very cursory & suitable only for networks

INTRO TO ECONOMICS

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(with material by G. Mankiw, Jerry Brocks, John B. Taylor and others)

Disclaimers

- Focus on issues relevant to communication markets
  - not: unemployment, inflation, balance of trade, income inequality, … (mostly, *macro economics*)
  - not: reading a balance sheet
- Very introductory (& simplified)
- Try to point out limitations & assumptions
  - “real world” has non-rational humans & companies, fraud, …

Concepts

- Rational behavior
- Opportunity costs
- Elasticity of demand
- Consumer surplus
- Price setting
- Less-than-perfect competition

Basic economic principles

1. People face trade-offs → opportunity costs
   - time, money, reputation, health, …
   - efficiency: most value from available resources
   - equity, fairness: fair distribution of benefits
2. Cost = what you give up to get good or service
   - *Opportunity cost* is what you give up to obtain item.
3. Rational people think at the margins
   - Marginal changes are small, incremental adjustments to an existing plan of action.
   - "sunk cost" fallacy ($20 ticket + blizzard)
   - People make decisions by comparing costs & benefits at the margin.

Utility

- "In economics, utility refers to the benefits (satisfaction or happiness) consumers derive from a good, and it can be measured based on individuals' choices between alternatives or preferences revealed in their willingness to pay." (BE2014)
  - *Expected utility* has been used in economics as well as game and decision theory, including prospect theory, and is based on choices with uncertain outcomes.
  - *Experienced utility* relates to actual (hedonic) experiences associated with an outcome which is associated with theories on forecasting errors like the diversification bias.
  - *Procedural utility* is relevant if people value not only outcomes, but also the processes that lead to these outcomes (Frey, Benz, & Stutzer, 2004).
  - *Social utility* has been proposed in relation to game theory, where players not only always act self-interestedly, but also show concerns about the perceived intentions of other players and fairness .

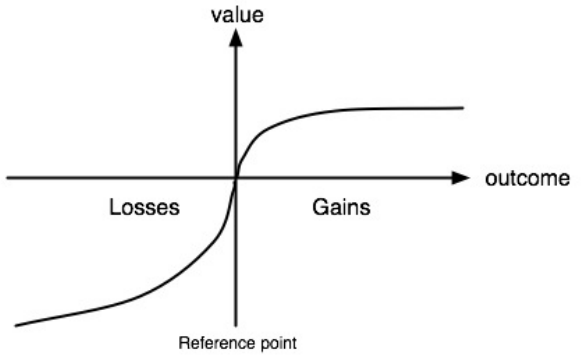
BE2014

#4: People respond to incentives

- Marginal changes in costs or benefits motivate people to respond.
- The decision to choose one alternative over another occurs when that alternative's marginal benefits exceed its marginal costs!
- Rational choice: stable preferences (Becker, 1976)

Behavioral economics

- 1979 *Prospect Theory* (Kahneman and Tversky)
  - reference dependence (gains & losses)
  - loss aversion (factor = 2.25) → housing prices
    - coin toss experiment
  - non-linear probability weighting: *prospect theory*
  - diminishing sensitivity to gains & losses
- Applied to individual behavior & financial markets (aggregate) → Thaler
- Sunstein "Nudges"
  - good decisions = experience, good information, prompt feedback (e.g., climate change, health)



Wikipedia

Prospect theory examples

- Experiment 1:
  - A) A certain win of $250, versus
    B) A 25% chance to win $1000 and a 75% chance to win nothing?
- Experiment 2:
  - C) A certain loss of $750, versus
    D) A 75% chance to lose $1000 and a 25% chance to lose nothing?
- Experiment 3:
  - Tails: you lose $10
  - Heads: you win $x – what's your *x*?

Pricing example

- participants whether they would buy a product (e.g., a cordless keyboard) for a dollar amount that was equal to the last two digits of their US social security number.
- They were then asked about the maximum they would be willing to pay. In the case of cordless keyboards, people in the top 20% of social security numbers were willing to pay three times as much compared to those in the bottom 20%.
- Reduction in price from $0.14 to zero is more powerful than a reduction from $0.15 to $0.01.

Ariely, Loewenstein, & Prelec, 2003

#5: Trade Can Make Everyone Better Off.

- People gain from their ability to trade with one another.
- Competition results in gains from trading.
- Trade allows people to specialize in what they do best.
  - “comparative advantage”

#6: Markets Are Usually a Good Way to Organize Economic Activity

- A *market economy* is an economy that allocates resources through the decentralized decisions of many firms and households as they interact in markets for goods and services.
  - Households decide what to buy and who to work for
  - Firms decide who to hire and what to produce

#7: Governments Can Sometimes Improve Market Outcomes

- *Market failure* occurs when the market fails to allocate resources efficiently.
- When the market fails (breaks down) government can intervene to promote efficiency and equity.
- Market failure may be caused by
  - an *externality*, which is the impact of one person or firm's actions on the well-being of a bystander.
  - *market power*, which is the ability of a single person or firm to unduly influence market prices.
    - acquired or government-granted monopolies
      - patents, trademarks, concessions, right-of-ways, franchises, …

Rivalry

	Excludable	Non-excludable
Rivalrous	Private goods (food, clothing, cars, personal electronics)	Common goods (fish stocks, timber, coal, roads)
Non-rivalrous	Club goods (cinemas, private parks, satellite TV)	Public goods (OTA TV, air, national defense)

Wikipedia

Externalities

- Negative impact on others
  - pollution, congestion (networks, land, …), …
  - cost transfer (e.g., health care)
  - privacy
- Lack of positive outcomes
  - under-investment in public goods: research, education, infrastructure, access for people with disabilities
  - lack of innovation (e.g., trade secrets) or cultural production
  - lack of resiliency (natural & man-made disasters)
- Introducing
  - regulation: “don’t cause it” → EPA fuel economy
    - but some externality-causing behaviors have positive effects
      - at least perceived by somebody (e.g., smoking)
  - taxation: “pay for it” → gas guzzler tax, cigarette taxes

Economic models

- Simplified real world
  - similar to scientific models and engineering models
    - e.g., ignore friction or quantum effects; simplify shapes
- Typical assumptions (not all of them):
  - rational behavior on relevant time scales (→ manager behavior)
  - no externalities
  - perfect information
  - competition (see later)
- Model output
  - what is optimized – consumer benefit? total benefit?
  - how large are the effects – often, examples are artificial and may exaggerate the effects
    - → econometrics
- Example: Open Internet modeling

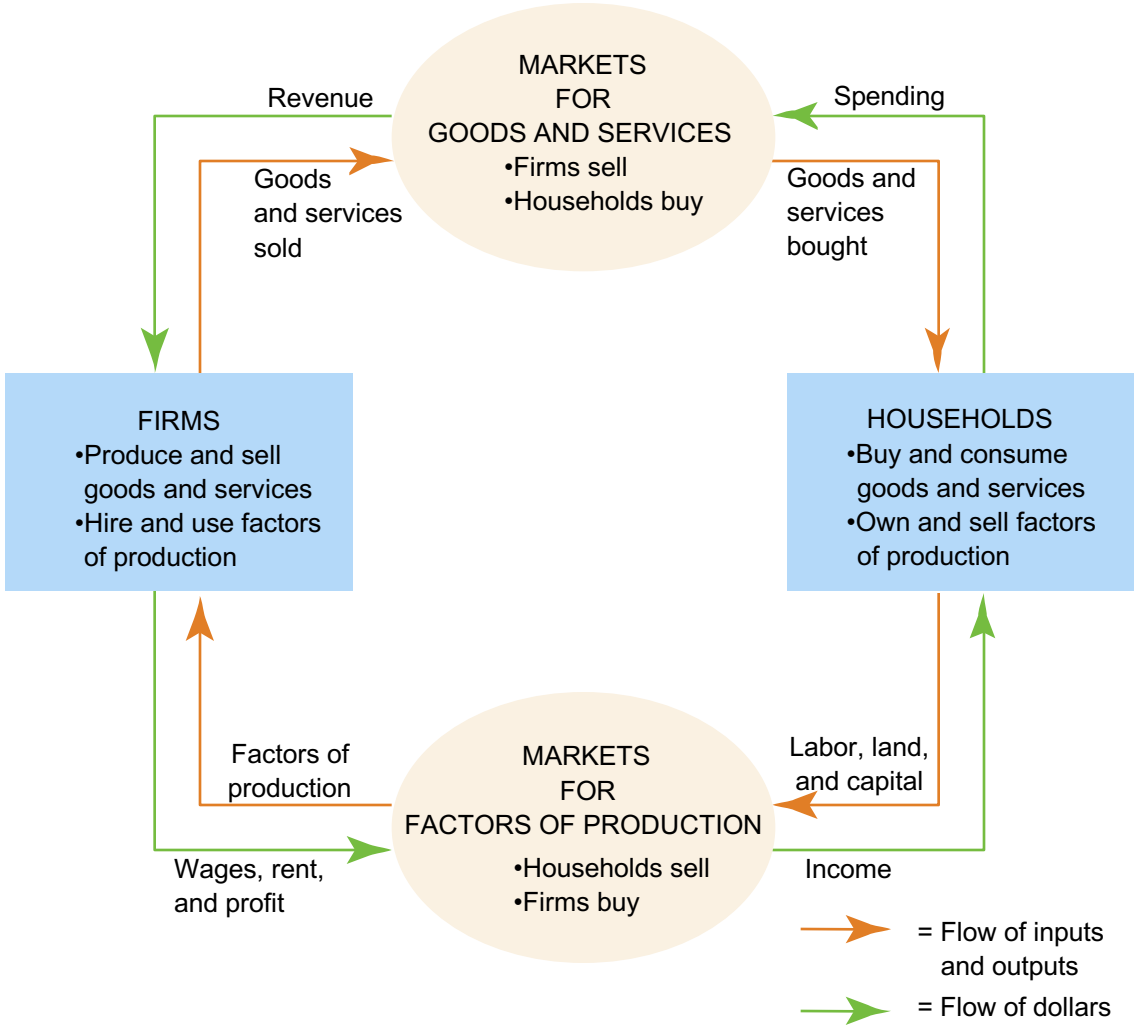
The Circular-Flow Diagram

- The circular-flow diagram is a visual model of the economy that shows how dollars flow through markets among households and firms.

Our first model: the circular-flow diagram

- Factors of Production
  - inputs used to produce goods and services
  - land, labor, and capital
  - but also public goods: knowledge, infrastructure, …

Figure 1 The Circular Flow



Requirements for efficient transactions

- Adequate information (location of buyers and sellers, product quality)
- Enforcement of contracts
- Protection of property rights
- Limited externalities
- Limits on market power or other limitations on fair bargaining

Perfect competition

- The more competition there is, the more likely are firms to be efficient and prices to be low.
- *Perfect competition* is the most competitive market imaginable in which everybody is a price taker. Firms earn only normal profits, the bare minimum profit necessary to keep them in business. If firms earn more than this (excess profits) other firms will enter the market and drive the price level down until there are only normal profits to be made.
  - Perfect competition is rare and may not even exist. It is so competitive that any individual buyer or seller has a negligible impact on the market price. Products are **homogeneous**. *Information is perfect*. Everybody is a price taker. Output will be maximized and price minimized.
  - Most markets exhibit some form of imperfect or monopolistic competition. There are fewer firms than in a perfectly competitive market and each can to some degree **create barriers to entry**. Thus firms can earn some excess profits without a new entrant being able to compete to bring prices down.

http://www.economist.com/economics-a-to-z/

(Near) perfect competition?

- Food trucks
- Chinese & Italian restaurants
- Stock and commodities (gold, pork bellies) markets
- Tutoring
- Selling real estate
- Low-wage employment
- Musicians (?)

Consumer surplus

- = The difference between what a consumer would be willing to pay for a good or service and what that consumer actually has to pay. Added to PRODUCER SURPLUS, it provides a measure of the total economic benefit of a sale.

Classic cost, production curve

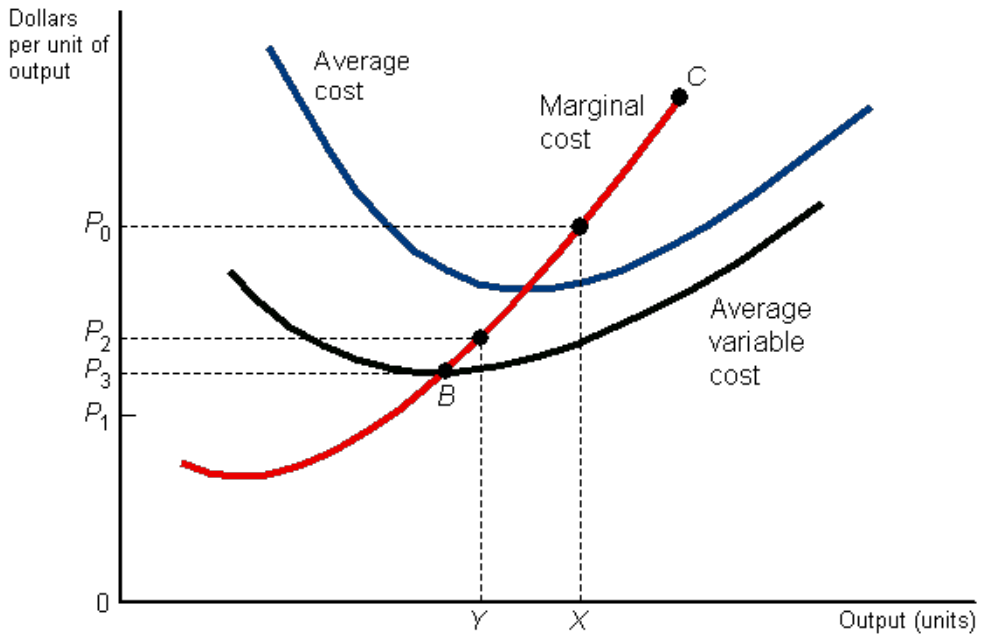
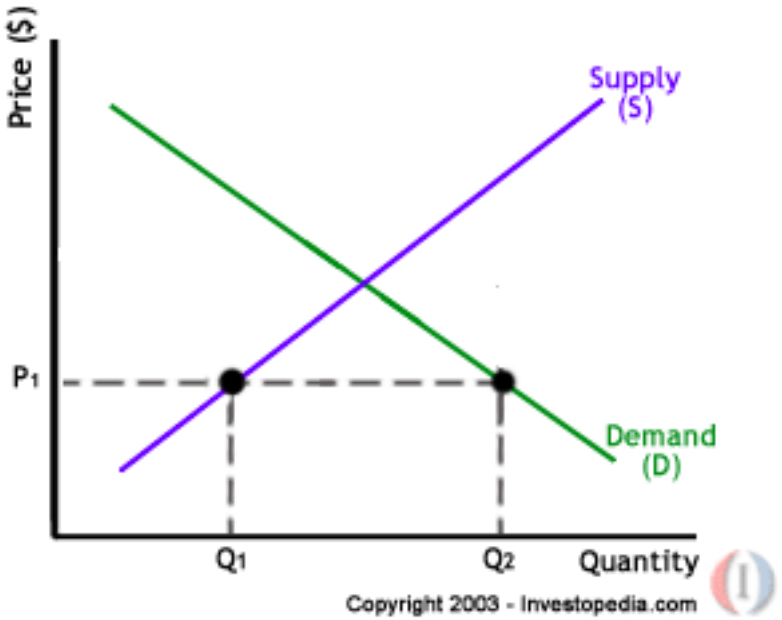


Figure 9.3 SHORT-RUN AVERAGE AND MARGINAL COST CURVES

Basic demand-supply diagram



Competitive equilibrium

- Firms expand if price is above marginal cost
- Firms contract if price is below marginal cost
- Equilibrium is where marginal cost (MC) crosses the demand curve
- P = MC is socially efficient in the sense of "allocative efficiency"

Equilibrium with economies of scale

- Marginal cost is below average cost
- Marginal cost pricing will not cover all of costs
- Non-regulated firms often use discriminatory pricing (information goods)
- Regulated firms must have some prices above marginal cost for viability

Equilibrium with economies of scope

- Prices designed to recover the incremental cost of each product will not recover the entire cost of the firm
- In an unregulated market, revenue from each product would be between the incremental cost and the stand-alone cost
- If revenue is less than the incremental cost, we say that product is cross-subsidized by another product

The elasticity of demand

- *Price elasticity of demand* is a measure of how much the quantity demanded of a good responds to a change in the price of that good.
- Price elasticity of demand is the percentage change in quantity demanded given a percent change in the price.

The price elasticity of demand and Its determinants

- Availability of close substitutes
- Necessities versus luxuries
- Definition of the market
- Time horizon

The price elasticity of demand and its determinants

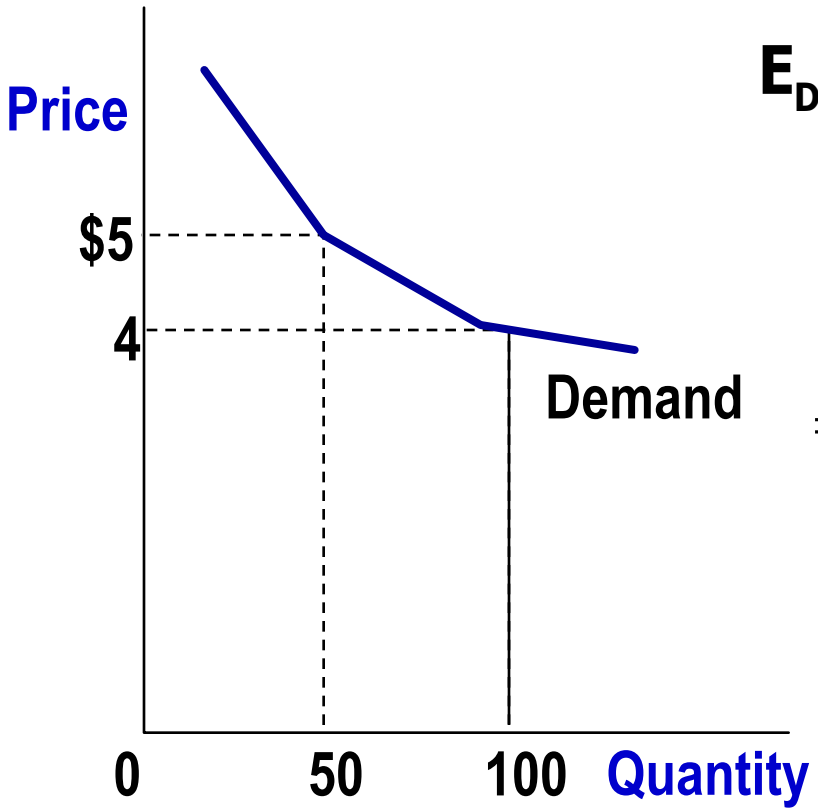
- Demand tends to be more elastic:
  - the larger the number of close substitutes.
  - if the good is a luxury.
  - the more narrowly defined the market.
  - the longer the time period.

Computing the Price Elasticity of Demand

- The price elasticity of demand is computed as the percentage change in the quantity demanded divided by the percentage change in price.

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

Computing the price elasticity of demand



$$E_D = \frac{(100-50)/(100+50)/2}{(4.00-5.00)/(4.00+5.00)/2}$$

$$= \frac{67\ \text{percent}}{-22\ \text{percent}} = -3$$

Demand is price elastic

Demand curves

- We can think of people as arrayed along the demand curve according to the maximum that they would pay for the good rather than do without.
- The maximum that an individual will pay is determined by that person's preferences for this good compared to other goods, by the prices of other goods, and by the individual's income.
- The difference between the demand curve and the price paid is the individual's "consumer surplus".

Network effects

- A network effect exists when an increase in the size of the network increases the value to subscribers of the network
- Network effects are sometimes called *economies of scale on the demand side*
- Network effects give an advantage to the largest firm in the industry, even without economies of scale in the supply of the product

Economies of scope

- Economies of scope exist when it is cheaper to produce two products together than to produce them separately
- When economies of scope exist, the sum of the stand-alone cost is greater than the total cost and the sum of the incremental cost is less than the total cost
- Example: car radio controversy
  - “vertical integration” in media companies

Monopoly

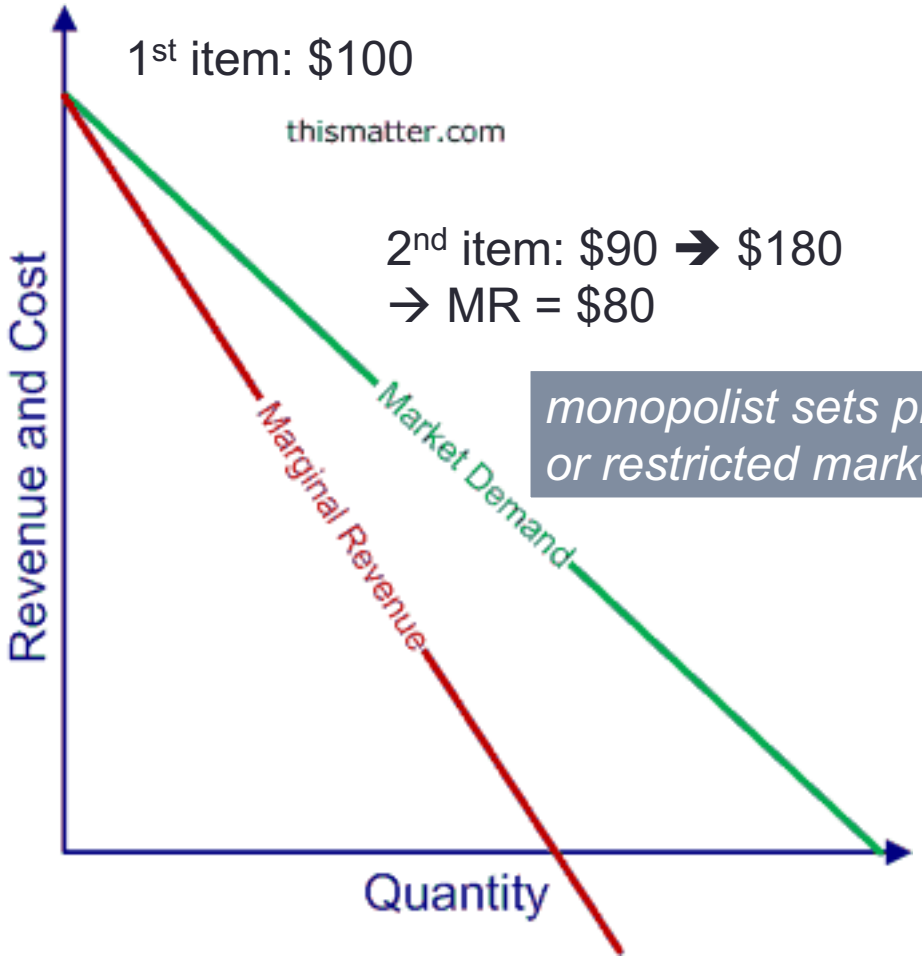
- Most markets exhibit some form of imperfect or **monopolistic competition**. There are fewer firms than in a perfectly competitive market and each can to some degree create barriers to entry. Thus, firms can earn some excess profits without a new entrant being able to compete to bring prices down.
- The least competitive market is a **monopoly**, dominated by a single firm that can earn substantial excess profits by controlling either the amount of output (supply) in the market or the price (but not both). In this sense it is a price setter.
- When there are few firms in a market (**oligopol**y) they have the opportunity to behave as a monopolist through some form of collusion (see **cartel**). A market dominated by a single firm does not necessarily have monopoly power if it is a **contestable market**.
  - In such a market, a single firm can dominate only if it produces as efficiently as possible and does not earn excess profits. If it becomes inefficient or earns excess profits, another more efficient or less profitable firm will enter the market and dominate it instead.

http://www.economist.com/economics-a-to-z/

Monopsony

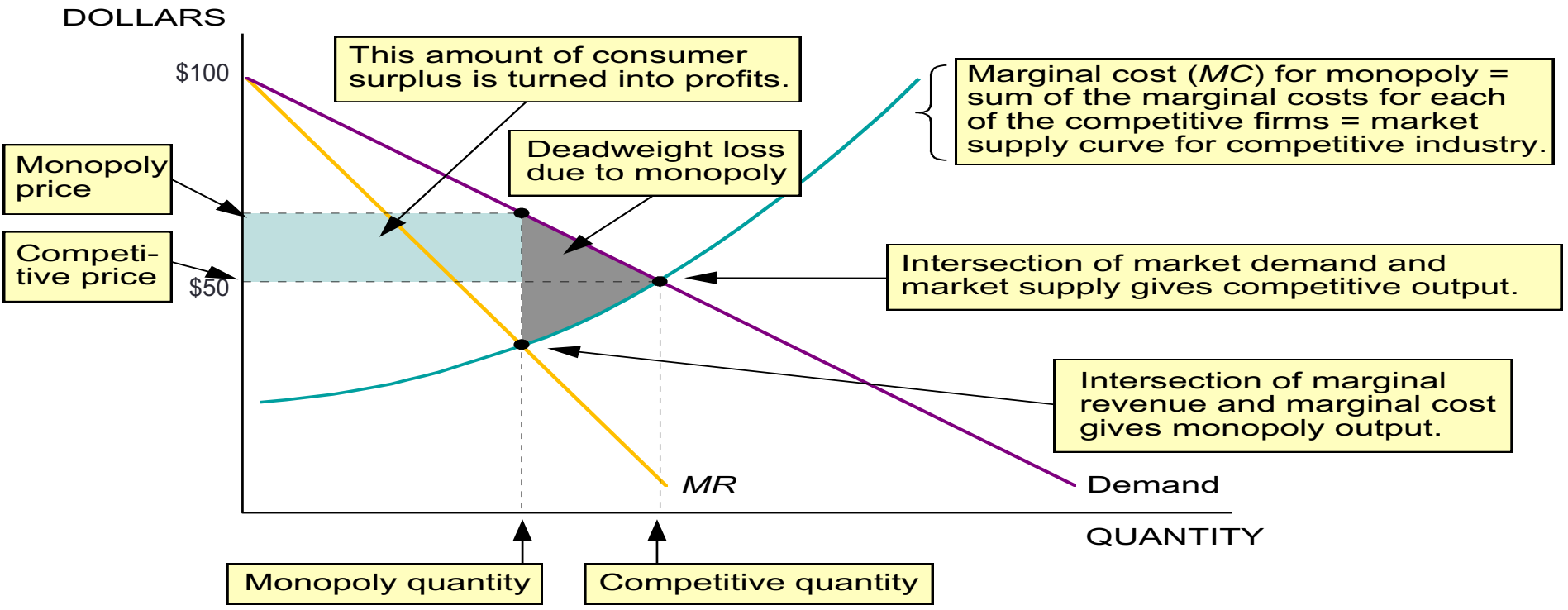
- A market similar to a monopoly except that a large buyer not seller controls a large proportion of the market and drives the prices down. Sometimes referred to as the buyer's monopoly. (investopedia)
  - Less common, but Amazon has been accused of that by book publishers.
  - Cable companies buying content rights?

Monopolist: marginal revenue



monopolist sets price (or, less likely, output + auction or restricted market)

The General Rationale for Government Intervention: Deadweight Loss from Monopoly



Two forms of government intervention

- ***Antitrust policy***
  - sometimes called competition policy
- Price and entry regulation of firms
  - sometimes called economic regulation
  - distinct from social regulation

Sherman Act (1890)

- Section 1: Price fixing (ADM case [1996])
- Section 2: Persons who "monopolize" or "attempt to monopolize" are "guilty of a felony"
  - 33 breakups
  - AT&T is most recent
    - IBM attempt, Microsoft
  - ***predatory pricing***
    - Price below shutdown point and drive other firms from the market, then monopolize

Merger Policy (Clayton Act (1914))

- Federal Trade Commission (FTC)
  - see also “Section 5” (unfair trade practices)
- Antitrust Division of the Department of Justice
  - plus FCC for mergers involving telecommunications (licenses)
- Factors to consider in a proposed merger
  - market power?
  - ease of entry?
  - economic efficiency

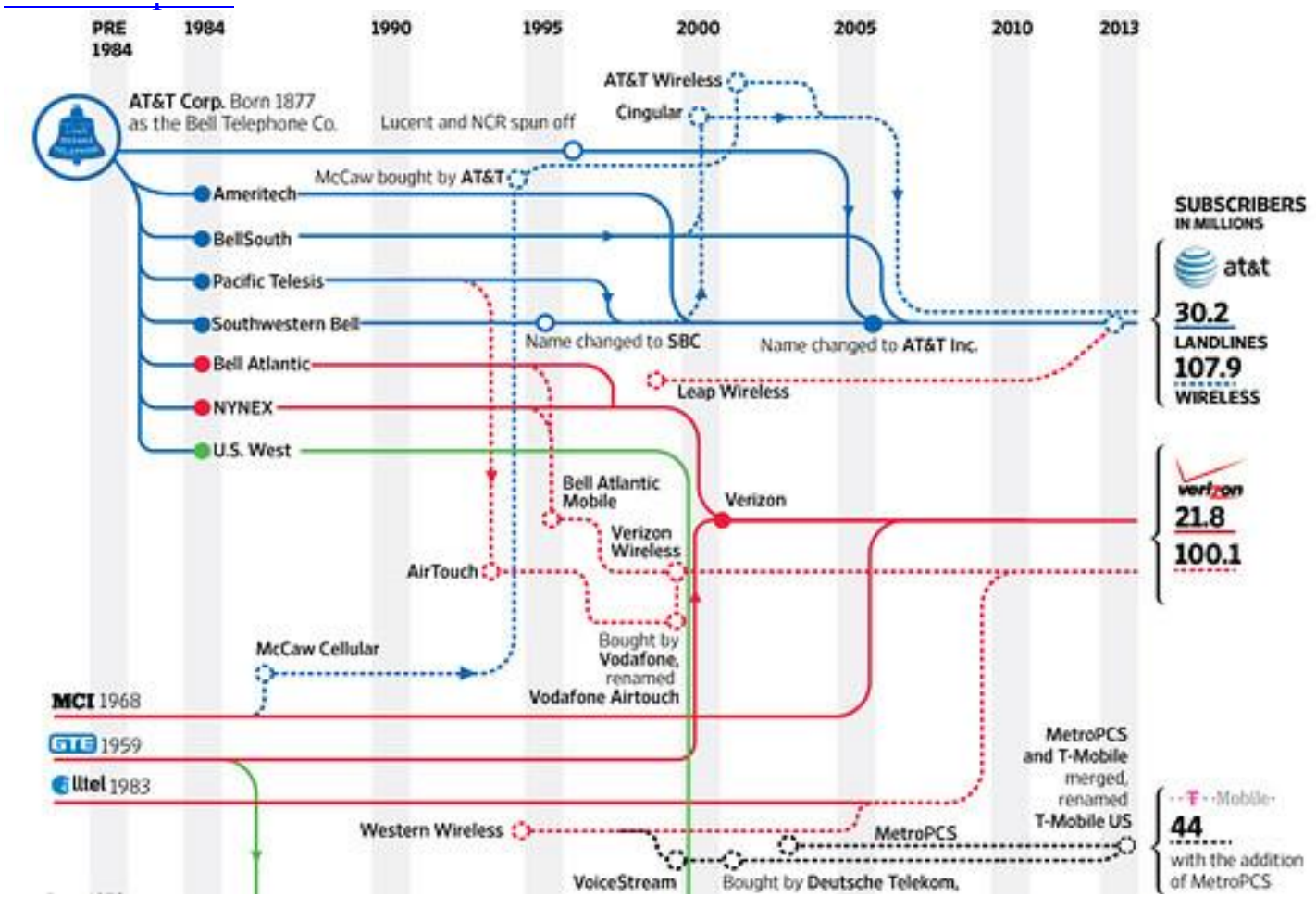
Herfindahl-Hirschman Index HHI or the "Herf"

- Definition: sum of squared market shares
  - example: a 3 firm industry (30,30,40) has HHI
    - = $(30)^2$ + $(30)^2$ + $(40)^2$
    - = 900 + 900 + 1600 = 3400
- Example: challenge if HHI > 1800 and merger would increase HHI by 50 or more
  - could two of the three firms merge? $(60)^2 + (40)^2$ =3600+1600=5200 **NO WAY!!!**

Example: Intuit - Microsoft proposed merger in 1996

- The DOJ blocked the merger. Why?
- The product was "financial software"
  - Quicken (Intuit)
  - Money (Microsoft)
- market definition (two versions)
  - DOJ: personal finance check writing programs (70, 22, 8)
  - Microsoft: should also include pencil and paper

Telecom mergers



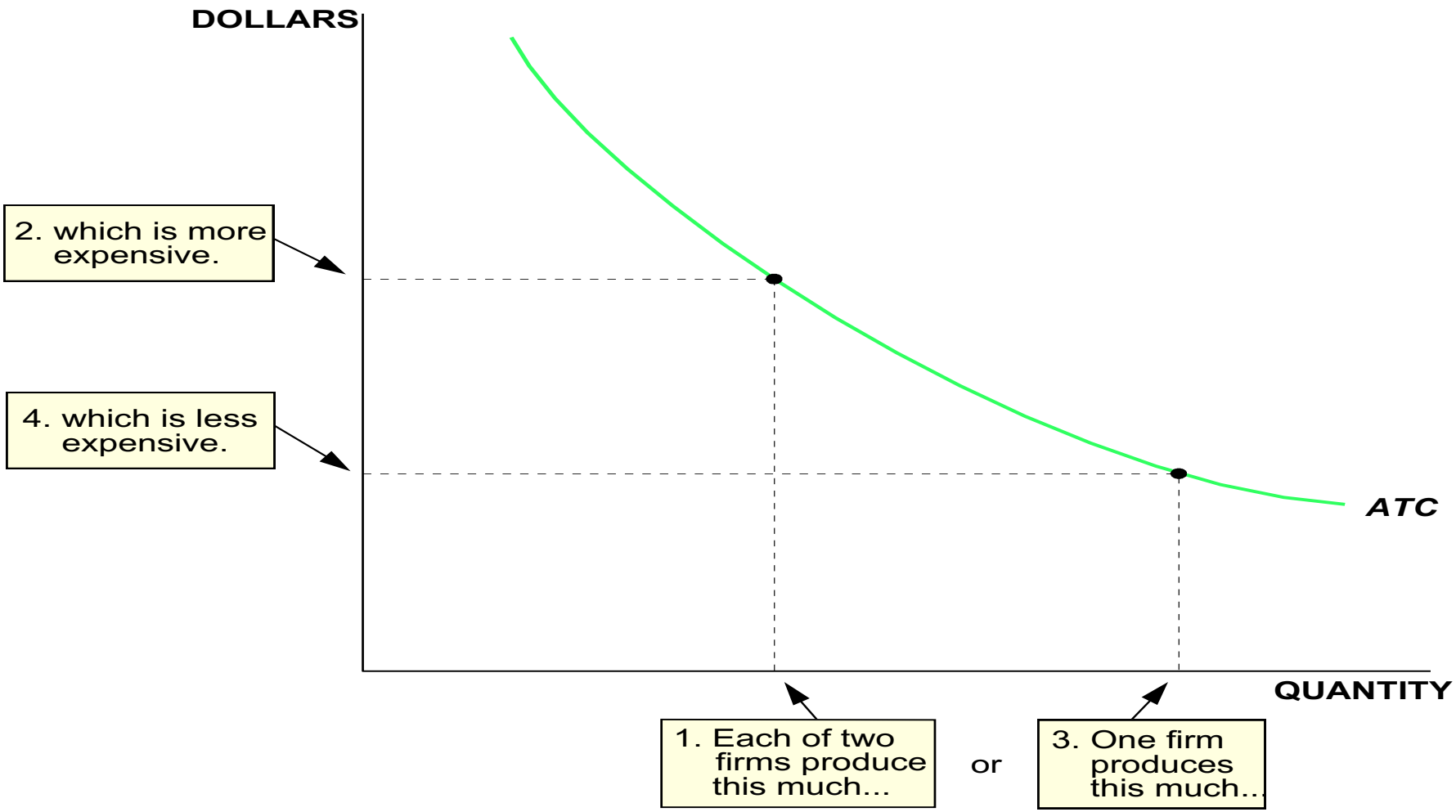
The deregulation movement

- Started in late 1970s, continued in 1980s
- Why? Economists were right, many regulated industries not natural monopolies
- Examples: price or entry regulations cut
  - air travel
  - railroads
  - telecommunications
  - trucking
  - cable TV (partially re-regulated in 1992; showing of competition)

Economic regulation of firms

- Both price and entry are regulated
- Regulatory agency (CAB, ICC, PUC) sets the price and restricts entry of other firms
- Rationale for regulation is that the industry is a natural monopoly (water, wire telephone, electricity distribution)
- But what is a natural monopoly?

Natural Monopoly: Decreasing Average Total Costs



Monopoly pricing

- An unregulated monopolist will maximize profits by choosing a price and quantity combination where MR = MC (marginal revenue = marginal cost).
- The ratio of price to marginal cost is determined by the elasticity of demand and is given by P/MC = *e/(e+1)*.
- For example, if e = -2, the profit maximizing price is equal to twice the marginal cost, but if e = -4, the profit maximizing price is only 1.33 times the marginal cost, and if e = -100 (near perfect competition), then the price is 1.01 times MC.

Price Discrimination (1)

- Price discrimination requires some market power, the ability to distinguish the components of the market that value the product at higher or lower rates, and the ability to limit resale from customers who pay a lower price to those who pay a higher price.
- *Perfect price discrimination* allows a monopolist to extract all of the consumer surplus from the market by charging each customer the maximum amount that customer would pay rather than do without the product, but perfect price discrimination is rarely possible.

Price Discrimination (2)

- Practical price discrimination generally involves distinguishing two or more market segments and setting different prices for those market segments.
- Profit maximizing price discrimination requires setting separate monopoly prices (MR = MC) in each segment. If the elasticity of demand is the same in both segments, no price discrimination is possible because both monopoly price computations yield the same result.
- Price discrimination is more feasible in services or goods with licensing agreements than in manufactured goods because it is hard to prevent resale with manufactured goods.

There are three ways to regulate the price of a natural monopoly.

- But first make sure it is a natural monopoly
- Borderline cases like cable TV?
  - How many over the air channels are there?
  - What about satellite dishes?
  - What about the electricity lines?
- Open Internet and merger debates – who is competing?
  - Satellite: ubiquitous, but latency
  - Cellular: nearly ubiquitous (95% claimed), but usage metering and variability

Cost Concepts

- Average cost (ATC) – total cost divided by the number of units produced
- Marginal cost (MC) – the cost of producing one additional unit
- Incremental cost – the cost of producing an additional quantity of output in the units that an efficient manager would choose – a practical approximation to marginal cost

Cost Concepts - continued

- Historical cost – the cost as recorded by an accounting system based on past expenditures
- Forward looking cost – the projected cost of production based on expected future expenditures

(1) Marginal cost pricing

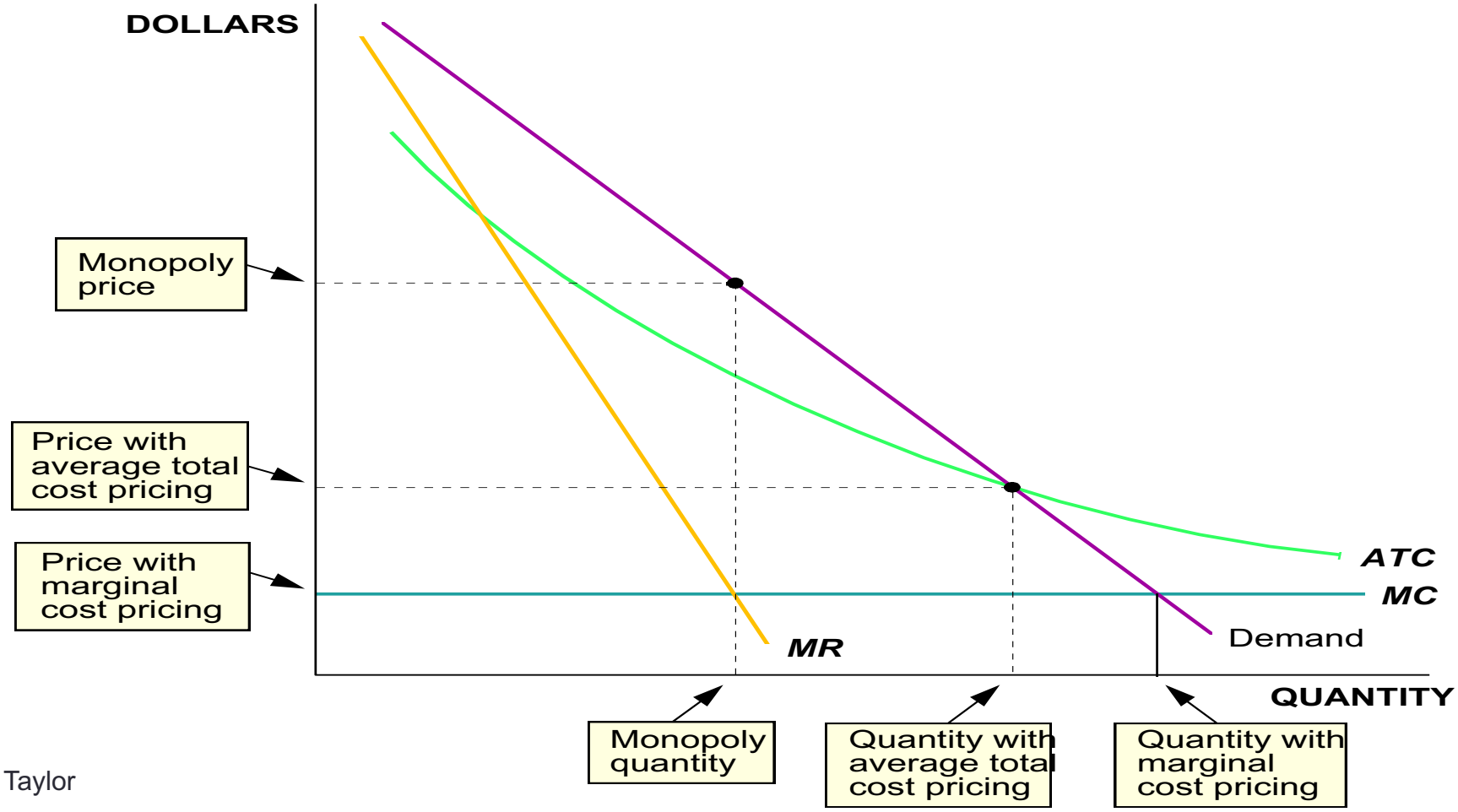
- Sounds pretty good, P = MC would mean efficiency and no deadweight loss
- But the firm will earn negative economic profits; who would bother to produce?

(2) Average cost pricing

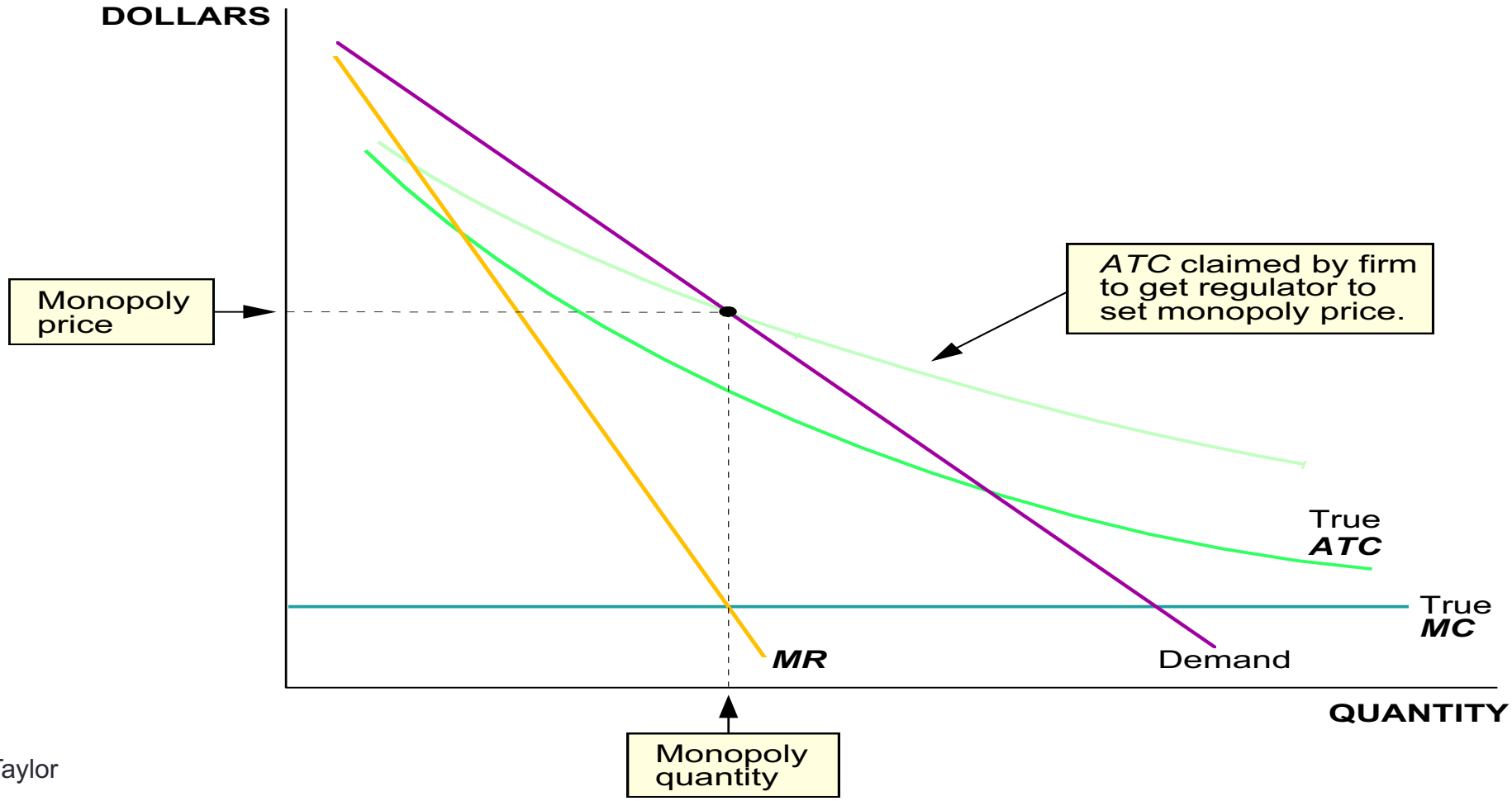
- This sounds better:
  - profits are not negative, rather they are zero
  - and P is not nearly as high as PM though P is greater than MC
- But ATC (average total cost) pricing can create bad incentives (corporate jets again, bad management)
  - → "rate of return" carriers
  - "A rate-of-return (ROR) carrier is one that is allowed to set rates on its various products and services so that it earns no more than the rate-of-return authorized by the FCC. FCC rules define the rate base (specified plant items) upon which a carrier is allowed to earn a return." (USAC)

Wrap-Up and Compare

$P = P_M$ $P = MC$ $P = ATC$



One other problem: Firm may claim a high cost to the regulators



Regulation addresses market failures

- Prevent or restrain monopolies
  - anti-trust: prevent horizontal & vertical monopolies
  - price setting or capping (“price cap regulation”)
- Mandate behavior in exchange for license/franchise or industry
  - PEG channels
  - Accessibility (“hearing aid compatibility”)
- Taxes to fund public goods
  - emergency calling
  - disability access (e.g., relay services)
  - universal service by geography and income
    - Internet access for students & libraries (“e-rate”)

Incentive Regulation

- Set regulated price several years in advance
  - for example, ATC plus an inflation factor
- Firm gets to keep extra profits (or suffer extra loss) without the regulator immediately changing the regulated price
- Thus firm has incentive to keep its costs down

Early railroad regulation

- Railroads = critical infrastructure good to facilitate other transactions
- High fixed cost and low marginal cost made competition problematic – recognized by Charles Francis Adams in 1867
- Early state railroad regulatory commissions and *Interstate Commerce Commission* (1887) developed common carrier common law precedents

State communications regulation

- States generally lost power to regulate railroads in 1886 Supreme Court Decision
- State railroad commissions or newly created regulatory bodies added electricity and telephones, using similar approaches to those developed for railroads
- AT&T supported state regulation as a justification for monopoly
  - Kingsbury commitment (1913)

Kingsbury commitment (1913)

Wishing to put their affairs beyond fair criticism, and in compliance with your suggestions formulated as a result of a number of interviews between us during the last sixty days, the American Telephone and Telegraph Company, and the other companies in what is know as the Bell System, have determined upon the following course of action:

First. The American Telephone and Telegraph Company will dispose promptly of its entire holdings of stock of the Western Union Telegraph…

Second. Neither the American Telephone and Telegraph …, will … acquire …. control over any other telephone company operating any exchange or line which is or may be operated in competition with any exchange or line included in the Bell System, or which constitutes or many constitute a link or portion of any system so operated or which may be so operated in competition with any exchange or line included in the Bell System.

Third. Arrangements will be made promptly under which all other telephone companies may secure for their subscribers toll service over the lines of the companies in the Bell System

New Deal regulation

- Widespread belief that markets had failed
- High point of optimistic strong approaches to regulation
- Emphasis on stabilizing industries and preserving existing structures
- Monopoly, cross subsidies, and unionized work forces created political support

Telephone Technology – 1950-1970

- Remained largely electromechanical
- Stable technology, prices, and products
- AT&T toll rate for a ten minute 200 mile call remained constant at $2.20 from 1943 through 1969
- Step-by-step switches reached peak use in 1973, 54 years after their introduction

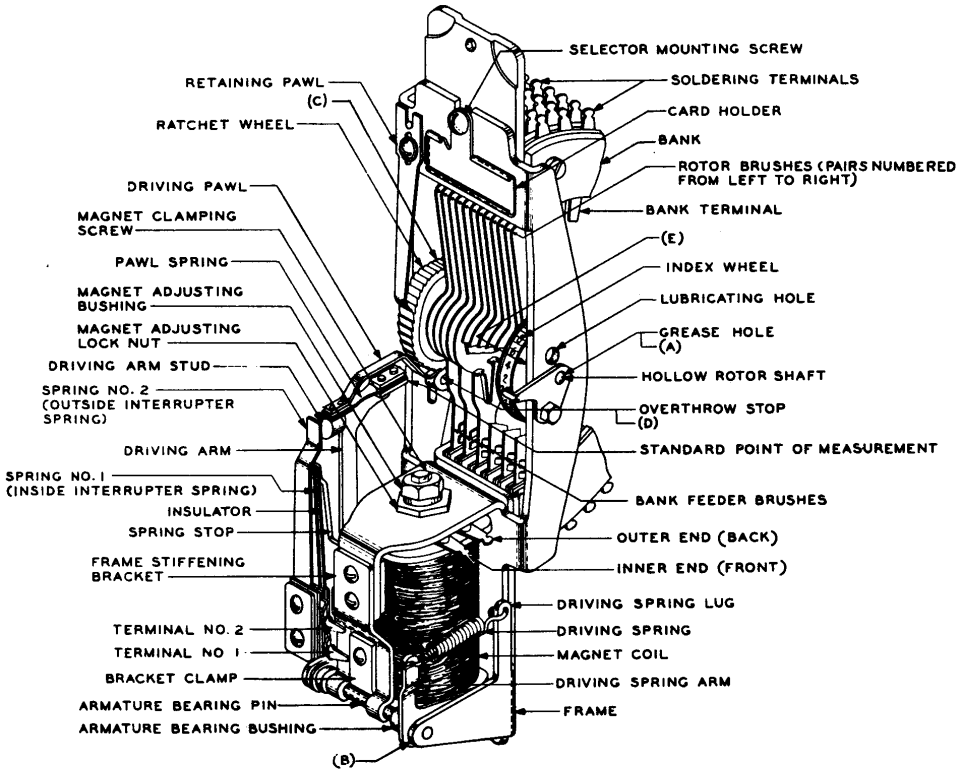


Figure 4-24. 206-Type Selector.

Structural Solutions

- Frustration with inability to resolve cost controversies led to structural separation of potentially competitive and monopoly services
  - TELRIC (= Total element long-run incremental cost)
  - = “measures the forward-looking incremental cost of adding or subtracting a network element" from a hypothetical system (that is efficient and uses current technologies). This allows the incumbent to recover a share of the fair value of their inputs in the long run.”
- FCC Computer II Proceeding – 1980
- DOJ divestiture – 1982 (→ AT&T break-up 1984)
- Structural separation assumes no significant economies of scope
- See: British Telecom, NTT, …

Regulatory summary

- Useful for capital intensive infrastructure industry with stable technology
- Allows long term investment with low cost of capital because of limited risk
- Provides stable prices and services to consumers
- Discourages change, including technological progress

ASYMMETRIC INFORMATION

Introduction

- Basic economic analysis assumes that all parties have the relevant information, with little attention to precisely what information is required and how it is acquired.
- With competition, prices themselves convey a great deal of information and reduce the need for detailed understanding of private information.
- With small numbers of agents bargaining, information issues become much more significant than under competition with large numbers of agents.

Definitions (1)

- *Asymmetric information* – one party to the bargain has relevant information unknown to the other party
  - regulated firm and regulatory agency, employee and employer
- *Moral hazard* – one party may undertake actions adverse to the other party that cannot be completely monitored
  - homeowner's private fire prevention efforts and insurance company
  - employee's intensity of effort and employer
  - health insurance

Adverse selection & mechanism design

- Adverse selection – an outcome that results from information asymmetry that would not have occurred if the uninformed party had access to the information possessed by the informed party (purchase of a bad used car from an owner that knew it was bad)
- Mechanism design – a method of designing contracts or regulatory structures to create private incentives to reveal truthful information (*incentive compatible* regulation such as price caps, a menu of options designed to reveal information, Vickrey auction)

Lemons Model

- Suppose buyers know that 50% of used cars are "lemons" worth $1000 and 50% are good cars worth $2000, but cannot distinguish between the good and bad cars.
- If neither buyers nor sellers can distinguish car types, the equilibrium price would be the expected value of $1500.
- If only sellers can distinguish, the equilibrium is to sell only bad cars at $1000.
- Asymetric information combined with moral hazard creates adverse selection and eliminates the market for good used cars.

Signaling Models (1)

- The lemons problem cannot be overcome by simply asking the buyer because the buyer may falsely assert that the car is good.
- The lemons problem can be overcome by investing in signals that are correlated with the unknown quality characteristic (advertising, brand reputation).
- In general, signals require the use of resources that would not be required to convey the information if all persons told the truth.

Signaling Models (2)

- Michael Spence originally developed signaling models in the context of education.
- Assume ability, not education, is the characteristic valued by employers.
- Assume high ability individuals find it easier to acquire educational credentials than low-ability individuals.
- Employers will pay according to education and individuals will rationally invest in education because of the correlation between education and the unknown but valued characteristic of ability.