Part 2. Market Failure I
Monopoly and Price Discrimination

Monopoly, Deadweight Loss, Two-Part Tariffs,
Direct Price Discrimination, Indirect Price Discrimination

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Monopoly

Introduction

A firm is a monopoly if it is the only firm in the market –
no other firm produces the same good or a close substitute for it.

The degree to which goods are substitutes is measured by the *cross price elasticity of demand*.

- Few pure monopolies
- A monopoly faces downward sloping demand (choice what price to charge)

→ It does not lose all its demand when it raises price above marginal cost: it has market power

→ A monopoly picks a point on the market demand curve to maximize profits

Sources of Monopoly

- Government policy
  - State owned or regulated monopoly (utilities)
  - Patents (drugs), copyrights (movies, music), trademarks (brand names), licences (nightclubs, cable), etc.
- Large efficient scale
  - Economies of scale (gas, electricity)
    decreasing average cost = natural monopoly
  - Network externality on demand side (MS Office, Pokemon Trading Cards)
- Firm's actions
  - Control of essential input (DeBeers)
  - Being more (cost-)efficient than other firms and/or preventing entry (Walmart, Microsoft)

Basic Model (Uniform Pricing)

- Let q = quantity sold/output, p = price per unit
- (Inverse) Demand Function $p = P(q)$

  downward sloping: $\frac{\partial P}{\partial q} = P'(q) < 0$
- Total Revenue = $P(q)q$;

  $\Rightarrow$ Average Revenue = P(q)

  $\Rightarrow$ Marginal Revenue = $\frac{\partial P(q)q}{\partial q} = P(q) + P'(q)q$
- Cost Function = $C(q)$

  $\Rightarrow$ Marginal Cost = $\frac{\partial C}{\partial q} = C'(q) > 0$
- Profit Function $\Pi(q) = P(q)q - C(q)$

Uniform Pricing (Cont'd)

- Firm chooses q to $\max_q \Pi(q) = P(q)q - C(q)$
- First-order condition

$$\frac{\partial \Pi}{\partial q} = 0 \qquad \Leftrightarrow \qquad P(q) + P'(q)q - C'(q) = 0$$

- optimal quantity q_m satisfies:

$$P(q_m) + P'(q_m)q_m = C'(q_m)$$

Marginal Revenue = Marginal Cost

Optimal price satisfies $p_m = P(q_m)$

the monopolist chooses quantity where marginal revenue equals marginal cost and charges the maximum price that bears that quantity

The Inverse Elasticity Rule

- Recall price elasticity of demand: $\epsilon = -\frac{\partial q}{\partial p}\frac{p}{q} = -\frac{1}{P'(q)}\frac{p}{q}$
- Then $P(q_m) + P'(q_m)q_m = C'(q_m)$ becomes

$$P(q_m)\left[1 - \frac{1}{\epsilon}\right] = C'(q_m)$$

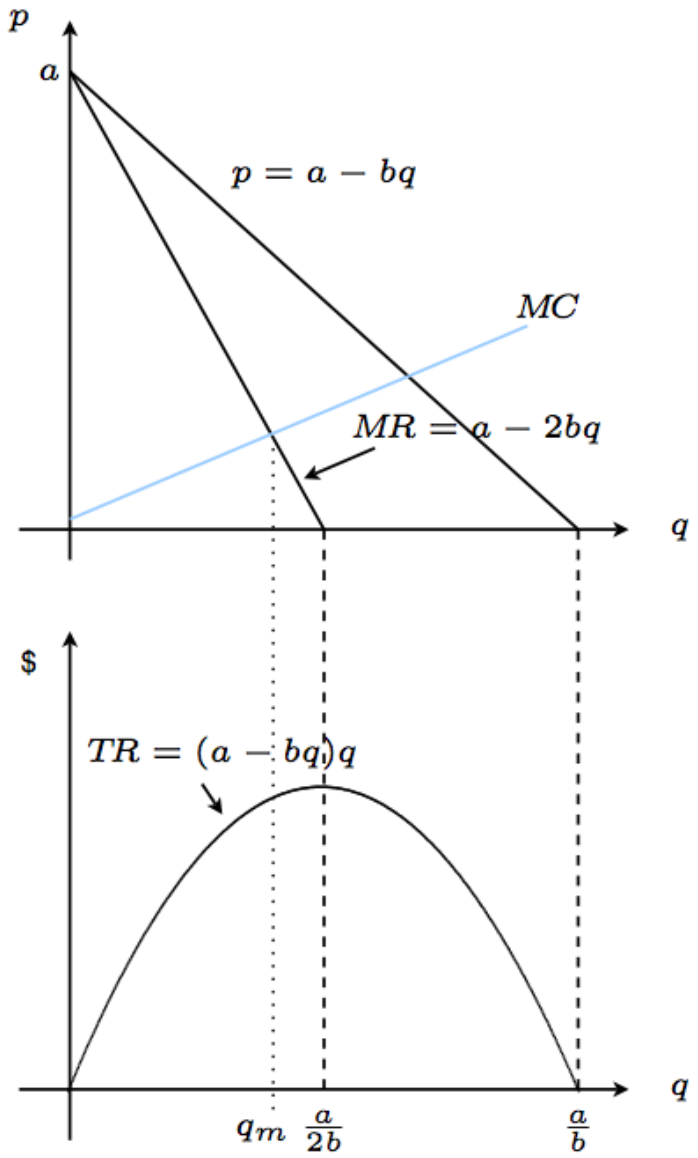
$$\frac{P(q_m) - C'(q_m)}{P(q_m)} = \frac{1}{\epsilon}$$

Inverse Elasticity Rule:

price-cost margin (Lerner Index) = Inverse elasticity

- Markup higher (resp. lower) the more inelastic (resp. elastic) demand
- Since $C'(q) > 0$, a monopolist always produces in the elastic portion of the demand $(\epsilon > 1)$

Example: Linear Demand



$$P(q) = a - bq$$

$$\epsilon = -\frac{\partial q}{\partial p}\frac{p}{q} = -\frac{1}{b}\frac{a-bq}{q} = \frac{a}{bq} - 1$$

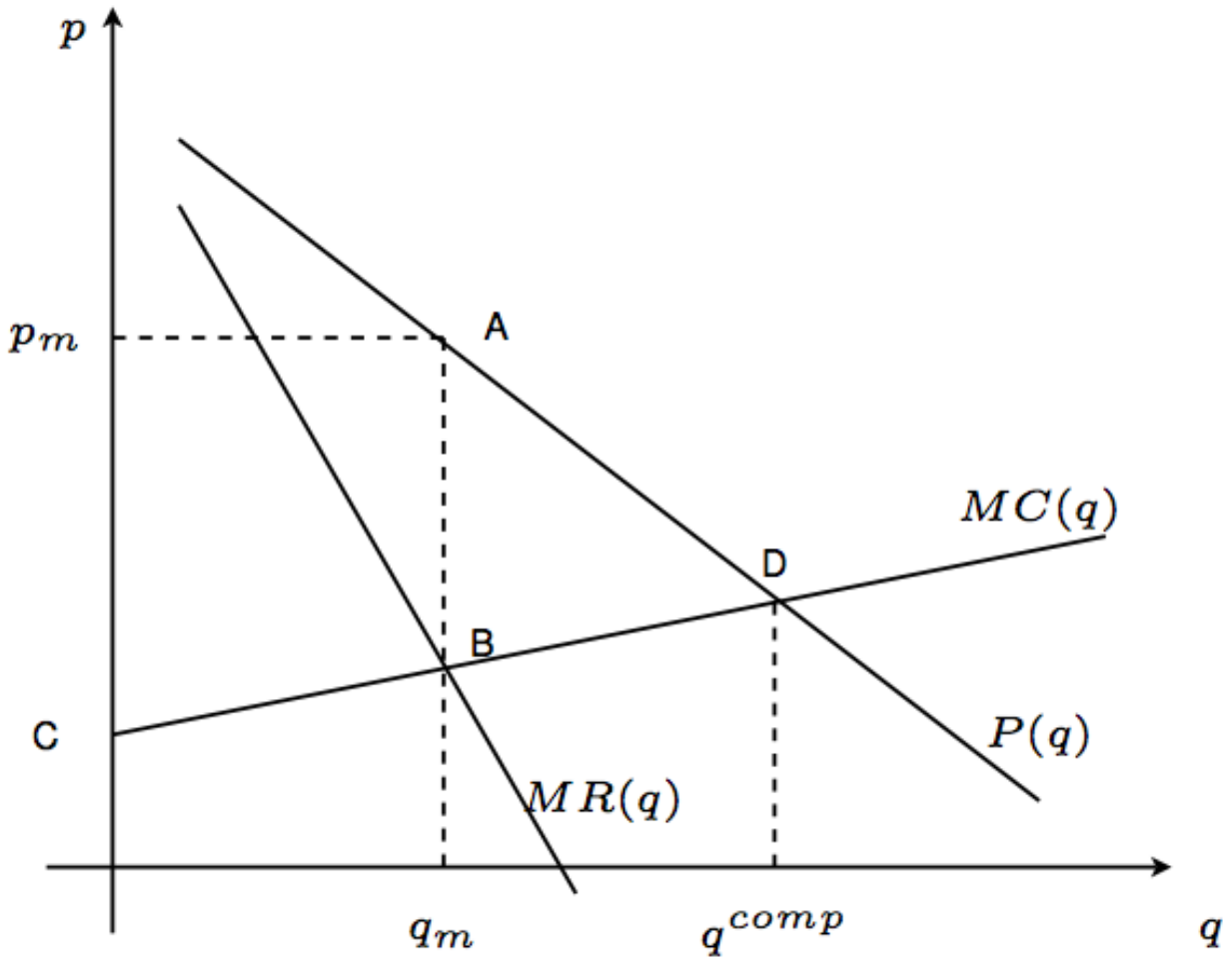
- elastic demand: $q < \frac{a}{2b}, e > 1$
  $\Rightarrow MR > 0$
  $\Rightarrow TR$ positively sloped
- inelastic demand: $q > \frac{a}{2b}, e < 1$
  $\Rightarrow MR < 0$
  $\Rightarrow TR$ negatively sloped

Price Elasticities of Demand - Estimates

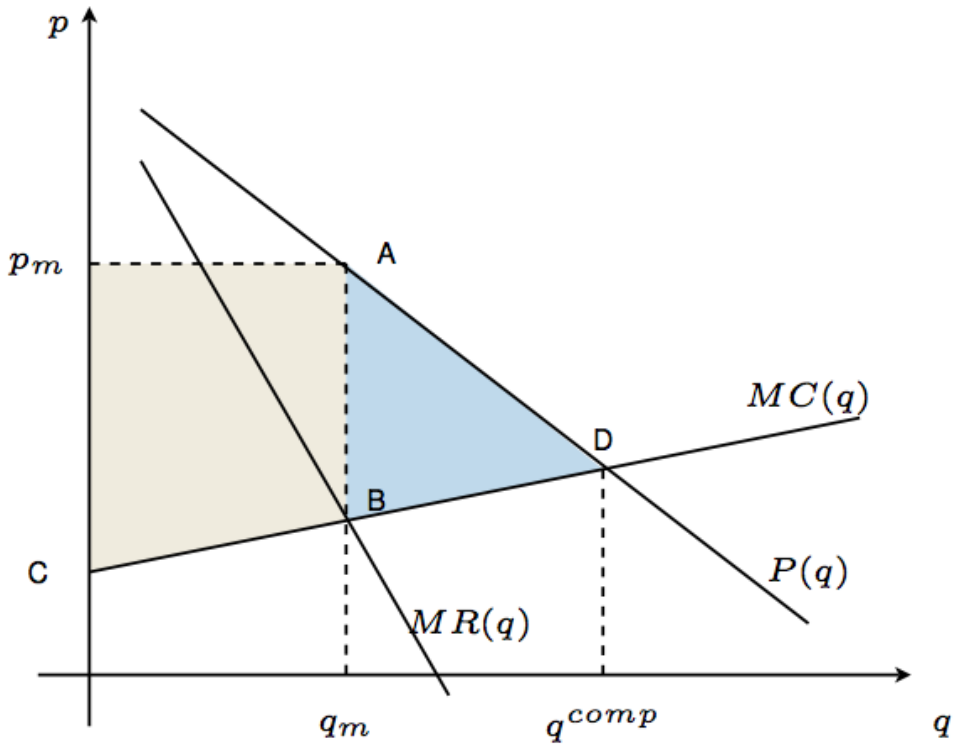
Salt	0.1	Movies	0.9
Matches	0.1	Housing, owner occupied, long-run	1.2
Toothpicks	0.1	Shellfish, consumed at home	0.9
Airline travel, short-run	0.1	Oysters, consumed at home	1.1
Gasoline, short-run	0.2	Private education	1.1
Gasoline, long-run	0.7	Tires, short-run	0.9
Residential natural gas, short-run	0.1	Tires, long-run	1.2
Residential natural gas, long-run	0.5	Radio and television receivers	1.2
Coffee	0.25	Restaurant meals	2.3
Fish (cod) consumed at home	0.5	Foreign travel, long-run	4.0
Tobacco products, short-run	0.45	Airline travel, long-run	2.4
Legal services, short-run	0.4	Fresh green peas	2.8
Physician services	0.6	Automobiles, short-run	1.2 – 1.5
Taxi, short-run	0.6	Chevrolet automobiles	4.0
Automobiles, long-run	0.2	Fresh tomatoes	4.6

[a] **Note:** Source http://scholar.harvard.edu/files/alada/files/price_elasticity_of_demand_handout.pdf

Graphic Analysis



Graphic Analysis



monopoly profit = p_m ABC

deadweight loss = ABD

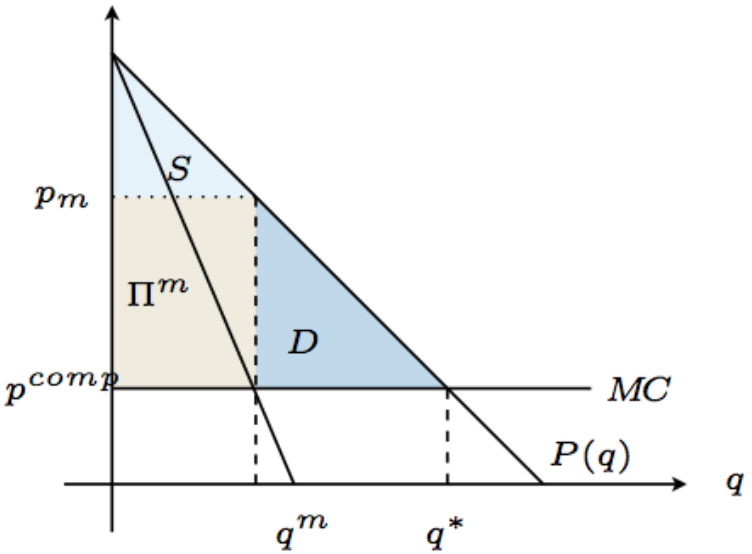
- The monopolist restricts output/charges higher price than under competition
- Monopolist outcome is inefficient (not Pareto optimal), the blue triangle is the "burden of monopoly"

→ Possible gov't interventions: price regulation, taxation, ...

Two-Part Tariffs

Two-part tariff = Fixed 'entry' fee plus per unit price

- Examples: communication services (cable, phone), utilities (gas, electricity), amusement parks, night clubs



firm can do better than Π^m with additional fixed fee $\rightarrow$ extracts S
but if $p = p^m$, max fixed fee is S
$\rightarrow$ lost profit $= D$

optimal:
$p = p^{comp} = MC$ and
fixed fee $= S + \Pi + D$

- Outcome Pareto **efficient**, monopolist extracts all surplus
- But: only works with homogeneous consumers

Government Policy

Monopolies create a loss to consumers and the economy as a whole....

What can/should the government do?

- Divesture of crucial inputs (ATT&T had to sell of local operations, National airlines required to divest slots and gates etc.)
- Encouraging competition (e.g. favourable treatment in wireless spectrum auctions for new competitors)
- Price/quantity regulation (service requirements, price ceilings), taxation

Other considerations

- Revenue through selling the right to form a monopoly (e.g. wireless spectrum, toll highways).
- Encourage innovation through patents and copyright

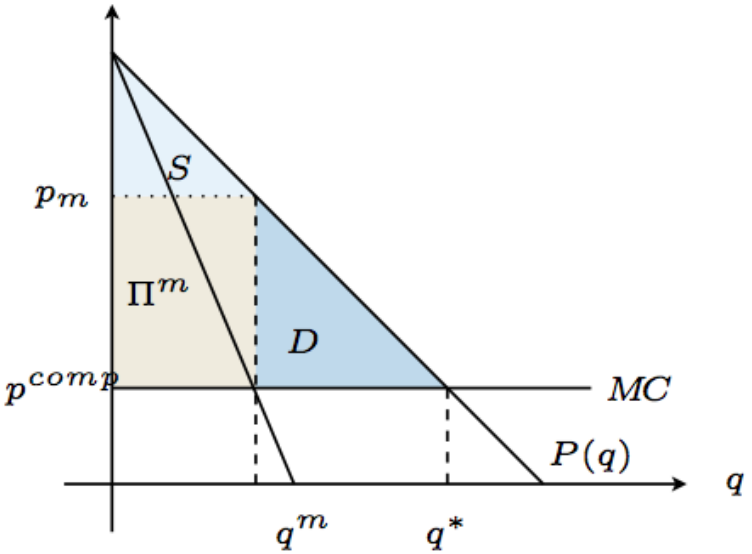
Price Discrimination

Introduction

Price Discrimination = Selling the same product to different buyers at different prices (market segmentation)

- Ordinary Price Discrimination $\rightarrow$ *direct* and *indirect* price discrimination
- Perfect Price Discrimination

Perfect Price Discrimination = Firm charges every consumer his or her reservation price



- final output
  $q^m = q^* = q^{comp}$
- outcome is Pareto **efficient**,
  monopolist extracts all surplus

Direct Price Discrimination

- Price based on **identity** of demand group
  - Observable consumer characteristic (students, seniors)
  - Location (Canada-US)
- Need:
  - Identify consumer types
  - Prevent arbitrage (buy low and resell)
- If monopolist can price discriminate, what prices should it charge?

Example

- Two observable buyer groups (markets) with demands

$$q_1 = 100 - p_1 \quad \text{and} \quad q_2 = 100 - 2p_2$$

- Monopolist with marginal cost $MC = 20$ per unit
- Profit function $\Pi = (100 - q_1)q_1 + (50 - \frac{1}{2}q_2)q_2 - 20(q_1 + q_2)$
- Profit max gives

$$\frac{\partial \Pi}{\partial q_1} = 100 - 2q_1 - 20 = 0 \qquad \Rightarrow q_1 = 40, p_1 = 60$$
$$\frac{\partial \Pi}{\partial q_2} = 50 - q_2 - 20 = 0 \qquad \Rightarrow q_2 = 30, p_2 = 35$$

- Total profit from price discrimination is $\Pi = 2050$

Example (cont'd)

- What if monopolist cannot price discriminate?
- Aggregate demand function:

$$q_1(p) + q_2(p) = 200 - 3p \Rightarrow P(q) = \frac{200}{3} - \frac{1}{3}q$$

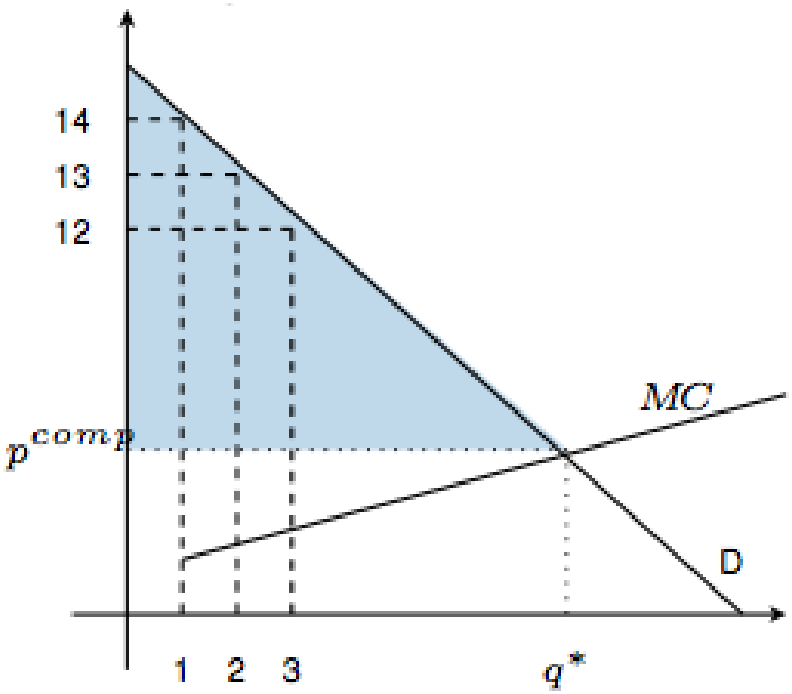
- Profit function $\Pi = (\frac{200}{3} - \frac{1}{3}q)q - 20q$
- Profit max gives

$$\frac{\partial \Pi}{\partial q} = \frac{200}{3} - \frac{2}{3}q - 20 = 0 \qquad \Rightarrow q = 70, p = 43.33$$

- Total profit is $\Pi = 1633.33$

The monopolist's total profit is higher when he can price discriminate than when he cannot.

General Analysis



Maximizing $\Pi = P(q_1)q_1 + P(q_2)q_2 - C(q_1 + q_2)$ gives

$$MR(q_1) = P(q_1)[1 - \frac{1}{\epsilon_1(q_1)}] = MC(q_1 + q_2)$$

$$MR(q_2) = P(q_2)[1 - \frac{1}{\epsilon_2(q_2)}] = MC(q_1 + q_2) \qquad \Rightarrow MR(q_1) = MR(q_2)$$

and $\epsilon_1(q_1) > \epsilon_2(q_2) \Rightarrow p_1 < p_2$

Indirect Price Discrimination

- Price based on **choices** made by consumers
- Works through self selection
- General idea:

  Firms offer different "packages" (price/quantity or price/quality) and consumers "pick" the package they prefer most

  $\rightarrow$ Self select into different demand groups from which monopolist is able to extract additional consumer surplus through price discrimination
- No need for directly identifying demand groups
- Arbitrage may still be problem

Example: Buy One get Second One for Half Price

- Tim Hortons, makes sandwiches at MC = $ 2
  offers: if you buy one for full price second sandwich is 50 % off....WHY?

- Explanation: **indirect PD**
  sandwich value for hungry customer (Henry) = $ 8 for first sandwich
  $ 4 for second sandwich

  sandwich value for less hungry customer (Larry) = $ 6 for first sandwich
  $ 2 for second sandwich

- linear pricing: charge $6 per sandwich
  → each buys on sandwich, profit is $ 8 = 12-4

- direct (perfect) PD: charge $ 8 to Henry, $ 6 to Larry
  → each buys one sandwich, profit is $ 10 = 8+6 - 4
  but: not feasible if types of customers cannot be identified!

- indirect PD: charge $6 for first sandwich, $3 for second sandwich
  → Henry buys two sandwiches, Larry buys one sandwich

- total profit under indirect PD 12 + 3 - 6 = $ 9 which is more than $ 8 under linear pricing

Examples of indirect PD

- Quantity discounts and coupons

  Those who buy more/collect coupons get cheaper per unit price (families/consumers with low value for time are more price-sensitive than individuals)

- Rate plans in communications

  Those who demand more pay higher fixed fee and lower marginal price (cable, internet,phone, mobile)

- Price drops through time/"sales"

  Those who wait with purchase get cheaper price (patient consumers have lower value of good and are more price-sensitive)

- Tie–in sales

  Those who buy more of tie-in product pay more for original product (Polaroid, iTunes)

- Bundling

  Those who want one product have to purchase another one at a price higher than their reservation price (Cable bundles, "all you can eat")

Welfare Effects of Price Discrimination

Is price discrimination good or bad?

- If firm produces **less** than under uniform pricing, welfare is lower
- If firm produces **more** than under uniform pricing, welfare **may** be higher

  Example: perfect price discrimination
- Price discrimination tends to benefit the poor and hurt the rich