sometimes elected.

How much power do they have?

- Agencies' latitude depends on law.
  - some have considerable discretion.
  - others have precise mandates and formulas written into law.
- Nevertheless, change is slow and costly, so regulated markets are biased toward preserving the status quo.

How does regulation proceed?

- Two approaches to regulation.
  - Case-by-case
  - Rulemaking
- Affected parties can always appeal to U.S. Court of Appeals.

Conclusions

- _____ and _____ established right of government to regulate any industry, subject to fair return on investment (_____).
- A wave of legislation in _____s brought railroads, trucking, finance, radio, telephones, airlines, etc. under federal regulation.
- Trend toward deregulation began in _____s, continues today.

THEORIES OF REGULATION
Page 1

THEORIES OF REGULATION

- What theories attempt to explain regulation?
- What is the difference between normative and positive theories?

Two kinds of theory

- Normative theory = shows how regulation _____ work.
- Positive theory = predicts how regulation _____ work.

Normative theory: regulation should respond to market failures

- *Natural monopoly* causes goods to be _____ at too high a price (greater than marginal cost).
- *External costs* cause goods that hurt others to be _____.
- *Imperfect information* causes unobservable quality to be _____.

Normative theory: regulation should maximize social welfare

Maximizes consumer surplus + producer surplus, eliminating _____.

- Lowers prices to marginal cost in monopoly industries.
- Restricts output of goods that generate external costs.
- Solves information problems.

Positive theories of regulation

Simple theories
- Normative analysis as positive theory, also called "_____."
- Capture theory.

Economic theories
- Stigler-Peltzman model of politicians' behavior.
- Becker model of competing influence groups.

Public interest theory

Assumes regulation does what it should do.

Problems: contrary evidence.

- Some regulated industries are not natural monopolies: _____.
- Sometimes industries lobbied for their own regulation: _____.
- Studies show little downward effect of regulation on price or profit (at least before 1960).

THEORIES OF REGULATION
Page 2

Capture theory

- Says regulatory agencies "captured" by industries they are supposed to regulate.
- Regulation serves producers only.

Capture theory: Problems

- Does not explain how producers can capture an agency under democratic government.
- Cannot explain regulatory bias toward protecting small producers. Example: oil refining.
- Cannot explain cross-subsidization.
- Cannot explain regulation that reduces profit and is opposed by industry. Examples: Environment, occupational safety, product safety.
- Cannot explain deregulation.

Conclusions

- Normative theory shows how regulation _____ work to increase social welfare.
- Positive theories predicts how regulation _____ work:
  - Public interest theory predicts regulation works as it should.
  - Capture theory predicts regulation serves only the _____,
  - Neither explains actual regulation well.

ECONOMIC THEORIES OF REGULATION
Page 1

> ### ECONOMIC THEORIES OF REGULATION
>
> • What are economic theories of regulation?
> • What can they explain?

What are "economic" theories of regulation?

• Positive theories that try to explain how regulation _____.
• Intended to match the real world better than public-interest or capture theories of regulation.
• Use economic concepts of _____ (choosing the best) and _____ (the point where no one wants to change).

Economic theories discussed here

• Stigler-Peltzman model
  • Politicians supply regulation, which is demanded by consumers and producers, to maximize support.
• Becker model
  • Consumers and producers compete to influence regulators.

Stigler-Peltzman model

• Why regulation? The State, unlike private firms, can offer the power of coercion.
• Regulation can redistribute _____ by
  • raising or lowering prices.
  • restricting entry.
  • forcing production and sale below cost.
• Politicians are motivated to supply regulation because want to _____.

Stigler-Peltzman model: demand for regulation

• Groups are more willing to pay for regulation (with votes and other political resources) if they are
  • likely to _____ from regulation.
  • _____. This tends to favor small groups with strongly-felt preferences.

George Stigler, "The theory of economic regulation," *Bell Journal of Economics and Management Science 2* (Spring 1971): 3-21.
Sam Peltzman, "Toward a more general theory of regulation," *Journal of Law and Economics 19* (August 1976): 211-40.

Stigler-Peltzman model: demand for regulation (cont'd)

• Suppose Group A has a million members who each stand to gain $1, while Group B has a thousand members who each stand to gain $1000.
• If the groups are opposed,
  • Group _____ will win out because each member stands to gain a lot;
  • Group _____ will likely be undermined by free-rider problems ("let George do it!").

ECONOMIC THEORIES OF REGULATION
Page 3

Stigler-Peltzman model: why natural monopolies are regulated

- Industries that are natural monopolies:
 - local telephone,
  - electric and gas utilities
  - railroads.
- Why? Because _____ stand to gain a lot.
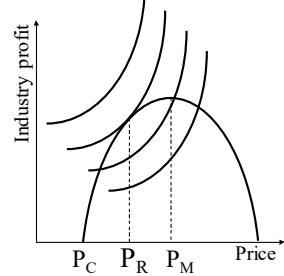
Stigler-Peltzman model: Why competitive industries are regulated

- Also, industries that are naturally competitive:
- Agriculture, trucking, taxicabs, oil and gas production, securities.
- Why? Because _____ stand to gain a lot.
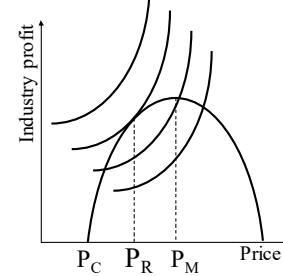
Stigler-Peltzman model: conclusions

- Politicians are motivated to supply regulation because want to _____.
- To maximize support, politicians typically choose a price _____ competitive and monopoly prices.
- Politicians are most likely to target industries that are natural monopolies or competitive, not industries in between.

Becker model

- Regulation is an outcome of political pressure by competing interest groups.
- Each group chooses a level of pressure based on the costs (resources), the benefits (transfer of wealth), and the level of pressure chosen by opposing groups.

Gary S. Becker, "A Theory of Competition Among Pressure Groups for Political Influence," *Quarterly Journal of Economics* 98 (August 1983): 371-400.

Becker model: how groups react to each others' pressure

- The more pressure one group exerts, the more the other group will exert in response.
- However, each group's response is less than one-for-one.
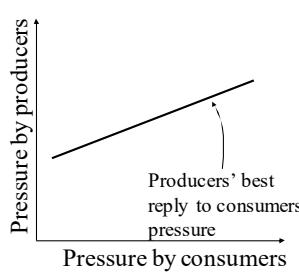
Becker model: equilibrium

- In equilibrium, no group wants to change its level of pressure.
- Thus a _____ equilibrium.
- Intersection of "best reply" functions.
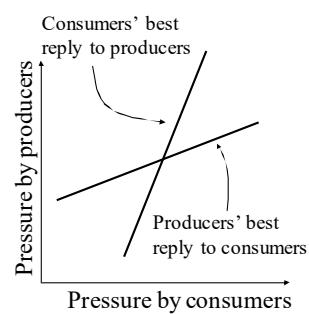
ECONOMIC THEORIES OF REGULATION
Page 4

Becker model: inefficiency of political process

- Some wealth is always lost in transfer (deadweight loss and costs of regulation).
- All groups suffer from free-riding, but some groups more than others.

Becker model: equilibrium is not Pareto-optimal

- Same regulatory outcome could be obtained and resources saved if all groups exerted less pressure.
- Similar to "Prisoner's dilemma."
- Similar to Cournot model of oligopoly.
- But deadweight loss does affect regulation.

Becker model: the role of deadweight loss

- Suppose Group A benefits from regulation and Group B suffers.
- If deadweight loss is increased by regulation, then Group B suffers _____ than Group A benefits.
- The greater the deadweight loss from regulation, the _____ pressure Group B is willing to exert against it.
- Example: price floor in competitive market.

Becker model: the role of deadweight loss (cont'd)

- If deadweight loss is reduced by regulation, then Group B suffers _____ than Group A benefits.
- The more deadweight loss is reduced, the _____ pressure Group B is will exert against it.
- Example: price ceiling on natural monopoly.

Becker model: implications

- Regulatory policies that improve social welfare are _____ likely to be adopted than policies that reduce social welfare.
- Assumes interest groups are equally efficient at applying pressure.
- So the public-interest model may not be too far off.

Becker model: conclusions

- Regulation is an outcome of a game between competing interest groups.
- Policies that reduce deadweight loss are more likely to be adopted.
- But competitive markets might still be regulated.

ECONOMIC THEORIES OF REGULATION
Page 5

Cross-subsidization: definition

- Cross-subsidization occurs when regulation sets price below marginal cost for some consumers and above marginal cost for others. Examples:
- _____ telephone service.
- Air service to _____.

Cross-subsidization according to Posner

- Posner argues that this kind of wealth distribution is similar to other government policies like
  - welfare programs for the poor
  - progressive income taxes.

Richard A. Posner, "Taxation by Regulation," *Bell Journal of Economics and Management Science* 2 (Spring 1971): 22-50.

Do economic theories explain changes in regulation in the real world?

- According to economic theories of regulation, changes in regulation occur in response to
  - changes in cost or demand for products
  - changes in relative influence of interest groups.
- This may explain deregulation of railroads and branch banking.
- It does not explain deregulation of trucking.

Conclusions

- Economic theories model regulation using the concepts of optimization and equilibrium.
- The Stigler-Peltzman model views politicians as _____ political support by trading off the interests of consumers and producers.
- The Becker model views regulation as the _____ outcome of a game between competing interest groups.

NATURAL MONOPOLY
## Page 1

NATURAL MONOPOLY

- What is a natural monopoly?
- What are economies of scale?
- What are economies of scope?

Definition of natural monopoly

- An industry is a natural monopoly if a given level of total output can be produced more cheaply by one firm than by several firms.
- Natural monopoly has _____ to do with natural resources!

Natural monopoly with falling average cost curve

- An industry where any firm has falling average cost is a natural monopoly at _____ levels of output.
- Economies of scale everywhere!
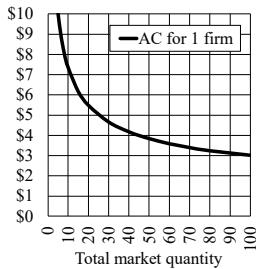
Natural monopoly with U-shaped average cost curve

- Natural monopoly is also possible if each firm has a U-shaped cost curve.
- This industry is a natural monopoly for industry output less than Q = _____.
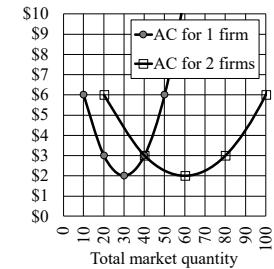
Efficient scale

Efficient scale =
- output level corresponding to minimum AC.
- output level where economies of scale are exhausted.

Efficient scale = q_{ES}
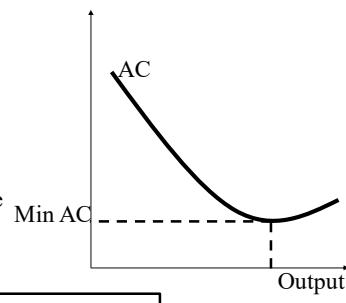
Efficient scale (cont'd)

- If AC levels off, efficient scale is a *range* of output levels.

Minimum efficient scale = MES
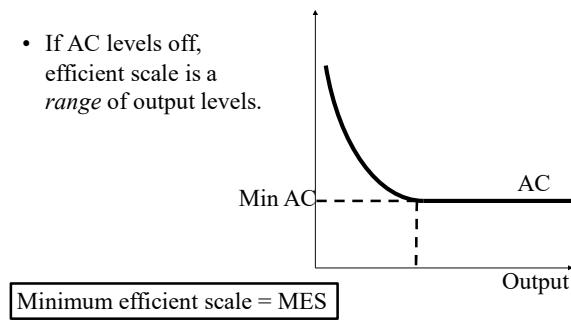
NATURAL MONOPOLY
Page 2

Natural monopoly with minimum efficient scale

- An industry where AC levels off is a natural monopoly at output levels up to twice the min. efficient scale.
- This industry is a natural monopoly for industry output less than Q = _____.


Total market quantity
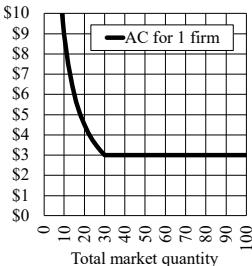
Allocative efficiency versus productive efficiency

- If an industry is a natural monopoly, competition is not a stable outcome.
- Dilemma:
  - Production by several firms leads to competition and lower _____.
  - But production by only one firm may lead to lower _____ of production.

Temporary natural monopoly

- Natural monopoly may disappear if MES decreases or demand increases sufficiently.
- This industry is a natural monopoly at "old demand" but ___ at "new demand."
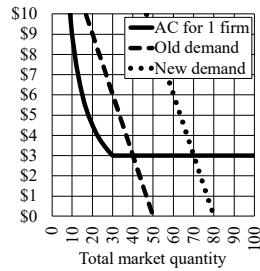

Total market quantity

Temporary natural monopoly

- Natural monopoly may disappear if MES decreases or demand increases sufficiently.
- This industry is a natural monopoly at "old demand" but <u>not</u> at "new demand."

Total market quantity
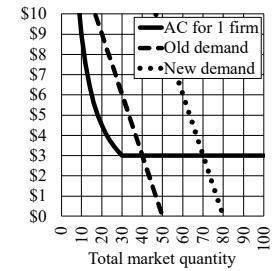
Examples of temporary natural monopoly

- Long-distance telephone service.
  - Demand grew rapidly in mid-20th century.
- Long-distance freight transportation.
  - Railroads (19th century) have high MES.
  - Trucking (1920s and 1930s) have lower MES.

Conclusions

- Natural monopoly means total industry output can be produced most cheaply by _____ firm.
- Falling average cost (economies scale) imply natural monopoly at _____ output levels
- Natural monopoly can also occur over certain ranges if average cost levels out or is U-shaped.
- Natural monopoly makes competition unstable and perhaps _____.

PRICING WITH ECONOMIES OF SCALE
Page 1


PRICING WITH ECONOMIES OF SCALE

- What pricing problem arises with economies of scale?

Marginal-cost pricing

- To maximize welfare, regulator should ideally set price = _____ cost.
- This ensures that everyone willing to pay the marginal cost is served.
- Competitive markets do this automatically.

Marginal cost in the presence of economies of scale

- If average cost (AC) is falling, then marginal cost (MC) is less than average cost.
- Intuitively, marginal cost works like gravity, "pulling" AC down.
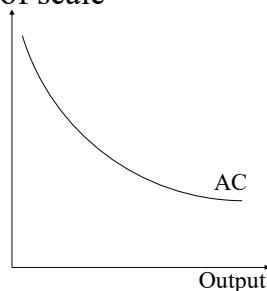
Marginal cost pricing results in a loss

- If average cost (AC) is falling, setting price at marginal cost causes P = MC < AC.
- The firm makes a loss.
- Not permitted! (See Smyth v. Ames.)
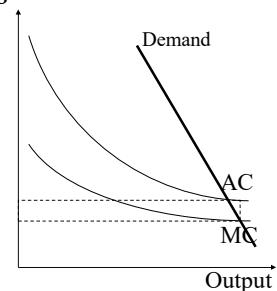
Pricing choices in presence of economies of scale

(1) Set price equal to marginal cost. Subsidize firm out of general tax revenues.

(2) Set price equal to average cost and endure deadweight loss.
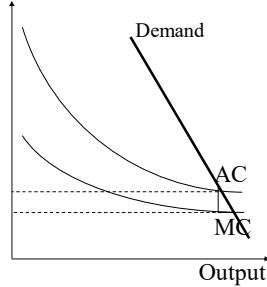
Pricing choices in presence of economies of scale (cont'd)

(3) Use second-degree price discrimination to reduce deadweight social loss.

- *Linear pricing*: same price per unit sold. (Thus consumer's expenditure is a linear function of output: expenditure = p q.)
- *Nonlinear pricing*: fees, blocks and other complications so that consumer's expenditure ≠ p q.

PRICING WITH ECONOMIES OF SCALE
Page 2

Pricing choices in presence of economies of scale (cont'd)

(3) Use _____ pricing to reduce deadweight social loss.

- Monthly service fees, pricing blocks, quantity discounts, etc.
- Also called "nonlinear pricing."
- Economic efficiency requires only that the _____ price equal marginal cost.

Conclusions

- In the presence of economies of scale, marginal cost pricing yields a loss.
- Regulator must choose between
  - _____-cost pricing with a subsidy.
  - _____-cost pricing with deadweight loss.
  - Multipart pricing ("nonlinear pricing").

MULTIPART TARIFFS
Page 1

MULTIPART TARIFFS

- Suppose MC<AC.
- Can price = MC and yet total revenue = total cost?

Assume economies of scale and scope

- Suppose a regulated monopolist produces several products, or sells the same product in several markets.
- Due to economies of scale and scope, simple marginal-cost pricing _____ cover total costs.
- Is there a way to maintain economic efficiency using more complicated pricing?

Simple "linear" pricing

- Price has just one component: p.
- A consumer's spending is a linear function of the quantity consumed:
- Monthly bill = p q.
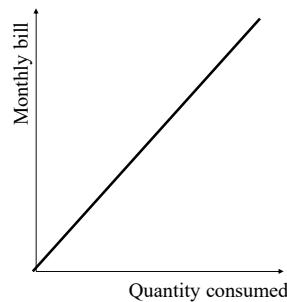
Multipart tariffs: definition

- Fees, blocks and other complications, so that "price" has more than one component.
- Synonyms:
  - nonlinear pricing.
  - 2nd degree price discrimination.
- Note: in the world of regulation, a *tariff* means a *pricing policy* or *pricing schedule*.

Why multipart tariffs are useful

- Suppose there are economies of scale.
  - MC pricing would cause regulated firm to lose money.
  - AC pricing would cause deadweight loss.
- Multipart tariffs can capture some consumer surplus _____ reducing efficiency.
- The marginal unit is still sold at a price equal to _____ cost.

### Why multipart tariffs are useful (cont'd)

- Unlike third-degree (market-segmenting) price discrimination, all customers get the same price *schedule*.
- Although marginal price = marginal cost, average price (=spending/q) _____ marginal cost.
- Customers choose how much to buy, and thus what average price to pay.

MULTIPART TARIFFS
Page 2

Entry fee

- Consumer pays some fixed amount regardless of usage.
- In addition, consumer pays a price for usage.
- Ideally, usage price is set equal to _____.

Monthly bill / *Quantity consumed*

Maximum entry fee

- Maximum possible entry fee is consumer surplus with P=MC.
- In this example, the usage price should be set at _____.
- The maximum possible entry fee is _____.

Individual demand
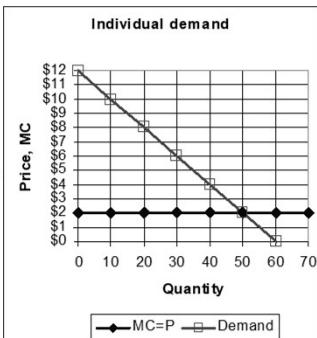
Declining-block tariff

- Instead of an entry fee, usage could be priced in blocks.
- For example, the first *n* units could carry a high price.
- Succeeding units could carry a low price.

Monthly bill / *Quantity consumed* / n
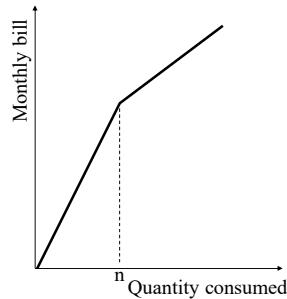
For large consumers, declining-block tariff is equivalent to entry fee

- The second block should be set equal to marginal cost.
- In this example, the first block is equivalent to an entry fee of _____.

Individual demand
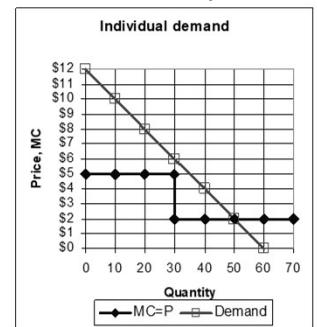
So why use declining-block tariffs?

- Small customers may be unwilling to pay large entry fee.
- In this example, the customer would _____ pay $90 entry fee.
- Maximum entry fee willing to pay = _____.

Individual demand
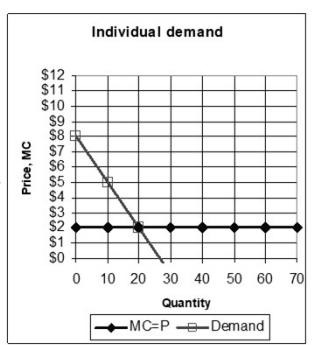
Declining-block tariffs sometimes superior to entry fees

- Same customer willing to buy with declining-block tariff.
- Chooses _____ units.
- Enjoys $_____ in consumer surplus.
- Contributes $_____ beyond marginal cost.

Individual demand
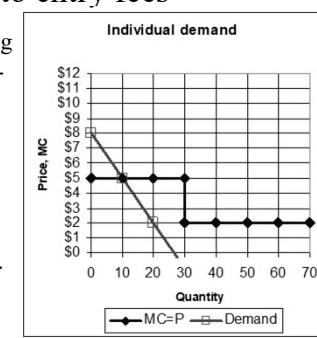
MULTIPART TARIFFS
Page 3

Threat of arbitrage

- Like all price discrimination, multipart tariffs may be undercut if consumers can sell to each other.
- Example: one consumer pays the entry fee and buys for everyone.
- Consequence: electric power tariffs often specify that power may not be resold.

Conclusions

- Multipart tariffs (or "_____") are prices with several components.
- Examples include entry fees and declining blocks.
- With multipart tariffs, one can set the marginal price equal to _____ and yet total cost = _____.

NATURAL MONOPOLY
Page 1

MULTIPRODUCT FIRMS

•How can we write the total cost function of a firm that produces multiple outputs?
•What are economies of scope?

The multiproduct firm

- Most real-world firms produce multiple products.
- Examples: _____
  _____ .
- Such firms typically have *joint costs*—costs associated with several outputs.
- Examples: _____
  _____ .

Total cost function for multiproduct firm

- The total cost function of the multiproduct firm depends on all of its outputs.
- Example: Let q_D = number of dinners served and q_L = number of lunches served.
- Then let $TC(q_D, q_L)$ = total cost function for a restaurant that serves both lunch and dinner.

Economies of scope

- Joint costs create *economies of scope.*
- Definition: An industry has economies of scope if combinations of *different* outputs can be produced more cheaply together by one firm than separately by more than one firm:
  $TC(q_D, q_L) \qquad TC(q_D, 0) + TC(0, q_L)$.

Economies of scope: example

- Producing 50 dinners alone costs $TC(50,0) = \$_____$.

Total cost		Lunches		
		0	100	200
	0	$0	$250	$500
Dinners	50	$400	$500	$700
	100	$800	$900	$1000

Economies of scope: example (cont'd)

- Producing 200 lunches alone costs $TC(0,200) = \$_____$.

Total cost		Lunches		
		0	100	200
	0	$0	$250	$500
Dinners	50	$400	$500	$700
	100	$800	$900	$1000

NATURAL MONOPOLY
Page 2

Economies of scope: example (cont'd)

- Producing 50 dinners AND 200 lunches together costs only TC(50,200) = $_____ .

Total cost		Lunches		
		0	100	200
Dinners	0	$0	$250	$500
	50	$400	$500	$700
	100	$800	$900	$1000

Conclusions

- If a firm produces several outputs, its total cost function depends on _____ of the quantities.
- "Economies of _____" means a combination of different outputs can be produced most cheaply by one firm.

RAMSEY PRICING
Page 1

RAMSEY PRICING

- Suppose MC<AC and multipart tariffs are not feasible.
- How should prices be set?

Assume economies of scale and scope

- Suppose a regulated monopolist produces several products, or sells the same product in several markets.
- Ideally, all prices should be set equal to _____.
- But suppose that, due to economies of scale and scope, MC pricing _____ cover total costs.

The pricing problem

- Also assume that multipart tariffs are impossible for some reason.
- Obviously, some product(s) or customer(s) must be priced _____ marginal cost.
- Which one(s)? How much?

Markups

- Gaps between price and marginal cost are called "markups."
- Good i's markup is
$$\frac{P_i - MC_i}{P_i}$$
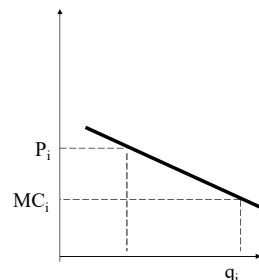
Equal markups?
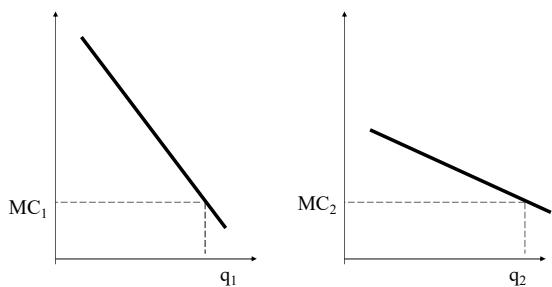
Equal markups not a good idea

- Preceding slide shows that same markup can produce very different deadweight loss, depending on shape of demand curve.
- The more elastic the demand curve, the _____ the deadweight loss.
- So equal markups do _____ minimize social deadweight loss.

RAMSEY PRICING
Page 2

Ramsey rule

- Ramsey showed that if cross-price elasticities = 0, then markups should be _____ proportional to price elasticities of demand.
- The more elastic demand, the _____ the optimal markup of price over marginal cost.

Frank Ramsey, "A Contribution to the Theory of Taxation," *Economic Journal*, Vol. 37 (March 1927), pp. 47-61.

The Ramsey formula

- Thus the markup for each product should be
$$\frac{P_i - MC_i}{P_i} = \frac{a}{\varepsilon_i}$$
where a is some constant of proportionality.
- The more revenue is required, the _____ a must be.

Another version of the Ramsey rule

- Suppose there are only two products.
- Then the Ramsey rule can be expressed as
$$\frac{\left(\frac{P_1 - MC_1}{P_1}\right)}{\left(\frac{P_2 - MC_2}{P_2}\right)} =$$
- Markups _____ proportional to elasticities.

Example 1: regulated telephone prices

- For much of the 20th century, landline telephone prices were regulated.
- Business demand for phone service probably _____ elastic than residential demand.
- Business customers typically paid a _____ monthly price than residential customers.

Example 2: regulated railroad freight rates

- For much of the 20th century, railroad freight rates were regulated under the principle of "value of service" pricing.
- More valuable goods (liquor, electronic equipment, etc.) paid higher rates than less valuable goods (gravel, sand, potatoes, etc.).
- Demand for shipping by first group was probably _____ elastic.

Extreme case of Ramsey rule

- In general, product with _____-elastic demand should get the higher markup.
- If demand for one product is perfectly inelastic, then *only* that product should have a price greater than marginal cost (because _____ deadweight loss.)

P_2
MC_2
q_2
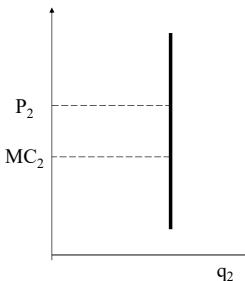
RAMSEY PRICING
Page 3

Comparison: Ramsey pricing versus market-segmenting monopoly price discrimination

- An unregulated monopolist uses pricing rule

$$P_i = \frac{MC_i}{1 + \frac{1}{\varepsilon_i}} \quad or \quad \frac{P_i - MC_i}{P_i} = \frac{1}{\varepsilon_i}$$

- Equivalent to Ramsey rule with $a =$ ___.
- But monopolist sets prices to maximize profit, not just break even!

But Ramsey pricing may be vulnerable to "cream skimming"

- If one product or market is priced far above MC, it may be possible for an entrant to enter only that _____ market.
- This takes away profitable business from the regulated monopolist and undercuts its ability to break even.

Example of illegal cream-skimming

- U.S. Postal Service charges same 1st-class rate for delivery across town or across country. But delivery across town costs much less.
- Markup is thus very high for local delivery.
- Occasionally, firms try to enter local market alone, skimming the cream.
- However, this is illegal and vigorously prosecuted by Postal Service because threatens its ability to break even.

Example of legal cream-skimming

- In late 1970s, AT&T's long distance telephone rates were marked up much higher above MC than local telephone service.
- (Not actually Ramsey pricing, because elasticity of demand for long-distance service was in fact _____ than for local service.)
- But MCI, Sprint, and other companies entered the long-distance market alone, skimming the cream and forcing regulators to realign rates.

Conclusions

- Suppose prices must be raised _____ marginal cost to ensure regulated firm breaks even.
- To minimize deadweight loss, markup should be _____ proportional to price elasticity of demand (Ramsey rule).
- However, Ramsey prices can be vulnerable to _____ attacks.

TRADITIONAL RATE-OF-RETURN REGULATION
Page 1

TRADITIONAL RATE-OF-RETURN REGULATION

•How are utilities traditionally regulated?

The rate case

- Traditionally, utility rates are set in *rate cases*, quasi-judicial proceedings before state or federal regulatory commissions.
- Utility usually asks for rate increases so that it can get more revenue, to balance increased costs.

The utility's revenue

- Most utilities sell a number of different products or services.
- Suppose a utility has n products, i=1,…,n.
- Let q_i = quantity sold of product i.
- Let p_i = price of product i.
- The utility's revenue is given by

$$\text{Revenue} = \sum_{i=1}^{n}$$

Rate level and rate structure

- Argument focuses on this equation:

$$\sum_{i=1}^{n} p_i q_i = \text{expenses} + \left(s \times RB\right)$$

- First, the right side is evaluated based on data from a recent "test period."
- This establishes the utility's revenue requirement.
- Then, p_i are set to balance the equation.

Expenses versus rate base

- *Expenses* include labor, materials, depreciation, and taxes.
- *Rate base* (RB) is utility's investment in
  _____.
- Here, s denotes the allowed or "fair" *rate of return*.
- Hence called "rate of return (ROR) regulation."

Setting the allowed rate of return

- This issue usually occupies most of a rate case.
- The utility argues for a _____ rate.
- The commission staff or the consumer advocate argues for a _____ rate.

TRADITIONAL RATE-OF-RETURN REGULATION
Page 2

Computing value of rate base

- Most common method is to use _____, minus depreciation.
- Other methods include
  - Reproduction cost (cost of building same designs today).
  - Replacement cost (cost of building equivalent capacity today).

Another way to compute value of rate base?

- Could add up the market value of the company's outstanding stocks and bonds.
- But the value of any company's stock depends on expected future profits.
- So these depend on the rates to be set by the regulatory commission!

Averch-Johnson effect

- Suppose the allowed rate of return (s) is set *above* the competitive rate of return (r).
- Effectively, the commission is _____ plant and equipment (physical capital).
- In theory, one should expect the utility to respond by _____ physical capital.

H. Averch and Leland Johnson, "Behavior of the Firm Under Regulatory Constraint," *American Economic Review*, December 1962.

Graph of Averch-Johnson effect

- An unregulated firm minimizes cost by choosing an input combination such that slope of isoquant = ratio of input prices.
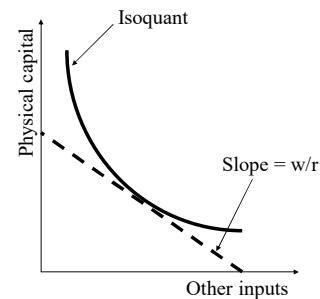
Graph of Averch-Johnson effect (cont'd)

- But if commission allows rate of return s>r, then in theory the utility will substitute physical capital for other inputs.
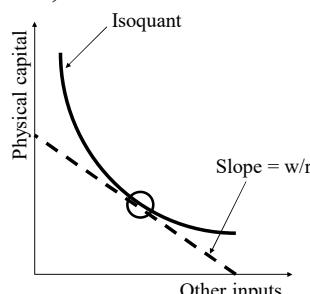
Averch-Johnson effect in practice

- Regulators often conduct "prudence reviews" to determine whether capital investments are really justified.
- Sometimes they decline to include new investments in the rate base.
- Overall statistical evidence for Averch-Johnson effect is _____ at best.

TRADITIONAL RATE-OF-RETURN REGULATION
Page 3

Conclusions

- Traditionally, utility rates (prices) are set to cover expenses and produce a "fair" rate of return on the "_____" (physical capital).

- If the allowed rate of return is set too high, the utility might in theory use too much capital (the _____ effect).

INCENTIVE REGULATION
## Page 1

INCENTIVE REGULATION

•How can a regulator encourage utilities to be more efficient?

Perverse incentives in traditional ROR regulation

- Suppose a utility is extremely vigilant in increasing efficiency and decreasing expenses.
- Then its actual ROR might rise above the previously allowed rate of return (s).
- But then at the next rate case, its prices would be adjusted _____!

Lack of incentives for technical efficiency

- Let "gross ROR" = rate of return before rates are adjusted.
- Let "net ROR" = rate of return after rates are adjusted.

Net ROR

Gross ROR (efficiency)

Allowed ROR
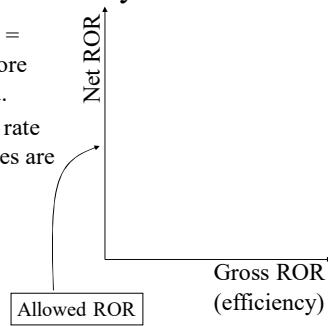
Creating incentives for technical efficiency

- How can utility be encouraged to keep expenses low?
- Commission could review expenses.
- Or commission could set rates so as to encourage efficiency.

ROR regulatory lag

- If rate cases are infrequent, utility has some incentive to keep costs low immediately after new rates are set.
- Between rate cases, utility keeps any savings and pays any cost overruns!

Net ROR

45°

Gross ROR (efficiency)

Allowed ROR
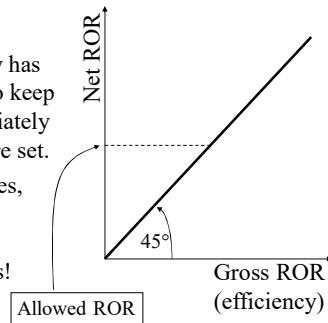
Effects of ROR regulatory lag

- Regulatory lag thus tends to _____ technical efficiency, but it creates other problems.
- If costs are rising because of inflation, rates will quickly become too _____ to be efficient and firm's ROR is effectively lowered.
- If costs are falling because of better productivity due to technical change, rates will quickly become too _____ to be efficient and consumer surplus is not as large as it should be.

INCENTIVE REGULATION
Page 2

Deliberate policies to encourage efficiency

- Regulatory lag is an inadvertent policy that may encourage efficiency.
- Deliberate policies include
  - Performance standards.
  - Earnings sharing.
  - Price caps.

Performance standards: a supplement to ROR regulation

Many electric power and gas companies are given incentive bonuses based on specific measures of performance, such as

- heat rates (a measure of fuel efficiency)
- customer response time
- base load utilization (a measure of capacity utilization)

Earnings sharing: flexible ROR regulation

- Utility is permitted to keep a fraction of its excess earnings, up to a maximum.
- Example: Pacific Bell (1990s).
 - r_{min} = _____
  - r_{max} = _____
  - fraction = _____.

slope = fraction

Net ROR

45°

Gross ROR (efficiency)

r_{max} r_{min}

Price caps: an alternative to traditional ROR regulation

- *Price caps* use the benefits of regulatory lag while trying to avoid the problems.
- Maximum rates are set for an extended period, with automatic adjustments.

Net ROR

45°

Gross ROR (efficiency)

Expected ROR

Price caps create incentives for efficiency

- If utility is more efficient than expected, it keeps the savings.
- If utility is less efficient than expected, it pays the cost overrun.

Net ROR

45°

Gross ROR (efficiency)

Expected ROR

Adjustments to the price cap

- *Rate increase = rate of inflation – X + Z*, where X = rate of productivity growth, and Z = pass-through of costs beyond the utility's control (e.g., fuel prices).
- Key idea: adjustments must be _____ of utility's performance.
- Otherwise no incentive to perform well!

INCENTIVE REGULATION
Page 3

The X-factor

- Hardest part is setting X factor.
- Difficult to forecast productivity growth.
- Typical practice is to use past rate of productivity growth, then add "stretch factor" for anticipated increase from switching from ROR regulation to price caps.

Pricing under price cap regulation

- Typically, rate increase applies to an average of all prices $p_1,\ldots,p_n$.
- Utility given substantial flexibility on individual prices p_i.
- Price caps are _____. Utility may still reduce rates if desired.

Price caps in practice

- Used to regulate AT&T's long-distance telephone service.
- Increasingly popular in state telephone regulation as well. Largely replaced earnings sharing, which was popular in the early 1990s.
- However, now telephone rates are no longer regulated at all.

Conclusions

- Regulatory lag encourages utilities to reduce expenses, but risks misaligning prices in the long run.
- Performance standards, earnings sharing, and _____ can encourage the utility to keep expenses low.

COMMON COSTS AND JOINT COSTS
Page 1

COMMON COSTS AND JOINT COSTS

•In setting utility rates, how should costs of inputs shared by several products be allocated?

Allocating costs

- Most utilities produce *many* kinds of output.
- Often inputs are shared by several kinds of output.
- Examples:
  - Same generators are used to produce power during day and during night.
  - Same track carries passenger and freight traffic on railroads.

"Fully distributed costs"

- How should the costs of shared inputs be allocated in setting prices?
- Typical regulatory practice distributed shared costs _____ to output (e.g., kilowatt-hours) or _____ to other inputs (e.g., car-miles for railroads).
- Like average-cost pricing, sometimes this practice makes sense, sometimes it does not.

Ideal pricing: P = MC

- "Fully distributed costs" makes sense if it produces _____ cost pricing.
- This is likely to occur if the shared inputs are used to their capacity and inputs are proportional to outputs.
- This is *not* likely to occur if there is excess capacity of some kind, for then MC < fully distributed costs.

Restaurant example: two outputs

Cost item	Lunch	Dinner	Shared
Food and labor, per customer	$4	$10	
Electric power, per customer			$1
Furniture, equipment per customer of capacity			$3

Fully-distributed costs for the restaurant example

- Suppose there are 50 lunch customers and 100 dinner customers.
- Total shared costs are
$1 × (50+100) for electricity, plus
$3 × max(50,100) for furniture, equipment
= _____.
- Shared costs per customer
= 450 / (50+100) = _____.

COMMON COSTS AND JOINT COSTS
Page 2

Fully-distributed costs for the restaurant example (cont'd)

- So the price of lunch would be set at
  $P_L = \$4 + \$3 = \underline{\hspace{1.5cm}}$.
- The price of dinner would be set at
  $P_D = \$10 + \$3 = \underline{\hspace{1.5cm}}$.

Shared costs in reality

In reality, costs of shared inputs often fall into two categories:

1) Costs of inputs that can be used to produce *either output*: $\underline{\hspace{3cm}}$ costs.

2) Costs of inputs that are used to produce *both outputs jointly*: $\underline{\hspace{2.5cm}}$ costs.

These are Kahn's definitions. See Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Volume 1, New York: Wiley, 1970, p.78.

(1) Common costs: definition

- Costs of inputs that can be used to produce *either* of several outputs.
- Amount needed of a common input depends on $\underline{\hspace{2cm}}$ of the different outputs.

This is Kahn's definition. See Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Volume 1, New York: Wiley, 1970, p.78.

(1) Common costs: examples

- Telecommunications
  - Outputs: local calls, long-distance calls.
  - Common input: $\underline{\hspace{3cm}}$.
- Railroads
  - Outputs: passenger traffic, freight traffic.
  - Common input: $\underline{\hspace{3cm}}$.

(2) Joint costs: definition

- Costs of inputs that are used to produce several different outputs *simultaneously*.
- The amount needed of a joint input depends on the $\underline{\hspace{3cm}}$ of the different outputs.

This is Kahn's definition. See Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Volume 1, New York: Wiley, 1970, p.79.

(2) Joint costs: examples

- Trucking or railroads
  - Outputs: Freight hauled one direction, freight hauled back the other direction.
  - Joint input: $\underline{\hspace{3.5cm}}$.
- Intercity busses
  - Outputs: passenger service, package service.
  - Joint input: $\underline{\hspace{3.5cm}}$.

COMMON COSTS AND JOINT COSTS
Page 3

(2) Joint costs: more examples

- Electric power
  - Outputs: electricity during peak hours (afternoon), electricity during off-peak hours (night).
  - Joint inputs: _____.
- Telecommunications
  - Outputs: Phone calls during peak hours (day), phone call during off-peak hours (night).
  - Joint inputs: _____.

(2) Joint costs: more examples from unregulated markets

- Hotels
  - Outputs: lodging during peak tourist season, lodging during off-season.
  - Joint input: _____.
- Restaurants:
  - Outputs: service on New Year's Eve, service other evenings.
  - Joint inputs: _____.

(2) Joint costs: still more examples from unregulated markets

- Airlines
  - Outputs: tickets during peak periods like Thanksgiving, tickets during other periods.
  - Joint inputs: _____.

Restaurant example again

Cost item	Lunch	Dinner	Shared
Food and labor, per customer	$4	$10	
Electric power, per customer			$1
Furniture, equipment per customer of capacity			$3

Cost function for the restaurant

- Let q_L = number of lunch customers.
- Let q_D = number of dinner customers.
- Total cost is $c(q_L,q_D)$
  $= 4q_L + 10q_D + 1q_L + 1q_D + 3 \max(q_L,q_D)$
  $=$

  _____.

Marginal costs for the restaurant

- $c(q_L,q_D) = 5q_L + 11q_D + 3 \max(q_L,q_D)$.
- Assume there are more dinner customers than lunch customers, so that $q_L < q_D$, and $\max(q_L,q_D) = q_D$.
- MC of lunch $= \frac{\partial c}{\partial q_L} =$
- MC of dinner $= \frac{\partial c}{\partial q_D} =$

COMMON COSTS AND JOINT COSTS
Page 4

Comparison of pricing methods for restaurant example

|	Fully-distributed costs	Marginal costs
Price of lunch	$7	$5
Lunch revenue (50 diners)	$350	$250
Price of dinner	$13	$14
Dinner revenue (100 diners)	$1300	$1400
Total revenue		

Pricing with common or joint costs

- Method of fully-distributed costs makes sense in pricing outputs with _____ costs.
- However, method does not make sense with _____ costs because joint input may not always be used to its capacity.
- To understand joint costs, consider another unregulated example: hotels.

Competitive SR supply curves with joint production: curves are identical!
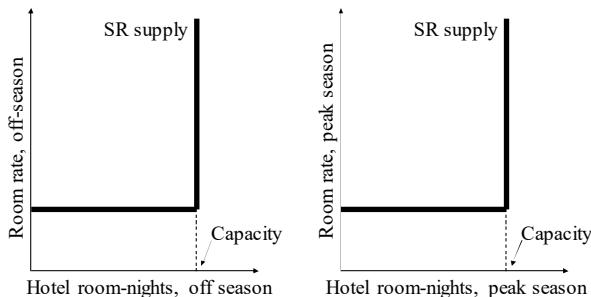
Competitive pricing with joint production: prices are *not* identical!
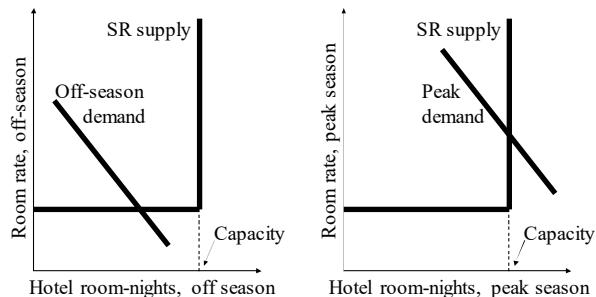
"Fully distributed costs" are _____ used for pricing outputs with *joint* inputs in unregulated markets.

- If hotels used "fully distributed costs," then their rates would be _____ year round!
- If theatres used "fully distributed costs" then a ticket would cost the _____ in the evening as for a matinee performance!
- If airlines used "fully distributed costs," then a ticket would cost the _____ in peak travel periods as in off-peak periods!

What determines capacity?

- In unregulated private markets, joint costs of capacity are not "fully distributed" across outputs.
- Instead, some outputs drawing on the same capacity are priced much higher than others.
- The amount of capacity available plays a key role in pricing.
- But what determines the equilibrium amount of capacity in these markets?

COMMON COSTS AND JOINT COSTS
Page 5

Competitive LR supply of physical hotel rooms (capacity)

(Annualized) marginal construction cost

Physical hotel rooms
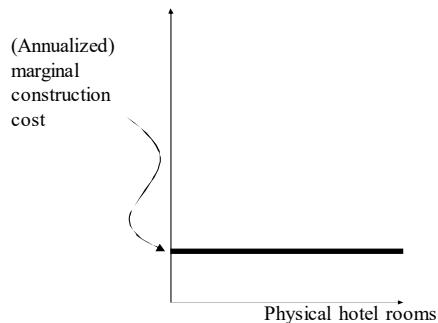
Competitive LR demand for physical hotel rooms (capacity): vertical sum

Peak demand = nightly peak demand for room × (peak nights/365)

Off-peak demand = nightly off-peak demand for rooms × (off-peak nights/365)

Physical hotel rooms
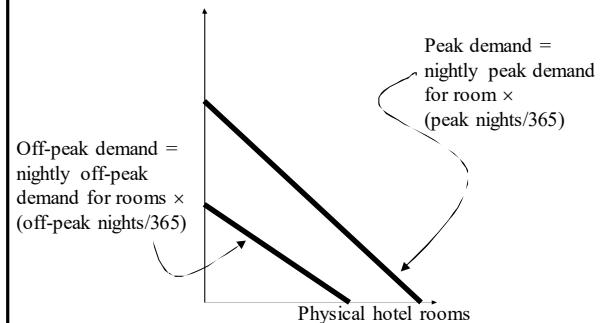
Equilibrium hotel room capacity

Physical hotel rooms
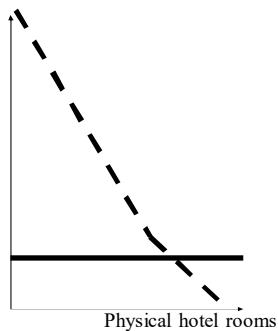
Conclusions

- Costs of inputs that are used to produce several outputs are often allocated by the method of _____ costs.
- This may make sense if the input is used to produce *either* output: "_____ costs."
- It does not make sense if the input is used to produce *both* outputs: "_____ costs."

PEAK-LOAD PRICING IN THEORY
Page 1

PEAK-LOAD PRICING IN
THEORY

•What is "peak-load pricing"?
•Why does it improve social welfare?

The pricing problem

• In competitive markets, the market
mechanism sets prices equal to
_____.
  • Firms that set price any other way lose money
• The regulated firm has little incentive
because it is guaranteed to break even.
  • Regulators must set prices equal to
  _____ to maximize welfare.

Pricing with joint cost

• Suppose demand varies over time periods,
but the same capacity is used by all time
periods.
• Examples:
  • generating capacity in electric power
  • switches and trunks in telecommunications.
• How should peak and off-peak period prices
be set to maximize welfare?

Assumptions about demand

• For simplicity, assume
just two periods, peak
and off-peak.
• Each period lasts the
same number of hours:
n hours.

Usage price

Peak
demand

Off-peak
demand

Usage
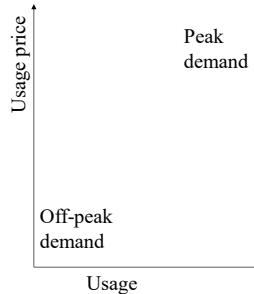
Assumptions about demand (cont'd)

• No cross-elasticities: That is, cross-
elasticities of demand between peak and
off-peak are _____.
• "Firm" peak: Even if off-peak is priced as
low as average variable cost, off-peak
quantity demanded is still _____
than capacity.


Measurement conventions

• Quantities are *usage*.
  • For example, kilowatt-hours for electricity.
• Capacity is measured as *maximum usage*
producible in n hours.
  • For example, if n = 12 hours and a generator
  can produce 10,000 kilowatts, capacity =
  120,000 kilowatt-hours.


PEAK-LOAD PRICING IN THEORY
Page 2

Assumptions about production and cost in the short run

- Capacity is fixed in the short run.
- Until capacity is reached, SMC = SAVC is constant.
- It equals the cost of running the plant (mostly fuel).
- At capacity, SMC becomes vertical.
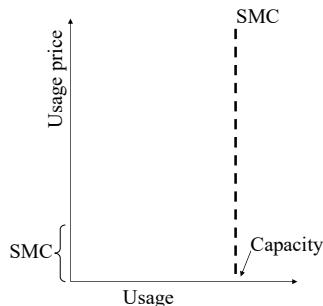
Assumptions about production and cost in the long run

- Marginal cost of capacity (MCC) is constant.
- Therefore, long-run marginal cost LMC is also constant.
- (Holds if production is constant-returns-to-scale.)
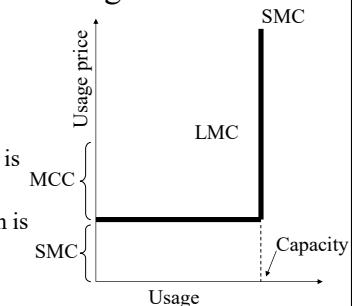
Optimal short-run pricing

- **Marginal-cost pricing** always maximizes social welfare.
- In the "firm-peak" case, off-peak customers only pay SAVC.
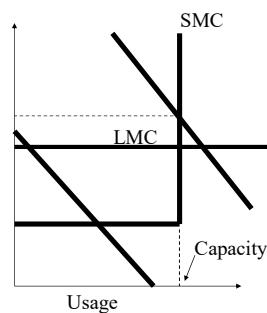
Adjusting capacity in the long run ("firm-peak" case)

- If P_{PEAK} > LMC, then capacity should be _____.
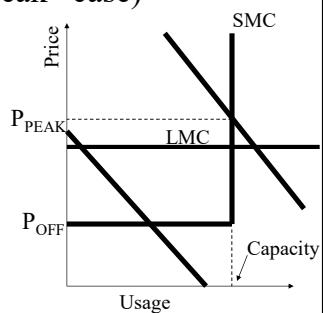
Adjusting capacity in the long run ("firm-peak" case) (cont'd)

- If P_{PEAK} < LMC, then capacity should be _____.
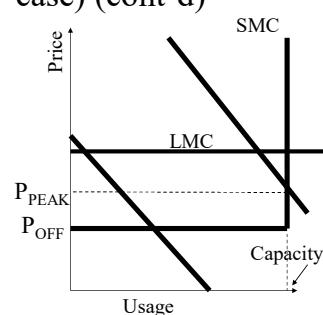
Optimal capacity in the long run ("firm-peak" case)

- Optimal capacity occurs when P_{PEAK} = LMC.
- In this case, peak customers pay all capacity cost.
- (In "shifting-peak" case, off peak customers pay some capacity cost, too.)
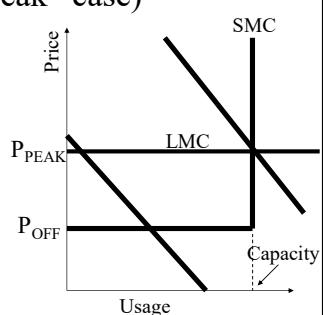
PEAK-LOAD PRICING IN THEORY
Page 3

Contrast peak-load pricing with uniform pricing

- Suppose a single price P* is charged for peak and off-peak usage.
- Assuming P* is chosen so that firm breaks even, LMC > P* > SMC.
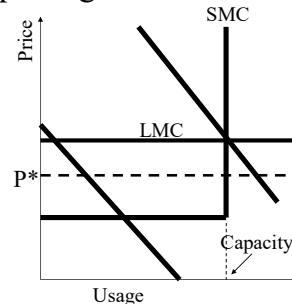
Effect of uniform pricing on quantities demanded

- Too _____ will be consumed during peak.
- Too _____ will be consumed off-peak.
- Capacity will have to be larger than optimal.
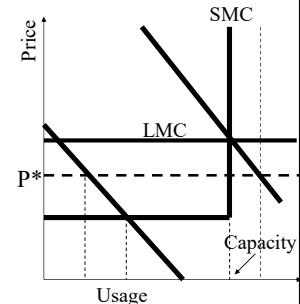
Welfare loss from uniform pricing

Two kinds of welfare loss.

(1) Some off-peak customers willing to pay SMC are *not* served.

(2) Some peak customers unwilling to pay LMC *are* served.
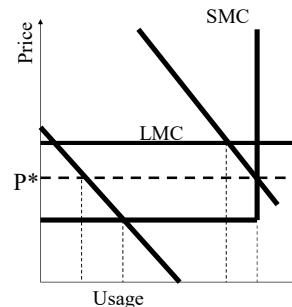
Conclusions

- To minimize social welfare loss, peak and off-peak prices must equal

  _____.

- In the "firm-peak" case, capacity must be chosen so that peak price equals

  _____.

- If a uniform price is chosen, capacity will be too _____ and deadweight loss will occur in both peak and off-peak periods.

PEAK-LOAD PRICING IN PRACTICE: ELECTRIC POWER
Page 1

PEAK-LOAD PRICING IN PRACTICE: ELECTRIC POWER

• How close are electricity rates to ideal peak-load pricing?

Electric power supply in practice

• Electric power generating companies typically have a variety of plants using different fuels.
• Companies use plants with lowest SMC first, then move up as needed.
• Usually, the plants with the lowest SMC have the highest marginal cost of capacity (MCC).

Example

Plant	SMC	Capacity
A	$0.02 per kWh	40 thousand kWh
B	$0.12 per kWh	10 thousand kWh
C	$0.04 per kWh	20 thousand kWh

• Clearly, company should use Plant _____ first, then Plant _____, and then Plant _____.

Power company's supply
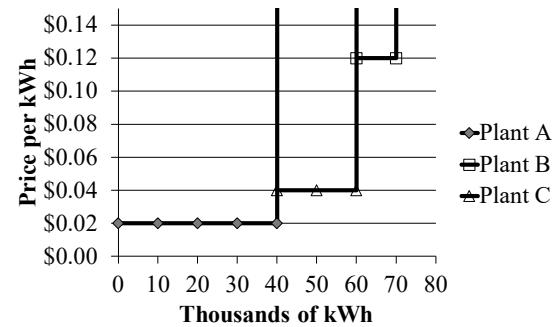
Electric power demand in practice

• Demand does not jump between two levels.
• It moves gradually throughout the day and throughout the year.
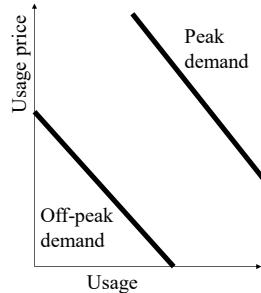
Electric power demand in practice (cont'd)

• A heat wave or a cold snap can increase demand unexpectedly.
• Pushes up marginal cost.
• Difficult to set appropriate price in advance.

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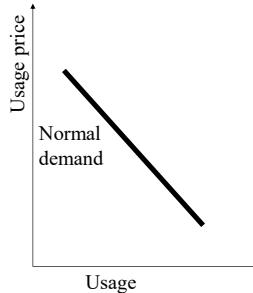
PEAK-LOAD PRICING IN PRACTICE: ELECTRIC POWER
Page 2

Ideal peak-load pricing

- Prices should be flexible.
- Prices should change by season and by time of day.
- Prices should _____ during heat waves.
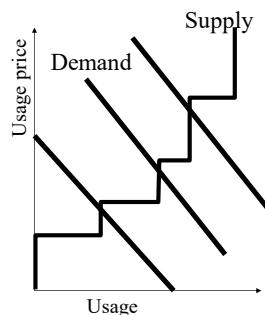
Peak-load pricing in practice

- Peak-load pricing requires that each customer have an adequate meter for measuring electricity usage.
- Most meters now in service are primitive, so peak-load pricing is generally imperfect in practice.
- However, technology is improving.

| Meter type	Peak-load pricing capability
Usage-only meter: records total usage for the month.	Seasonal (summer/winter).
Usage plus "demand" register: records total usage plus maximum usage.	"Demand charge".
Time-of-use meter: records usage by period (day/night).	Daily peak/off peak.
Critical-peak meter: records usage by period, plus optional temporary period.	Daily peak/off peak plus temporary "critical-peak" prices set by utility.
Interval meter: records usage each hour.	Each hour can potentially have different price.

Objections to better peak-load pricing

1) Advanced meters are still _____.
2) Demand response is _____: customers cannot adjust power consumption to prices that fluctuate hourly.
3) Real-time and critical-peak pricing create _____ for consumers. Their monthly bills could vary a lot without changes in usage.

Proposed solutions

1) Wait for costs to fall. Technology is getting rapidly cheaper.
2) Give customers programmable controls that turn appliances on and off automatically in response to price changes.
3) Allow customers to prepay for their expected usage at a fixed rate, but price any deviations at marginal cost.

Conclusions

- Electric power supply _____ in stairsteps, as generating companies use progressively more expensive plants.
- Power demand _____ throughout the day and year, and shifts abruptly with weather.
- Ideal peak-load pricing is still difficult to implement in electric power, due to limitations of current _____.

MARKETS FOR WHOLESALE ELECTRIC POWER
Page 1

MARKETS FOR WHOLESALE ELECTRIC POWER

•How is wholesale electric power traded?

Interconnections

- Utilities are connected to customers and to each other by a grid.
- Grid originally constructed for long-term bilateral wholesale power purchases.
- Now being used to buy and sell more frequently.

A simplified power grid
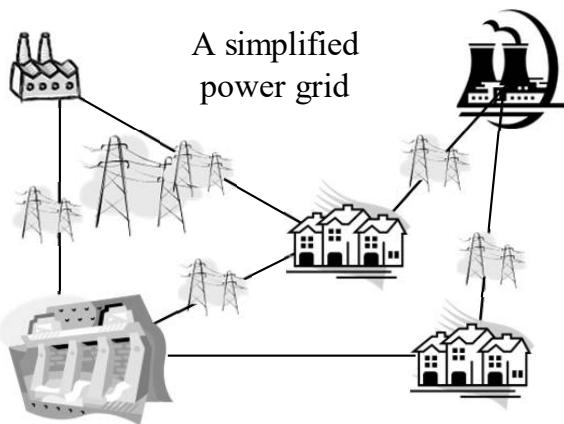
Who regulates wholesale electricity?

- Federal Energy Regulatory Commission (FERC) regulates transmission and wholesale sales of electricity in interstate commerce.
- Does _____ regulate retail power sales or siting of transmission lines (state responsibilities) or siting of generators (state or NRC responsibility).

Wholesale power markets

- 1992 Energy Policy Act allowed FERC to order utilities to "wheel" (transmit) power across their lines.
- FERC has used this mandate to encourage wholesale power markets.
- But transmission lines are natural _____. Also, if a utility owned transmission lines, it could block its rivals.

Wholesale power markets

- 1992 Energy Policy Act allowed FERC to order utilities to "wheel" (transmit) power across their lines.
- FERC has used this mandate to encourage wholesale power markets.
- But transmission lines are natural _____monopolies_____. Also, if a utility owned transmission lines, it could block its rivals.

MARKETS FOR WHOLESALE ELECTRIC POWER
Page 2

ISOs and RTOs

- FERC has encouraged utilities to form ISOs and RTOs, nonprofit organizations owned by utilities, and turn over transmission operations to them.
- ISO = _____ system operator.
- RTO = _____ transmission operator.

ISOs and RTOs

Non-utility power producers

- Power producers can join RTOs or ISOs even if they have _____ retail customers.
- These producers sell _____ power only, to utilities, through the RTO or ISO.
- Exempted from price regulation under 1992 Energy Policy Act.

Design of wholesale power markets

- In *centralized markets*, RTO is broker, similar to mythical "Walrasian auctioneer" in free markets.
- All offers to buy (bids) or sell (offers) must pass through RTO, which sets price.
- In *decentralized markets*, buyers and sellers can deal with each other directly or through private brokers.

Centralized markets: the "day-ahead" market

- Power producers and power users submit hourly bids and asks in advance to RTO.
- RTO software constructs demand and supply curves and computes hourly equilibrium prices.
- Equilibrium prices and accepted bids and offers for each hour are announced one day ahead.

Dispatch and settlement in the "day-ahead" market

- RTO then orders producers when to start and stop their generators.
- Producers who comply are paid _____ price (*not* their offer price). Producers who do not comply face penalties.
- Buyers also pay _____ price (*not* their bid price).

MARKETS FOR WHOLESALE ELECTRIC POWER
Page 3


"Day-ahead" market: simplified example

Offers received for hour #13 ending 1PM:	Bids received for hour #13 ending 1PM:
1. 15 megawatt-hours (mWh) at $20/mWh.	1. 15 megawatt-hours (mWh) at $80/mWh.
2. 5 mWh at $40/mWh.	2. 5 mWh at $60/mWh.
3. 10 mWh at $30/mWh.	

Example: equilibrium price = _____
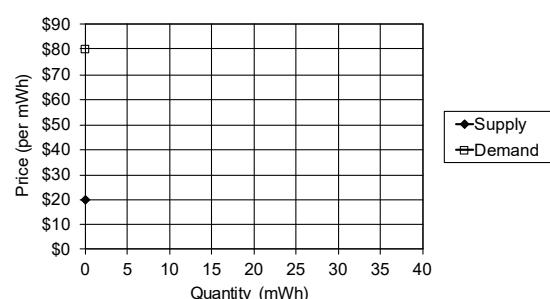
Example: dispatch and settlement

- RTO would accept the first and third offer, but the third producer would be ordered to supply only _____.
  - Both producers would be paid _____.
- RTO would accept both bids.
  - Both would pay _____.

Efficiency in "day-ahead" market

- Key point: if producers' offers = their true marginal costs, then RTO's procedure minimizes total production costs.
- But do producers have an incentive to ask their true marginal cost?
- _____, unless they have market power.

Incentives to bid true MC when everyone is paid the equilibrium price

- Suppose your MC is $30 and you expect the equilibrium price to be $30-$40.
- What happens if you bid $30?
- If equilibrium price > $30, then you will get to sell at a price > your MC and make money.
- If equilibrium price < $30, then you lose the auction, but you don't sell power at a loss.

Incentives to bid true MC when everyone is paid the equilibrium price (cont'd)

- By contrast, suppose you ask more than your MC, say $35.
- You will have _____ impact on price you are paid if you win.
- But you _____ chance of winning when P > your MC, and thus missing out!
- No gains from asking *more* than your MC.

MARKETS FOR WHOLESALE ELECTRIC POWER
Page 4

Incentives to bid true MC when everyone is paid the equilibrium price (cont'd)

- Suppose you ask less than your MC, say $25.
- You will have _____ impact on price you are paid.
- But you _____ chance of winning when P < your MC, and thus losing money!
- No gains from asking *less* than your MC.

"Pay as bid"

- Observers sometimes note that most offers are well below the equilibrium price.
- They suggest that buyers could save money if sellers were only paid their offer prices ("pay as bid"), not the equilibrium price.
- But then sellers would no longer have an incentive to ask their true marginal cost.
- Sellers would ask higher prices and the average price of power would probably _____.

Centralized markets:
the "real-time" market

- Actual power demand (or supply) may deviate slightly from quantity expected a day ahead.
- RTO also conducts a "real-time" market in five-minute increments throughout the day.
- Deviations from day-ahead quantities are paid for at "real-time" prices, which may differ from "day-ahead" prices.

Wholesale market results for a typical winter day

PJM-E Total Load and Average Price, 12/15/04
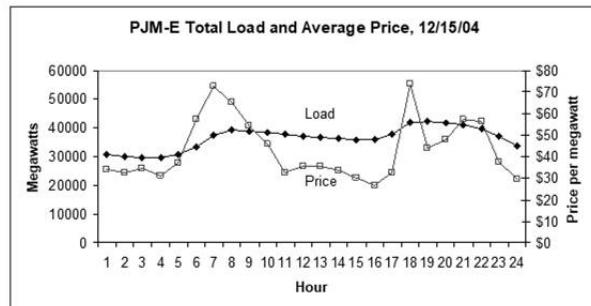
Wholesale market results for a typical summer day

PJM-E Total Load and Average Price, 6/15/04
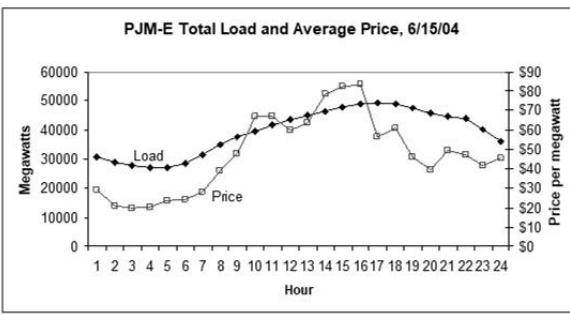
Real-life complications: reliability

- In electric power, quantity demanded must equal supply continuously or system will fail.
- RTO needs the ability to get extra power at a moment's notice in case of surprise events.
- So conducts separate auction for call options (options to buy power) for "reliability" (also called "capacity").

MARKETS FOR WHOLESALE ELECTRIC POWER
Page 5

Real-life complications: locational prices

- Transmission lines have finite capacity.
- If transmission lines going into a location reach capacity, then supply cannot be increased ("security-constrained").
- Price at that location may rise above price elsewhere.

Centralized markets: summary

- QUANTITIES are determined by using least-cost ("economic") generators first, unless transmission lines are congested.
  - "Security-constrained economic dispatch."
- PRICES are determined by marginal bids and offers, but may differ by location if transmission lines are congested.
  - "Locational marginal pricing" (LMP).

Conclusions

- FERC has encouraged centralized markets for _____ power.
- In centralized markets, RTOs receive bids and offers, compute demand and supply curves, set _____, and order producers to start and stop generating power.
- Prices of power change hourly and differ by location if transmission lines are _____.

THE CALIFORNIA ENERGY CRISIS OF 2000-01
Page 1

THE CALIFORNIA ELECTRIC POWER CRISIS OF 2000-01

• What went wrong in California?

Borenstein, Severin. 2002. "The Trouble With Electricity Markets: Understanding California's Restructuring Disaster." *Journal of Economic Perspectives*, 16(1): 191-211.

Deregulation in California

- In 1990s, plans were developed for a deregulated, competitive electric power market.
- Hope was for _____ prices.
- Four-year transition plan passed by legislature and went into effect March 31, 1998.

California's intentions

- Competition would be established at both _____ and _____ level.
- Retail providers would purchase wholesale power, purchase distribution from existing utilities, and sell directly to retail customers, it was hoped.
- Wholesale market-based prices for power would replace traditional ROR (cost-based) regulation.

Plan for deregulation

- California ISO would control power grid.
- Power Exchange (PX) would manage buying and selling.
- 3 major electric utilities encouraged to divest generating plants and purchase power through the PX. No more _____ integration of generation and distribution.

But longstanding supply problems were ignored

- Little investment in power generation in prior decade.
- Reason: uncertainty. Investors knew deregulation was coming but were not sure of consequences.
- Transmission lines from northern California to southern California had limited capacity.

Policy mistakes

- Competition permitted but existing utilities were made "default providers" of electric power, subject to price cap.
- Existing utilities prohibited from signing long-term contracts to purchase power. For "transparency," they were required to purchase power only in day-ahead market.

THE CALIFORNIA ENERGY CRISIS OF 2000-01
Page 2

More supply problems in 2000

- Drought in Pacific Northwest reduced the supply of hydropower.
- Other plants required downtime for maintenance.
- Prices of natural gas and emissions permits rose unexpectedly.

Rising wholesale prices in 2000

- Spot prices for wholesale power rose sharply from under $50 per mWh in April to over _____ per mWh in December.
- Customers remained with existing utilities because of the retail price cap.
- Existing utilities began to suffer huge losses.

Disaster in 2001

- Rolling blackouts.
- One utility (PG&E) declared bankruptcy. Others were close to bankruptcy.
- State was forced to pay the (by now) huge difference between _____ wholesale prices and _____ retail prices.
- Caps on retail rates were raised sharply to save utilities—but this angered consumers.

Lessons #1: risk

- Spot prices for wholesale power are extremely volatile and **utilities cannot absorb** _____.
- So, either retail rates must adjust quickly to fluctuating wholesale spot prices, *or*
- Utilities must be permitted to purchase power in forward markets, *or*
- Utilities must be permitted to be vertically integrated with generators.

Lesson #2: demand response

- Efficient usage requires that retail prices respond to temporary wholesale price spikes.
- Retail customers are the usage decision-makers. They must receive **accurate price signals** about when to conserve electricity.
- Otherwise, demand will be essentially _____.

Lesson #3: price caps

- **Price caps** on regulated utilities can **undermine retail competition**.
- If price caps on regulated utilities, the default providers, are set lower than cost, competitors will _____ the market.

THE CALIFORNIA ENERGY CRISIS OF 2000-01
Page 3

Conclusions

- California tried to deregulate wholesale and retail electric power in late 1990s and early 2000s.
- Limited wholesale supply led to sharply rising prices, utility bankruptcies and a state bailout.
- Retail competition never took hold because of price caps on existing utilities.
- A key lesson is the utilities must be protected from wholesale _____, for example by buying power in forward markets.

MARKET POWER IN WHOLESALE ELECTRIC POWER MARKETS
Page 1

MARKET POWER IN WHOLESALE ELECTRIC POWER MARKETS

- How can electric power producers gain market power?
- What can be done about it?

Borenstein, Severin. 2002. "The Trouble With Electricity Markets: Understanding California's Restructuring Disaster." *Journal of Economic Perspectives*, 16(1): 191-211.

Why are wholesale power spot prices so volatile?

- During periods of peak demand, supply is nearly vertical (extremely _____).
- Demand is nearly vertical (extremely _____) too, because most end-use customers see little or no change in their prices as wholesale prices change.


Why are wholesale power spot prices so volatile (cont'd)?

- On a hot summer day, use of air conditioning increases and demand shifts right.
- Wholesale price spikes upward.
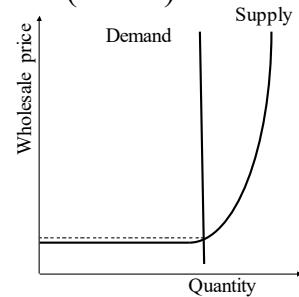
Potential market power

- Once inelastic part of supply curve is reached, a slight reduction in supply could have a big effect on price.
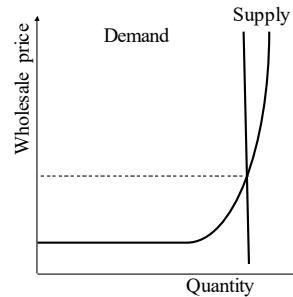
Potential market power (cont'd)

- Reducing the total quantity supplied by a small amount could cause price to rise substantially—e.g. from, say, $80 per mWh to $200 per mWh.
- Producers with more than one generator have incentive to take a generator off-line during peaks.

Cournot markup formula

- Let S_i = producer i's market share, ε = elasticity of demand, P = price, MC = marginal cost.
- If all other power producers keep their production constant, then the profit-maximizing price-cost margin for a particular generator is given by

$$\frac{P - MC}{P} =$$

MARKET POWER IN WHOLESALE ELECTRIC POWER MARKETS
Page 2

Markup formula: numerical examples

Demand elasticity (ε)	Market share (S_i)	Price-cost margin
-0.5	0.02	
-0.1	0.02	
-0.05	0.02	

Market power

- These examples show that even a small producer, with only 2% market share, can exert substantial market power when demand is extremely _____.

What can be done to mitigate market power?

1. Enlarge the market, reducing S_i .
2. Increase the demand elasticity.
3. Restructure power contracts to reduce gains from power over price.

$$\frac{P - MC}{P} = \frac{S_i}{|\varepsilon|}$$

1. How to enlarge the market

- Encourage _____ power producers to connect to the system.
- Make sure plenty of _____ lines are built within and between regions. Utilities might not do this on their own.

2. How to make demand more elastic

- Make retail prices respond to peaks in wholesale prices.

- With accurate price signals, retail demand elasticity is probably about -0.2 to -0.3, not -0.05.

3. How to restructure contracts to reduce gains from power over price

- Require large producers to sell most of their power through _____-term contracts. Then they will not profit much from a temporary rise in wholesale spot prices.
- Do _____ encourage divestiture of generation facilities. A utility that is both a buyer and a seller has little incentive to raise wholesale price.

MARKET POWER IN WHOLESALE ELECTRIC POWER MARKETS
Page 3

Questionable "solutions" sometimes advocated

- Price caps.
  - Problem: if set too low, can cause competitive supply to _____.
- "Pay-as-bid" pricing instead of everyone receiving the same equilibrium price.
  - Problem: offer prices will surely _____.

Conclusions

- Wholesale spot prices are _____ because during peak periods, a slight shift in demand or supply causes prices to change drastically.
- This can give producers _____ during peaks.
- Market power can be mitigated by _____ the market, making demand more _____, and requiring large producers to sign _____ contracts.

THE TEXAS ELECTRIC POWER CRISIS OF FEBRUARY 2021

- What went wrong in Texas?

ERCOT

The main grid operator in Texas is the Energy Reliability Council of Texas.

Not regulated by FERC because entirely within state.

What precipitated the crisis?

Unusually cold weather in Texas in February 2021.
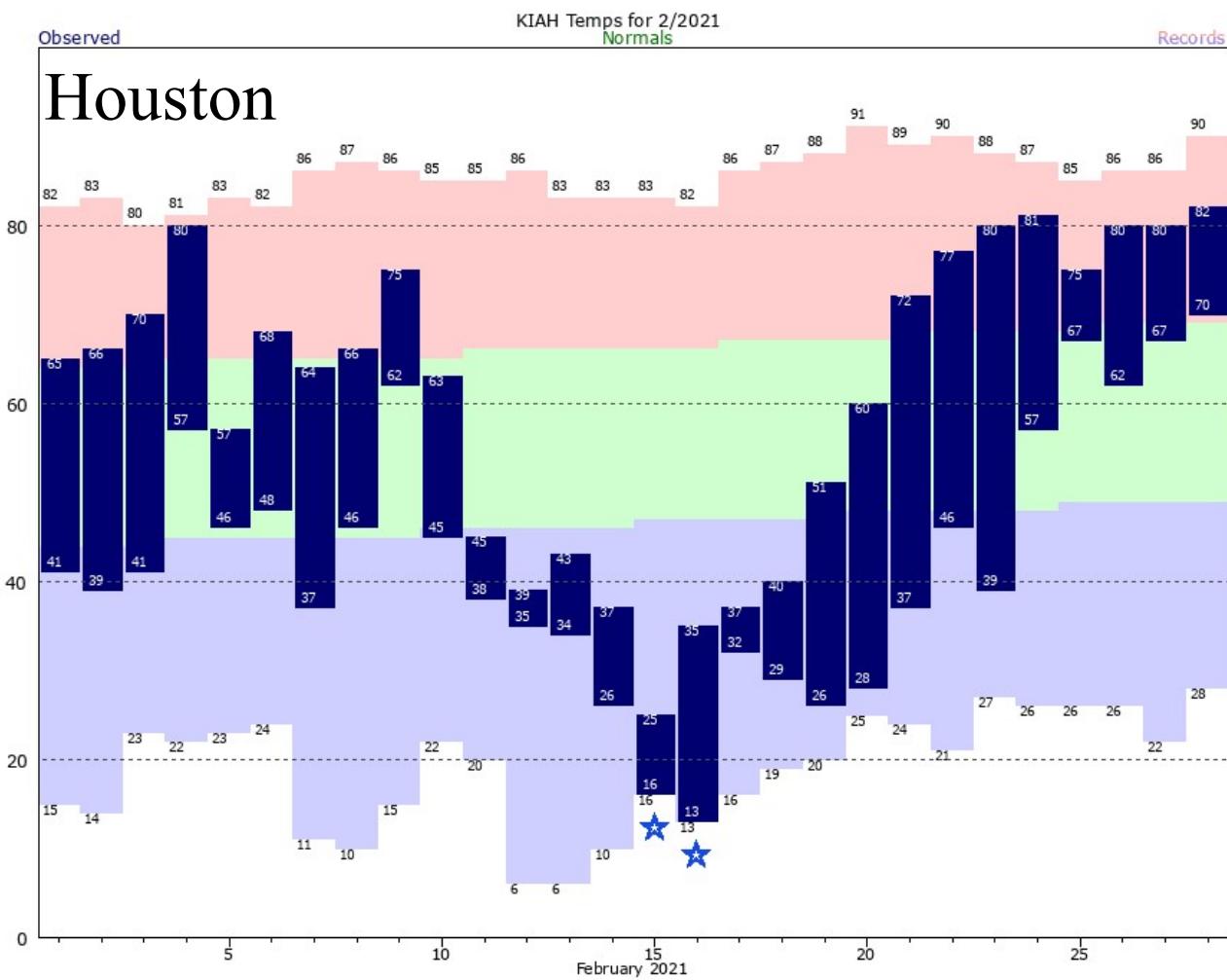
Supply collapse

- Many generators winterized.

- More than 200 sh down, including

- Natural gas plant of
  normal power su

- A nuclear power

- Wind farms.

- Coal plants.

Lost Power

As a winter storm blanketed Texas, more than two hundred electricity generators shut down. Net change in generating capacity from before the storm.

Blackout began

0 megawatts

-10,000

Net capacity of generators, minute-by-minute

- ■ Batteries
- ■ Solar
- ■ Natural gas
- ■ Wind
- ■ Coal
- ■ Hydro
- ■ Nuclear

-20,000

-30,000

Feb. 10   Feb. 11   Feb. 12   Feb. 13   Feb. 14   Feb. 15   Feb. 16   Feb. 17   Feb. 18   Feb. 19

Source: Edgar Virgüez, Duke University, analysis of Electric Reliability Council of Texas data

Blackouts

- Large numbers of power consumers lost power, sometimes for days.

- Without heat, pipes froze. When warm weather returned, pipes burst, causing extensive property damage.

- Some people died because for lack of power or lack of heat.

What happened to the ERCOT wholesale power market?

- Supply shifted left as many generators froze.

- Some gas pipelines lacked power to pump natural gas to generators, so additional generators shut down.

- Demand for electricity and gas shifted right in response to cold temperatures.
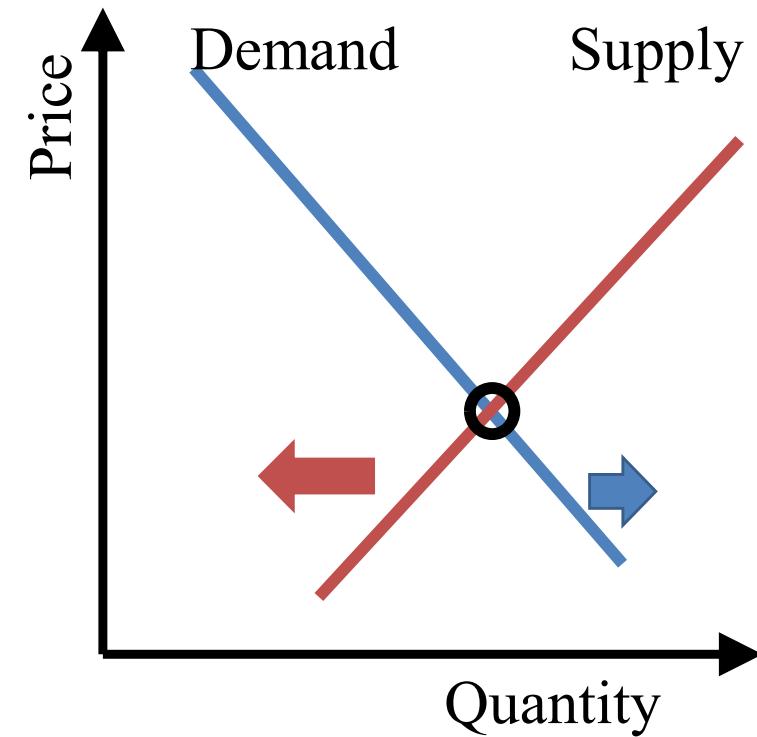
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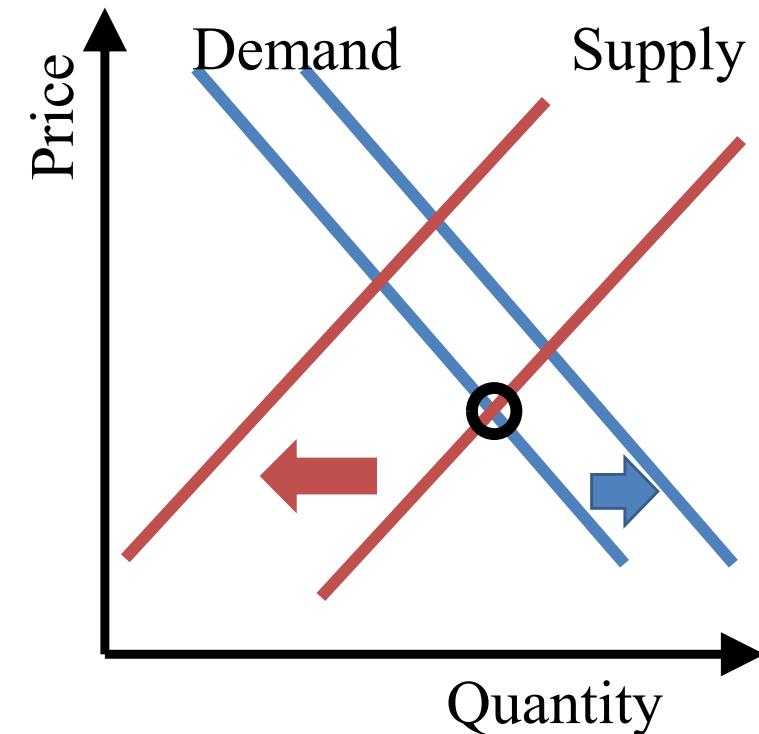
Multiple choice

Wholesale electricity prices rose rapidly, and were finally capped by authorities at

a. $100 per mWh.

b. $500 per mWh.

c. $1000 per mWh.
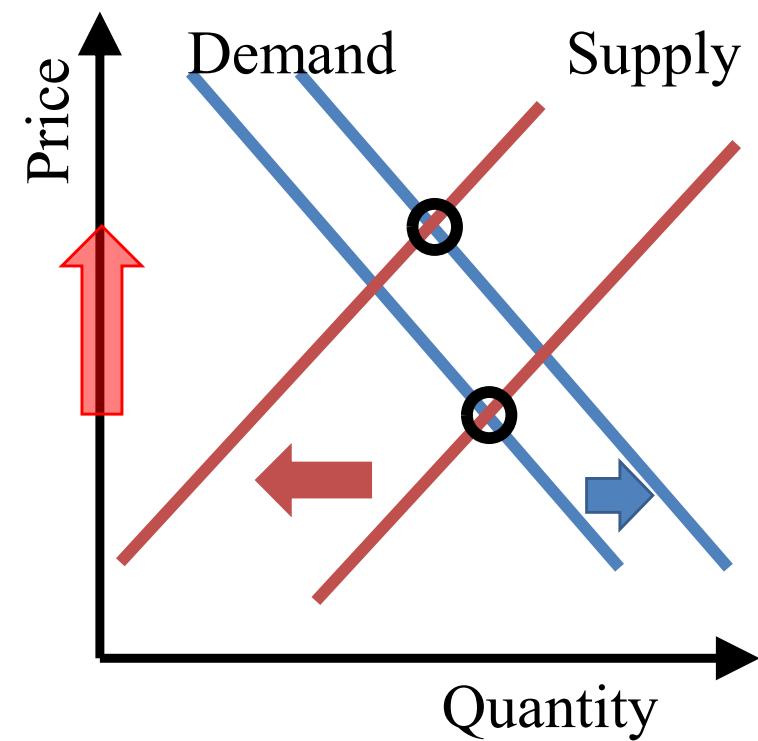
d. $9000 per mWh.

Multiple choice

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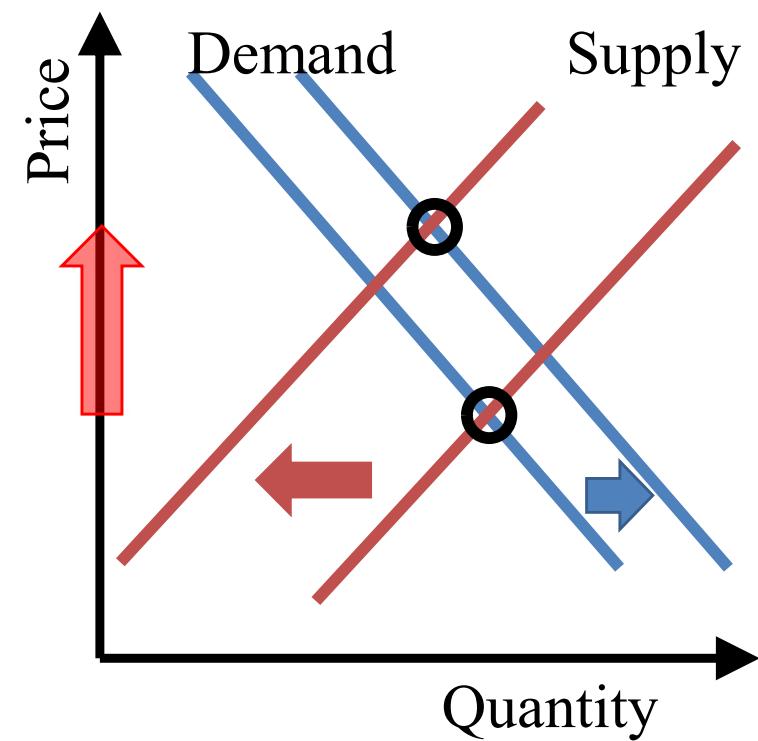
Who paid these prices?

- Some power customers paid retail prices tied to the wholesale prices.

  - They paid very large bills.

- Some power customers paid fixed prices to competitive retail power suppliers, who were forced to pay the price difference.

  - Some of these suppliers went bankrupt.

Reasons for failure: (1) missing reliability market

- Texas regulators assumed that unregulated prices would entice power generators to build "stand-by" capacity to take advantage of any price spikes.

- So they did not create a "reliability market" in Texas.

- But that's not what happened.

Reasons for failure: (2) no winterization

- FERC had recommended that power generators be required to winterize their facilities.

- But FERC had no authority over ERCOT because power lines did not cross state lines.

- Texas regulators assumed that unregulated prices would entice power generators to winterize their ordinary generators to take advantage of any price spikes.

- So they did not require winterization.

- But that's not what happened.

Reasons for failure: (3) no interconnection

- Most regional grids are connected to other grids.

- In emergency, they can purchase power from other regions.

Reasons for failure: (3) no interconnection (cont'd)

- But ERCOT was not connected to other regional grids.

- Deliberate choice to avoid oversight by FERC.

- Interestingly, El Paso is not part of ERCOT and did not experience an outage.

Conclusions

- Texas experienced a disastrous outage in February 2021, precipitated by cold temperatures that shifted electricity supply _____ and demand _____.

- Wholesale market prices exploded.

- Reasons for failure included (1) missing reliability market, (2) no winterization of generators, and (3) no interconnection with other regions.

Conclusions

- Texas experienced a disastrous outage in February 2021, precipitated by cold temperatures that shifted electricity supply _____left_____ and demand _____right_____.

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EFFECTS OF PRICE REGULATION IN COMPETITIVE MARKETS
Page 1

EFFECTS OF PRICE REGULATION
IN COMPETITIVE MARKETS

• What happens to a competitive market when a price floor is imposed?
• Does free entry improve the outcome?

### Direct effects of price floor on a potentially competitive market

• Suppose a market is competitive with perfectly elastic long-run supply at minimum AC.
• Suppose regulation is imposed, imposing a price floor (P_F) above minimum AC.
• What happens to quantity and consumer surplus?

Direct effects of price floor on consumers

• Quantity traded decreases.
• Consumer surplus decreases.
• Loss of consumer surplus = transfer (or rent) to producers + deadweight loss.
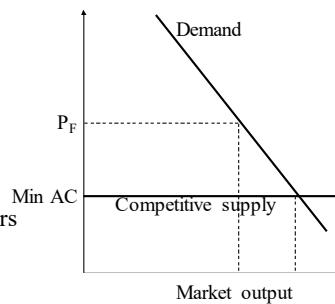
Effect on cost if all firms shrink proportionately

• If new firms enter in search of profits, or even if number of firms does not change, then firms must _____ in size.
• If AC is U-shaped or downward-sloping, then costs will rise.
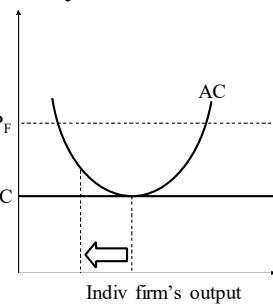
Higher costs reduce rents

• If AC rises, part of the transfer (or rent) is lost, causing further social welfare loss.
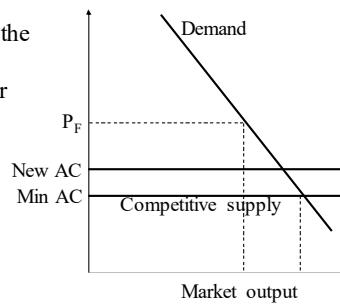
Free entry dissipates rents

• If entry is free, then firms will enter in search of profits.
• They keep entering until AC rises to P_F and rents fall to zero.
• "Too many small producers."
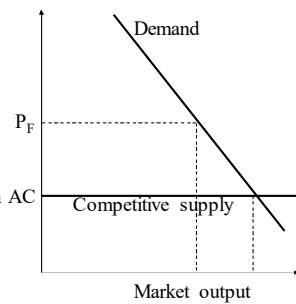
EFFECTS OF PRICE REGULATION IN COMPETITIVE MARKETS
Page 2

Restricted entry (or forced exit) preserves rents and social welfare

- *Given* a price floor, reducing the number of firms would preserve rents and _____ social welfare.
- But there is still social deadweight loss.

Demand

P_F

Min AC   Competitive supply

Market output
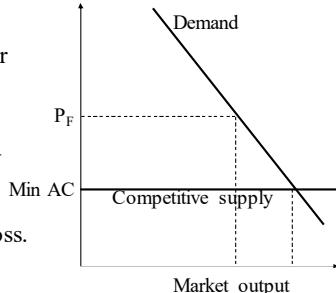
But who decides which firms stay and which firms leave?

- Some firms may be more efficient than others.
- But with the price floor, _____ firms enjoy rents (above-normal profit) so _____ can continue operation.
- Even if regulator were to eliminate some firm, no guarantee that regulator will choose least-efficient firm.

Conclusions

- A price floor _____ consumer surplus, transferring some of this to producers.
- But if AC is U-shaped or downward-sloping, producer costs are likely to _____ if no firms leave, especially if new firms enter. Rents may be dissipated.
- Entry restrictions can preserve some of the rents, if _____-cost firms are forced to exit.

INDIRECT EFFECTS OF REGULATION
Page 1

INDIRECT EFFECTS OF REGULATION

• How do minimum prices affect product quality and productive efficiency?
• How do maximum prices affect welfare?
• How does regulation affect innovation?

Indirect effects of price regulation

Aside from its effects on price and cost, regulation may have indirect effects on

1) product quality
2) production efficiency
3) cross-subsidization of products
4) capital formation
5) innovation.

1) Effect of price regulation on quality

• If price regulation prohibits firms from competing on price, they will compete in other respects.
• They may try to attract customers by producing a higher-quality product.
• But this still creates deadweight loss, because consumers would really prefer a lower-quality product at a lower cost.

Why do people buy low-quality products?

• Deception: People want high quality products but are deceived into buying products of low quality.

• Deliberate choice: People do not want to pay more for higher quality.

A simple model of quality

• Suppose markets are competitive, and long-run supply is horizontal at price = AC.
• Demand (willingness to pay) and AC are higher for the high-quality good.
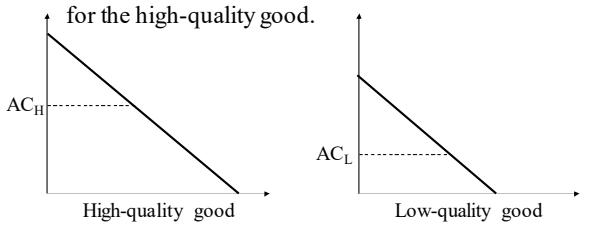
Quality in unregulated competitive equilibrium

• In equilibrium, both goods are produced.
• Equilibrium price of high-quality good is higher than equilibrium price of low-quality good.
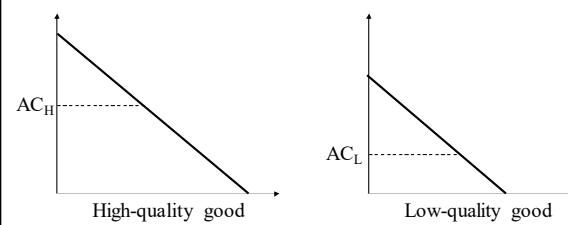
INDIRECT EFFECTS OF REGULATION
Page 2

Price floor on two goods

- Suppose regulation imposes the *same* price floor (P_F) on both goods, above minimum AC for each.
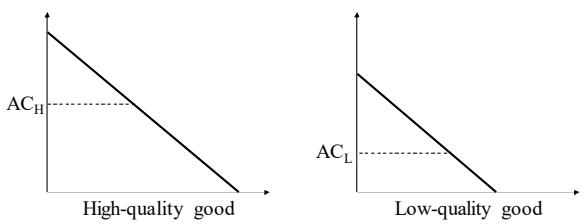
What happens to low-quality good?

- Price floor causes a loss of consumer surplus for the low-quality good.
- If price floor is high enough, no one will buy the low-quality good at all!
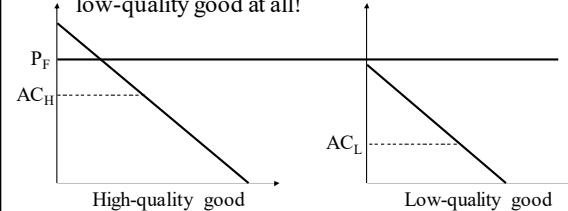
What happens to high-quality good?

- High-quality good is typically a substitute for low quality good, so its demand curve shifts right.
- Quantity demanded of high-quality good might even increase.
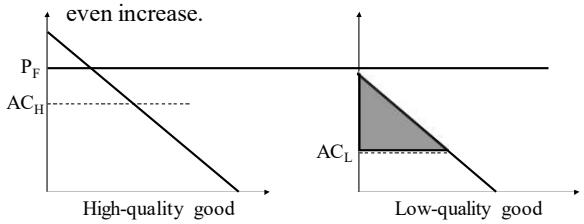
What happens to high-quality good (cont'd)?

- But there is still a loss of consumer surplus for high-quality good, too.
- Includes transfer to producers and DWL.
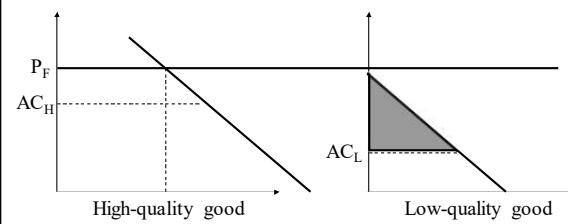
Summary: effect of price regulation on quality

- A price floor may drive out low-quality goods and increase quantity of high-quality goods.
- But this is _____ necessarily a good thing.
- Some people would prefer the low-quality good if it were available at its average cost.
- The price floor creates deadweight loss in _____ markets.

2) Effect of price regulation on productive efficiency

- Rents in regulated industries may prompt workers to demand higher wages, above the competitive level, especially if unionized.
- This may cause firms to substitute _____ for labor.
- Firm behaves as if opportunity cost of labor is _____ than it really is.
- Employment is inefficiently _____.

INDIRECT EFFECTS OF REGULATION
Page 3

Isoquant diagram of unregulated firm

- Unregulated firm chooses least cost input combination.
- This is where slope of isoquant = $\frac{competitive\ wage}{rental\ rate\ of\ capital}$.

Isoquant: input combinations producing the same level of output
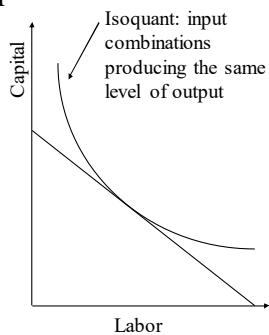
Isoquant diagram of regulated firm

- Unions demand higher wages in regulated industries: $w_R > w_C$.
- Firm chooses input combination where slope of isoquant = $\frac{unionized\ wage}{rental\ rate\ of\ capital}$
- Substitutes capital for labor.

Slope = w_R/r
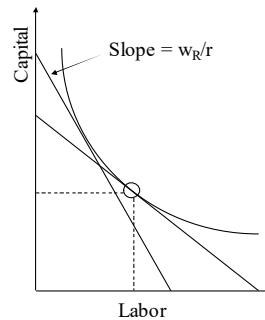
Deregulation and productive efficiency

- Deregulation would decrease wages and increase employment.
- Deregulation would also cause
  - Entry or expansion of _____ efficient firms.
  - Exit or contraction of _____ efficient firms.
- Example: Deregulation of branch banking decreased cost and decreased loan losses.

Jith Jayaratne and Philip E. Strahan, "Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence from Commercial Banking," *Journal of Law and Economics* 46 (April 1998): 239-274.

3) Effect of price regulation on cross-subsidization of products

- Sometimes regulated firm is required to cross-subsidize: set price above cost in one market and below cost in another.
- Regulated firm is not permitted to exit subsidized market.

AC
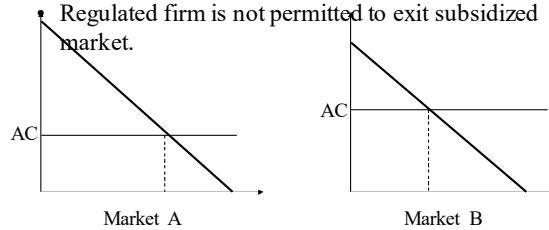
Market A   Market B

Direct effect of maximum prices and exit restrictions on welfare

- Causes deadweight loss in *both* markets.
- Too _____ produced in subsidizing market (A).
- Too _____ produced in subsidized market (B).

P_F
AC

AC
P_C

Market A   Market B
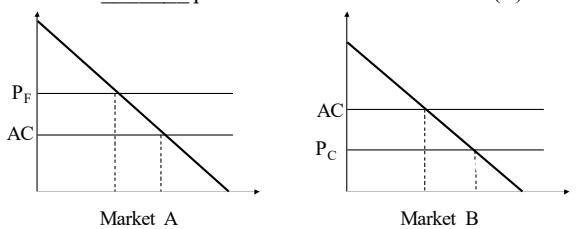
4) Effect of price regulation on capital formation

- If prices are set below cost, capital formation (investment) is likely to be reduced.
- If firm uses internal financing (retained earnings) it will have _____ (accounting) profit for reinvestment.
- If firm uses external financing (borrowing) it will likely face _____ cost of capital because investors fear bankruptcy.

INDIRECT EFFECTS OF REGULATION
Page 4

5) Effect of price regulation on innovation

- It is unclear whether price regulation encourages or discourages research and development (R&D), compared to competitive markets.
- Arguments can be given on both sides.

Price regulation might encourage innovation

- If R&D is conducted by big firms and financed internally out of profit, then *minimum* prices would _____ profit and _____ R&D.
- Also, if regulation encourages nonprice competition, it might incidentally _____ R&D.

Then again, price regulation might discourage innovation

- If R&D is conducted mostly by new entrants, entry restrictions will _____ R&D.
- Rate-of-return regulation (but not price caps) _____ firms from adopting cost-saving innovations, at least until after the next rate case.
- Some data suggest that regulation does slow productivity growth.

Competition and innovation

- But it is also unclear whether *competitive* markets generate the optimal amount of R&D.
- If R&D is a *nonexcludible public good*, then its benefits are enjoyed by competitive firms that do not produce it.
- Little incentive for competitive firms to invest in R&D if they can "_____" on others.

Conclusions

1) Regulation can increase quality by preventing price competition, but this _____ welfare.
2) Regulation may _____ productive efficiency, by allowing high-cost firms to survive.
3) Cross-subsidization causes deadweight loss in _____ markets.
4) Regulation probably reduces capital formation.
5) Effects on innovation are unclear.

MEASURING THE EFFECTS OF REGULATION
Page 1

MEASURING THE EFFECTS OF REGULATION

- How can we measure the effects of regulation in the real world?

Why measure effects of regulation and deregulation?

- To check whether theory is correct.
  - Example: Does elimination of price floor really increase quantity sold?
- To quantify benefits of deregulation.
  - Example: What are the welfare gains from eliminating cross-subsidization?

Challenges of measurement

- Changes in regulation often accompanied by other changes (in income, technology, etc.) that might also affect market price, quantity, number of firms, etc.
- To measure regulation's effect, must find a way to hold other factors constant.
- Unlike chemists or physicists, economists cannot do _____.

Approaches to measurement

1) Intertemporal approach.
2) Market comparison approach.
3) Difference-in-differences approach.
4) Counterfactual approach.

---

1) Intertemporal approach

- Compares observed outcomes before and after regulation (or deregulation).
- "Time-series" data.
- Must control for business cycle, economic growth, and other changes over time that might affect market outcomes.

Event studies

- Special kind of intertemporal study.
- Measure effect of single event on market outcomes.
- Example: effect of announcement of deregulation on stock price of regulated firm.
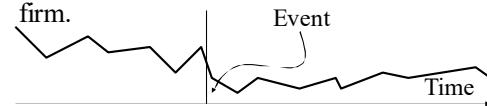
MEASURING THE EFFECTS OF REGULATION
Page 2

Example of intertemporal approach: NYSE

- Until 1975, NYSE set minimum commission rates on trades.
- Fixed rate per share. No volume discounts.
- Effect was cross-subsidization:
  - Low-volume trades priced _____ cost.
  - High-volume trades priced _____ cost.

Gregg A Jarrell, "Change at the Exchange: The Causes and Effects of Regulation," *Journal of Law and Economics*, 27 (October 1984), pp. 273-312.

Commission and cost per share, NYSE, 1968
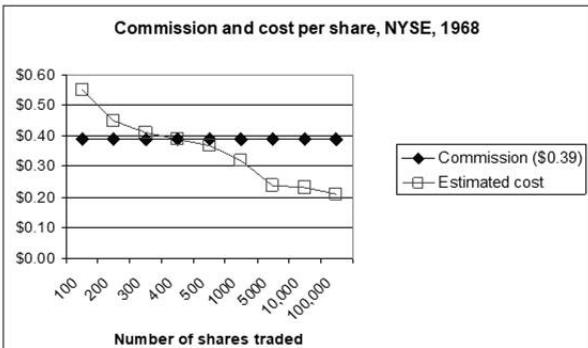
Gregg A Jarrell, "Change at the Exchange: The Causes and Effects of Regulation," *Journal of Law and Economics*, 27 (October 1984), pp. 273-312.

Example of intertemporal approach: NYSE (cont'd)

- In 1970s, U.S. Securities and Exchange Commission gradually deregulated rates for large-volume trades.
- Securities Act Amendments of 1975 prohibited all minimum rates.
- Data show that average rates _____ sharply at first, gradually thereafter.
- Rates for low-volume trades _____ slightly.

2) Market comparison approach

- Compares regulated markets with unregulated markets in the same time period.
- "Cross-sectional" data.
- Must control for differences in demand and supply that might affect market outcomes.
- In U.S., we can often compare states with different regulations.

Example of market comparison approach: eyeglasses

- In 1960s, many states banned advertising for eyeglasses and eye examinations.
- How does advertising affect market price?
  - Might _____ price if it helps firms differentiate their product from their rivals'.
  - Might _____ price if it helps consumers compare prices. Reduces each firm's market power.

Lee Benham, "The Effect of Advertising on the Price of Eyeglasses," *Journal of Law and Economics*, 15 (October 1972), pp. 337-52.

Example of market comparison approach: eyeglasses (cont'd)

- Data from a 1963 survey show that average price paid for eyeglasses was about 20% _____ in states that did not restrict advertising, compared with states that did.
- Are these the same eyeglasses? Might other factors beside regulation affect price?
- Author controlled for other factors (including income, family size, etc.) using _____ analysis and still found price difference.

MEASURING THE EFFECTS OF REGULATION
Page 3

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3) Difference-in-differences approach

- Compares two markets over time:
  - market that becomes regulated (or deregulated)
  - another market with no change.
- Differences across markets and changes in market conditions over time are thus held constant.

Difference-in-differences approach: numerical example

Market	Initial price	Later price	Difference	Difference-in-differences.
Deregulated market	$5	$6		
Control market	$3	$8		

- Conclusion: deregulation _____ price by $_____.

Example of difference-in-differences approach: *44 Liquormart*

- In *44 Liquormart* decision of May 1996, US Supreme Court struck down Rhode Island state law banning advertising liquor prices.

Jeffrey Milyo and Joel Waldfogel, "The Effect of Price Advertising on Prices: Evidence in the Wake of *44 Liquormart*," *American Economic Review*, 89 (December 1999), pp. 1081-96.

Example of difference-in-differences approach: *44 Liquormart* (cont'd)

- But nearby state of Massachusetts never had such law.
- So authors compared change in liquor prices in Massachusetts with change in prices in Rhode Island from June 1995 to June 1997.
- Found that liquor prices in Rhode Island _____ compared with Massachusetts.

---

4) Counterfactual approach

- Suppose regulation has always existed everywhere.
- Cannot use other approaches.
- Can try to extrapolate how the market would behave in absence of regulation.
- Try to predict market outcomes that would occur, *counter* to the current *fact* of regulation.

Counterfactual approach (cont'd)

- Typical strategy is to estimate demand and marginal cost (=supply) curves.
- Intersection is _____ outcome.
- Assumes that deregulation
  - leads to pure competition, not oligopoly.
  - would not change cost curves. (But in fact often deregulation increases efficiency and lowers cost curves.)


MEASURING THE EFFECTS OF REGULATION
Page 4

Example of counterfactual approach: usury laws

- In 1970s most states had legal maximums on mortgage interest rates.
- _____ binding in normal times.

Steven M. Crafton, "An Empirical Test of the Effect of Usury Laws," *Journal of Law and Economics*, 23 (April 1980), pp. 135-145.
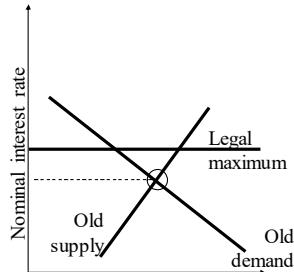
Inflation and real interest rates

- Borrowers and lenders are motivated by *real* interest rates.
- Real rate = nominal rate - expected inflation
- If inflation rises, then real interest rate remains constant only if nominal interest rate _____.

Effect of inflation on supply and demand for loans

- Inflation rate rose in US in 1970s.
- So demand and supply shifted up.
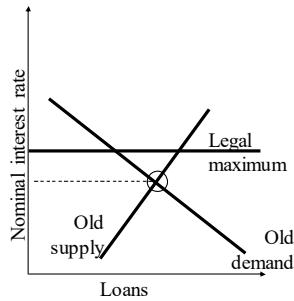
Excess demand for loans

- Equilibrium interest rate exceeded legal maximum.
- But observed interest rate was legal maximum.
- Creates excess _____ for loans.
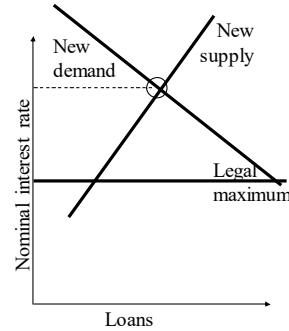
Consequences of excess demand

- Lenders can insist on more favorable terms.
- Reject less credit-worthy borrowers.
- Demand bigger down payments.
- Demand shorter maturity.

Actual effect of usury laws

- Using data from periods when usury laws were not binding, author estimated equation relating equilibrium mortgage rate to other factors.
- Applied equation to predict the (counterfactual) equilibrium rate when usury laws were binding.
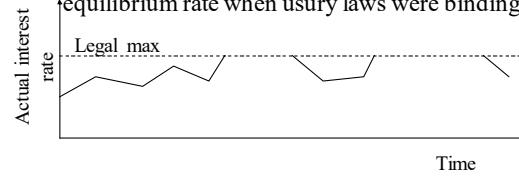
MEASURING THE EFFECTS OF REGULATION
Page 5

Actual effect of usury laws (cont'd)

- Then author computed gap
  = equilibrium rate - legal maximum rate.
- Found that, as predicted, the greater the gap,
  - the _____ the required down payment.
  - the _____ the maturity.

(graph: Actual interest rate vs Time, with "Legal max" dashed line)
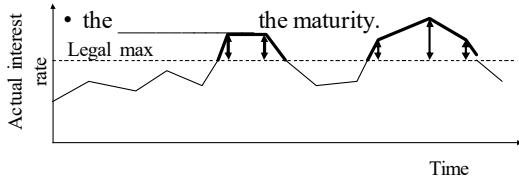
Application: Taxicab regulation

- During the Great Depression, many cities began regulating the number of taxicabs.
- Issued limited number of "medallions" (permits to operate a cab) which can be bought and sold.
- Entry restrictions generate rents for medallion holders.
- Fares often directly regulated as well.

Taxicab regulation: approaches to measurement

- _____ approach would measure changes in a city that deregulated.
- _____ approach would compare regulated and unregulated cities.
- _____ approach would compare changes in cities that deregulate with cities that maintain regulation.
- _____ approach would extrapolate likely effects of regulation from available information.

Taxicab regulation: counterfactual approach

- For the many cities that did not deregulate, we can estimate the effectiveness of regulation from price of medallion in secondary market.

(graph: Demand for medallions, P_M, Supply of medallions (set by gov't), Market for *medallions*)
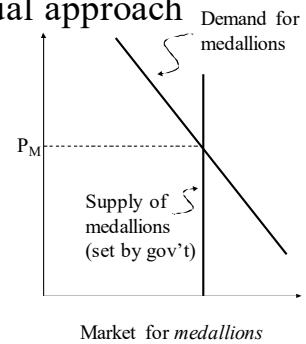
Interpreting medallion prices

- Price of medallion = present discounted value of expected future rents from entry restrictions.

(graph: Demand for fares, P_F, Competitive supply of fares, Market for *taxicab fares*)
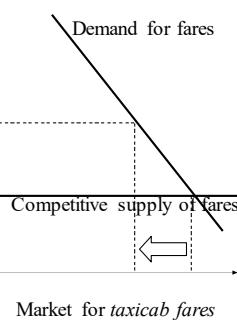
Rents ≠ deadweight loss

- However, DWL > 0 if rents > 0.
- And rents > 0 if the price of medallion > 0.

(graph: Demand for fares, P_F, RENTS, Competitive supply of fares, Market for *taxicab fares*)
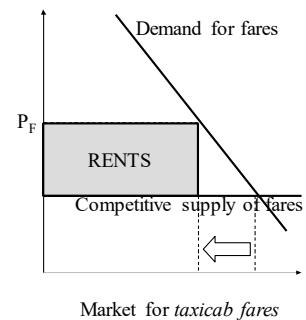
MEASURING THE EFFECTS OF REGULATION
Page 6

Rents from entry restrictions

- Suppose interest rate = 5%.
- In Indianapolis in 1980, price of medallion was about $450. Implies expected annual rent was 5% x $450 = _____ .
- In New York City in 1998, price of medallion was $230,000. Implies expected annual rent was 5% x $230,000 = _____ .

Conclusions

- The effect of regulation (or any policy change) can be measured using the intertemporal, market comparison, difference-in-differences, or counterfactual approaches.
- The _____ must control for changes in other variables affecting market outcomes.
- The _____ approach leans heavily on assumptions about how markets work.

REGULATION OF RAILROADS AND TRUCKING

Page 1

REGULATION OF RAILROADS AND TRUCKING

- When and why were railroads and trucking regulated?
- What effect did regulation have on rates?
- Why did railroads favor deregulation but truckers oppose deregulation?

Railroads before regulation

- Unstable industry in 1870s and 1880s.
- Periods of stable rates followed by price wars.
- Joint Executive Committee formed by railroads in 1879 to stabilize rates, but not very effective.

Interstate Commerce Act of 1887

- Interstate Commerce Act of 1887 created Interstate Commerce Commission (ICC) to ensure that
  - rates were "reasonable and just."
  - higher rates not charged for short hauls than for long hauls.
  - no discrimination among customers.

Interstate Commerce Commission (ICC)

- Little power at first.
- Hepburn Act of 1906 allowed ICC to set maximum rates.
- Transportation Act of 1920 allowed ICC to set minimum rates and control entry and exit from routes.
  - ICC authorized to guarantee adequate return on investment.

Natural monopoly explanation for railroad regulation

- It is widely asserted that AC falls with traffic.
- Alleged reason: "fixed cost" of right-of-way, track, stations.
- Empirical evidence is weak, however.
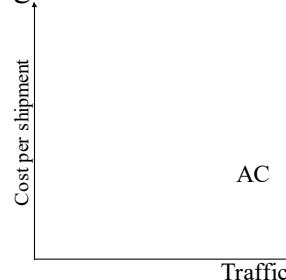
Explanations for railroad regulation

- Demand for regulation by railroads (_____ theory).
- Railroads wanted to establish a cartel, but were unable to do so without government help.
- Empirical evidence: substantial _____ in railroad stock prices when Act passed.

Robin A. Prager, "Using Stock Price Data to Measure the Effects of Regulation: the Interstate Commerce Act and the Railroad Industry," *RAND Journal of Economics*, Vol. 20 (Summer 1989), pp. 280-290.

REGULATION OF RAILROADS AND TRUCKING
Page 2

Competition from motor carriers

- In 1920s, railroads faced increasing competition from
  - trucks in freight.
  - buses in passenger traffic.
- Railroads pushed for state regulation.
- Stopped by Supreme Court decision in 1925 voiding state authority over interstate trucking or busing.

Motor Carrier Act of 1935

- Motor Carrier Act passed, partly because of lobbying by railroads.
- Brought interstate trucks and buses under ICC control.
- ICC given control of rates, entry, and exit.

Explanations for trucking regulation

- _____ natural monopoly argument here. Small firms as efficient as big firms.
- Instead, demand for regulation of trucks by _____.
  - ICC unable to raise railroad rates without controlling close competitors in trucking.
  - Railroads were a small well-organized group with much to gain.

Similarities in regulation of railroads and trucking

- Rate changes had to be approved by ICC.
- _____ into a market required a "certificate of convenience" from ICC.
- _____ required ICC approval.
- One difference: groups of trucking firms allowed to set own rates through "rate bureaus" _____ from antitrust laws.*

* Reed-Bulwinkle Act of 1948.

Rate regulation of railroads in practice

- "Value-of-service pricing."
  - _____ rates for high-value goods.
  - Example: higher rates for manufactured goods than raw materials and agricultural products.
- "Equalizing discrimination."
  - _____ rates (per mile) for short-haul and long-haul, regardless of cost.
  - A form of cross-subsidization.

Rate regulation of trucking in practice

- Same rates regardless of density of traffic.
  - A form of cross-subsidization.
- But trucking rates *could* vary by size of shipment (unlike railroads).
  - Larger shipments usually have lower marginal cost.
- Regulation's main effect was to keep trucking rates _____.

REGULATION OF RAILROADS AND TRUCKING
Page 3

Entry and exit regulation of railroads in practice

- _____ was the key issue.
- Cross-subsidization meant that some routes were priced _____ cost.
- ICC did _____ allow railroads to abandon unprofitable routes.

Entry and exit regulation of trucking in practice

- _____ was the key issue.
- Rates were set to ensure high profits.
- Firms applying to serve a new route had to show that demand could not be met by existing suppliers.
- Applications usually _____.
- In practice, only way to enter was to purchase license from existing firm.

Railroads press for deregulation

- Interstate Highways constructed in 1950s, giving greater advantage to trucks.
- Unregulated trucking sector expanded.
  - Owner-operators carrying exempt commodities.
  - Customers (manufacturers and wholesalers) shipping their own goods.
- Bankruptcy of Penn-Central, a large northeast railroad, in early 1970s.
- Other railroads in financial trouble, too.

Railroad Revitalization & Regulatory Reform Act of 1976

- Set "zone of reasonableness" in which railroads could change rates unless they enjoyed market dominance.
  - But ICC interpreted "market dominance" broadly, thereby retaining control over rates.
- Gave railroads more freedom to abandon unprofitable routes.

Changes in ICC policy on trucking in late 1970s

- 1975: ICC prohibited rate bureaus from blocking independent rate filings.
- Late 1970s: ICC permitted easier entry, lower rates. Also expanded deregulated zones around cities and airports.

Staggers Rail Act of 1980

- Limited ICC jurisdiction to routes where railroads enjoyed "market dominance."
  - ICC interpreted "market dominance" narrowly this time, so railroads given substantial freedom to set own rates.
- Gave railroads freedom of entry and exit.

REGULATION OF RAILROADS AND TRUCKING
Page 4

Motor Carrier Act of 1980

- Supported by Senator Ted Kennedy, President Jimmy Carter, and the National Association of Manufacturers (important trucking customers).
- Opposed by trucking industry, however.
- Codified many of the changes already made by ICC.

Recent developments

- Only a few states deregulated *intrastate* trucking in 1980s.
- Trucking Industry and Regulatory Reform Act of 1994 eliminated all rate regulation at *federal or state level* for interstate trucking firms that provided intrastate services.
- Interstate Commerce Commission abolished in 1995.

Conclusions

- The ICC was created in _____, largely to stop railroad price wars and equalize rates.
- As trucking began to compete with railroads, the ICC was given control over trucking rates in _____.
- Rail rates cross-subsidized unprofitable routes. Trucking rates maximized profits.
- Trucking and railroads were deregulated at the federal level about _____.

EFFECTS OF DEREGULATING RAILROADS AND TRUCKING
Page 1

EFFECTS OF DEREGULATING RAILROADS AND TRUCKING

- What happened to rates, profits, entry, and exit after deregulation?
- Why did traffic shift between railroads and trucking?

Effects on railroad rates

- Average rates (per ton-mile) _____ about 12% from 1981 through 1985.
- However, this was mostly due to change in composition of traffic.
- Shift from high-rate manufactures to low-rate bulk items (including agr. products).
- Some rates increased, some decreased.

Effects on trucking rates

- Average rates (per ton-mile) _____ about 5% from 1978 to 1985.
- Again this was partly due to changes in composition of traffic.
- Shift from low-rate bulk items (including agr. products) to high-rate manufactures.
- Most shippers reported their particular rates had _____ dramatically.

Estimated gains to customers (shippers) from rate changes

- Gains to trucking customers from deregulation were probably several billion dollars per year.
- Some rail customers gained, but more lost. Net loss was several billion dollars per year.
- Some of these gains and losses are transfers, so they do not equal _____ changes.

Other effects of deregulation on railroads

- After Staggers Act, railroads abandoned many unprofitable routes.
- Spending on maintenance _____ sharply.
- Profits _____.

### Effects of deregulation on trucking entry and exit

- Massive entry of new carriers.
- Simultaneous massive exit: thousands of bankruptcies per year.
- Value of ICC trucking license dropped from about $350,000 to near _____.
- Size distribution of firms did not change.

EFFECTS OF DEREGULATING RAILROADS AND TRUCKING
Page 2

Effects of deregulation on trucking efficiency and quality

- Fall in average costs, with fewer firms at the high end.
- Trucking firms permitted to cut rates on backhauls (similar to peak-load pricing).
- Shippers reported improved quality of service. Complaints to ICC declined.

Averge cost per ton-mile in trucking

Legend: 1977, 1983

Categories: < $0.10, $0.10-$0.20, $0.20-$0.30, $0.30-$0.40, $0.40-$0.50, $0.50-$0.60
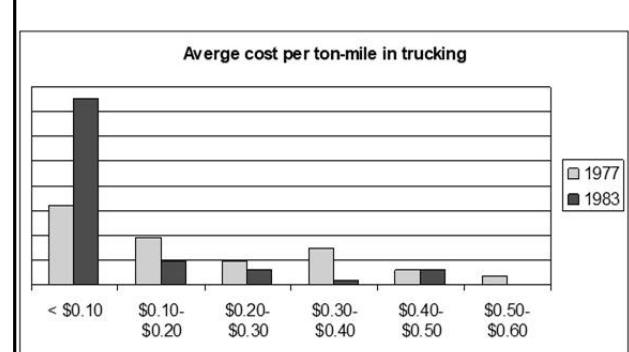
B. Starr McMullen and Linda R. Stanley, "The Impact of Deregulation on the Production Structure of the Motor Carrier Industry," *Economic Inquiry,* Vol. 26 (April 1988), pp. 299-316.

Effects of trucking deregulation on productivity growth and profits

- Productivity _____ after first year of deregulation.
- Stock prices fell with deregulation, so clearly expected profits _____.

Effect of trucking deregulation on truckers' wages

- Before deregulation, Teamsters' Union enjoyed wages _____ higher than wages of nonunion workers with similar skills doing similar work.
- Deregulation permitted rapid entry of nonunion trucking firms.
- After deregulation, Teamsters' wage premium dropped to about _____.

Why the composition of traffic changed

- Before deregulation, many goods were shipped on the wrong mode because regulated _____ did not reflect _____.
- Example: Rates for agr. commodities shipped by truck were deregulated in 1950s, but rail rates remained high.
- After deregulation, agr. commodities shifted to rail, and manufactures shifted to truck.

Conclusions

- Deregulation caused some rates to rise slightly and many rates to drop sharply, especially in _____.
- Profitability increased slightly in _____ and dropped sharply in _____.
- Efficiency increased as railroads dropped routes and truckers offered discounts on backhauls.
- Bulk traffic shifted to _____ and high-value traffic shifted to _____.

REGULATION OF AIRLINES
Page 1

REGULATION OF AIRLINES

- When were airlines regulated?
- What effect did regulation have on rates, routes, and quality of service?
- When were airlines deregulated?

Airlines before regulation

- Commercial airlines began hauling mail for Postal Service in late _____, and passengers in early _____.
- In _____, ICC given authority to allocate mail routes.

Civil Aeronautics Act

- Civil Aeronautics Act of _____ set up Civil Aeronautics Authority (later Civil Aeronautics Board, CAB).
- CAB given authority to award routes, regulate fares, and ensure safety.
- Safety regulation transferred to Federal Aviation Administration (FAA) in _____.

Powers of the Civil Aeronautics Board (CAB)

- CAB could regulate fares.
- CAB could prevent an airline from entering or abandoning a route.
- Also, by implication, CAB could control *how* an airline carried passengers from point to point (e.g., stops and plane changes).

Rate regulation of airlines in practice

- Overall rates set to protect profits.
- Cross-subsidization:
  - Rates set _____ cost for short-haul routes
  - Rates set _____ cost for long-haul routes.

Entry and exit regulation of airlines in practice

- In 1938, 16 "trunk" airlines were "grandfathered" and given certificates.
- From 1938 to 1978, CAB allowed entry of _____ new trunk airlines.
- Denied _____ applications from 1950-74.

REGULATION OF AIRLINES
Page 2

Entry and exit regulation of airlines in practice (cont'd)

- Airlines applying to serve a particular route had to demonstrate that they would not harm _____.
- In early 1970s, concerned about excess capacity and falling profits, CAB set a complete route moratorium, not permitting **ANY** airline to enter **ANY** new route.

Nonprice competition

- With prices controlled, airlines engaged in _____ competition for passengers.
  - More nonstop flights: reduced travel time.
  - More frequent departures and less crowded planes: load factor only about 50%.
  - More flight attendants.
  - Better food.
- As a result, airline profits from high fares were largely _____.

Unregulated sector

- Purely *intrastate* airlines were _____ subject to CAB regulation.
- In 1970s, fares on intrastate routes in California and Texas were roughly _____ as large as fares on interstate routes of similar length.

Calls for deregulation

- 1975 Senate hearings held by Ted Kennedy explored regulatory reform.
- John Robson appointed CAB chairman in 1975. Reduced entry restrictions, announced support for full deregulation.
- Alfred Kahn (economist) appointed CAB chairman in 1977. Further reduced entry restrictions and fare regulation.

Gradual deregulation by CAB

- 1976: Charter airlines granted access to regular routes, provided they required advance purchase and minimum stay.
- 1977: American Airlines requested and received similar "Super Saver" fares for NY-LA and NY-SF routes.
- 1978: CAB proposed automatic approval for fare changes (+10% or -70%).

Airline Deregulation Act of 1978

- Phased out airline regulation.
  - Route regulation to end Dec 31, 1981.
  - Fare regulation to end Jan 1, 1983.
  - CAB to be abolished Jan 1, 1985.
- But CAB under Kahn accelerated deregulation ahead of schedule.

REGULATION OF AIRLINES
Page 3

Conclusions

- The CAB was created in _____ .
- Rates were controlled to ensure profits, and to cross-subsidize _____ -haul flights.
- _____ was tightly restricted.
- Airlines were deregulated at the federal level in the late _____ and early _____ .

EFFECTS OF DEREGULATING AIRLINES
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EFFECTS OF DEREGULATING AIRLINES

- What happened to fares and passenger volume after deregulation?
- How did the emergence of "hub-and-spoke" route systems affect service?
- What antitrust problems have emerged?


Effect on fares

- End of cross-subsidization.
  - Fares fell for long-haul routes.
  - Fares rose for short-haul routes.
- Greater use of discounts (price _____)
- Big increase in number of tourist travelers on discount fares.

Effect on quality of service

- Increased "_____" (that is, more crowded planes) especially on long-haul flights.
- Some _____ in travel time between smaller cities because fewer nonstop flights.
- No change in safety.
- But volume of passengers increased substantially, suggesting the price-quality package became more attractive overall to consumers.


How to tell if consumers are better off

- If price and quality *both* go down, how can you tell if consumers are better off or worse off?
- Did consumer surplus increase?
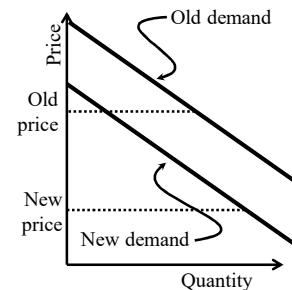
Trends in quantity of travel

Billions of passenger miles

- By car (highway)
- By air
- By train (intercity/Amtrak)
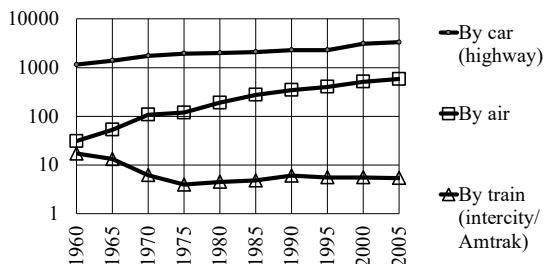
SOURCE: Bureau of Transportation Statistics, U.S. Dept. of Transportation Downloaded 12/19/2017.

Effect on entry and exit

- Massive entry at first by
  - Former intra-state carriers (e.g., _____).
  - Former charter airlines (e.g., _____).
  - New carriers (e.g., _____).
  - Old carriers changing routes.
- Followed by many exits and bankruptcies— end of CAB safety net.


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Effect on productive efficiency

- New "hub-and-spoke" route systems replaced "point-to-point" systems.
- Allowed _____ load factors and more frequent departures, but _____ total flight times between smaller cities.
- Unit costs fell more rapidly after deregulation than before.

Example: point-to-point route system
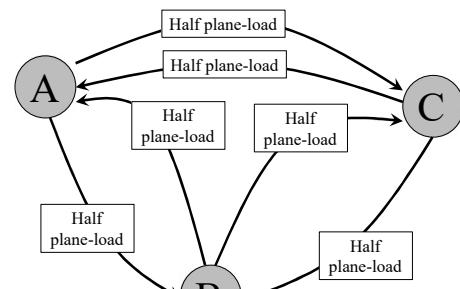
Example: hub-and-spoke route system
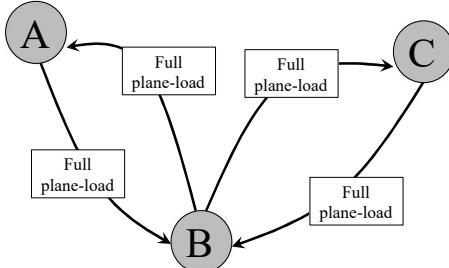
Hub-and-spoke route system: multiple hubs

Profits and wages

- Big _____ in profits, forcing mergers and bankruptcies.
- Labor unions forced to make wage _____ and accept two-tiered wage agreements (lower wages for new hires).
- Effects similar to trucking deregulation.

Trends in concentration

- HHI _____ on long-haul routes, but not short-haul routes.
- HHI _____ sharply in 1985-1987, when 20 airlines merged.
- HHI especially high at hubs, where one airline usually has very large market share.
- Fares also _____ at hubs.

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Opportunities for fare collusion

- Computer reservation systems used by travel agents and Airline Tariff Publishing Company (ATPCO) facilitate coordination of fares.
  - Consent decree in early 1990s restricted use of ATPCO for coordination.
- Marketing alliances attenuate competition.

Other possible antitrust problems

- Access to landing slots and gates is difficult for entrants at some airports.
- Frequent-flier programs seem designed to capture passengers.
  - Give advantage to airline flying more routes.
- Numerous instances of apparent predatory pricing.

Conclusions

- Fares _____ on long-haul flights and total volume of passengers _____.
- Development of _____ systems raised load factors, increased flight frequency, but lengthened flight times.
- New antitrust issues emerged including high concentration at hubs, price coordination, and apparent _____ pricing.