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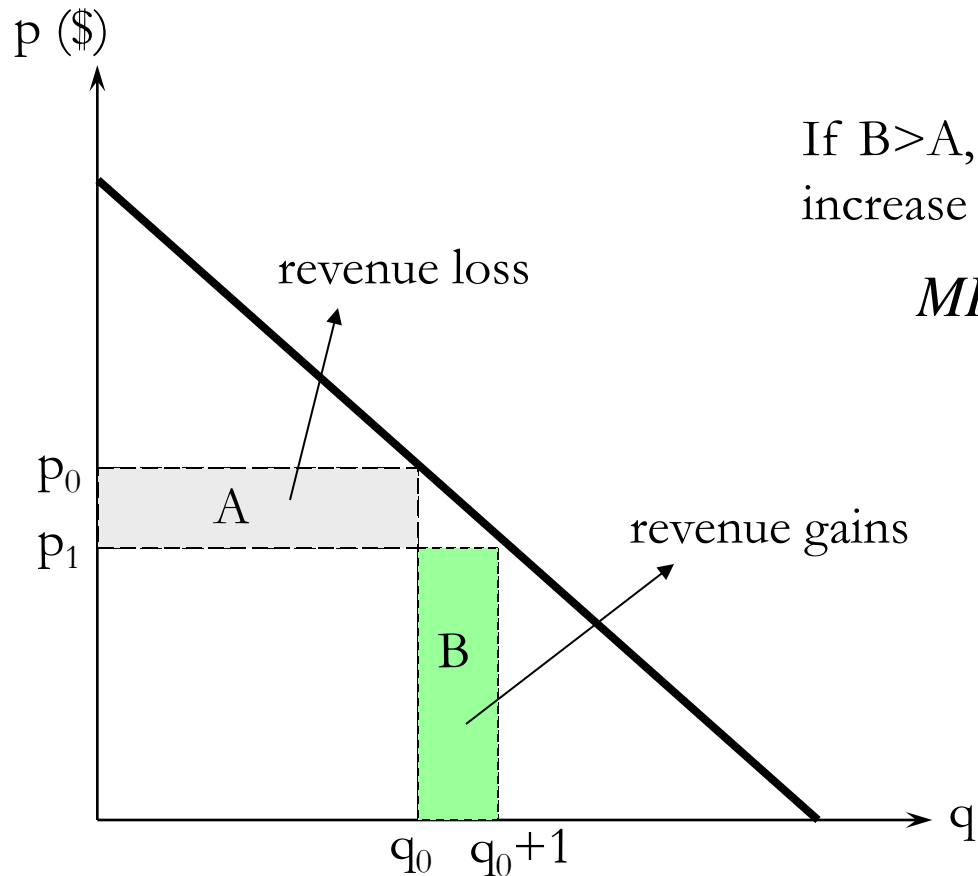
Topic 4:  
Microeconomics Review:  
Monopoly

EC 3322  
Semester I – 2008/2009

# Monopoly

- A firm is a monopoly if it is the only supplier of a product for which there is no close substitute.
- A monopoly can set price without being afraid of being undercut by its rivals.
- Since the firm is a price-setter, it faces a downward-sloping market demand → it can raise its price above marginal cost.
- A monopoly sets its output to maximize its profit (just like a competitive firm) → since demand is downward sloping → the more it sells, the lower the price will be.
  - A competitive firm → individual demand curve is horizontal → the price does not fall if it expands quantity.
- A firm's behavior and government regulation influence the firm's ability to become and remain a monopoly.

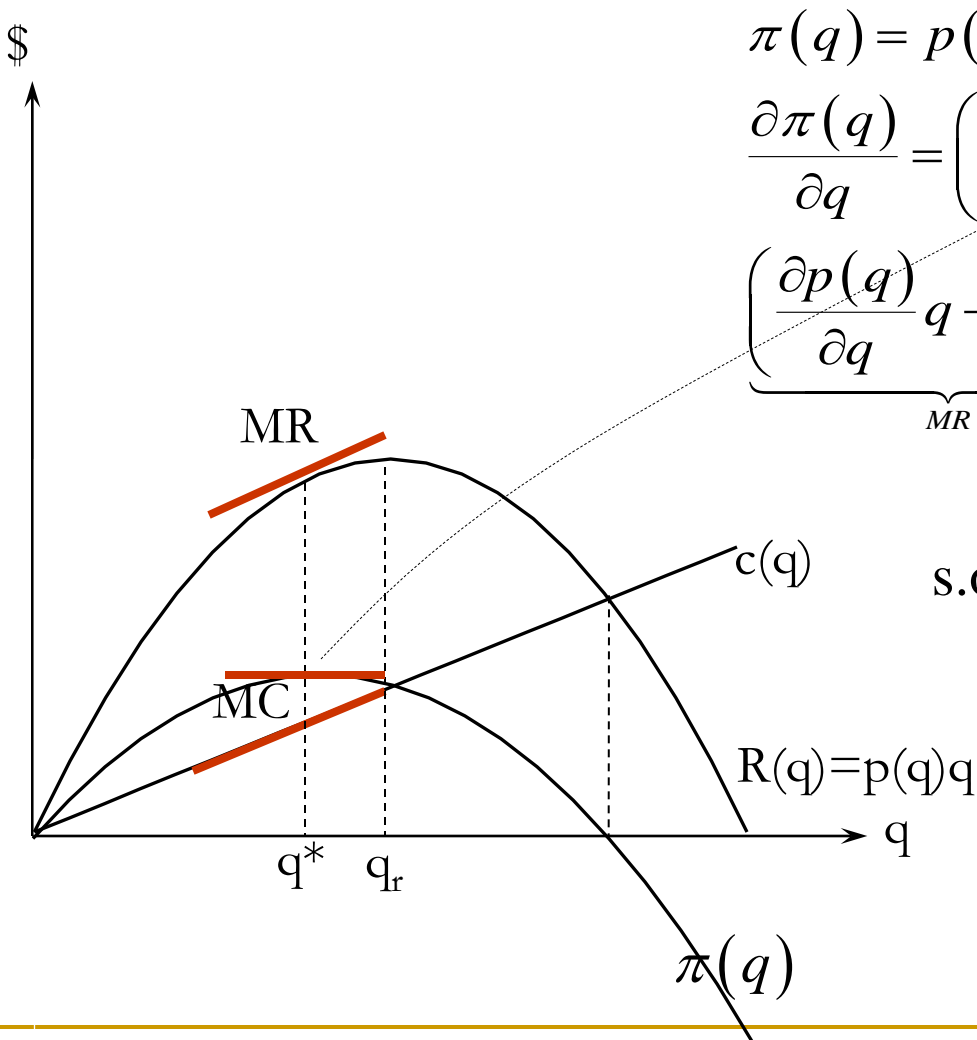
# Monopoly



If  $B > A$ , then selling one more unit will increase revenues.

$$MR = p_1(q_0 + 1) - p_0q_0$$

# Monopoly (Profit Maximization)



$$\pi(q) = p(q)q - c(q)$$

$$\frac{\partial \pi(q)}{\partial q} = \left( \frac{\partial p(q)}{\partial q} q + p(q) \right) - \frac{\partial c(q)}{\partial q} = 0$$

$$\underbrace{\left( \frac{\partial p(q)}{\partial q} q + p(q) \right)}_{MR} = \underbrace{\left( \frac{\partial c(q)}{\partial q} \right)}_{MC}$$

$$\text{s.o.c. } \frac{\partial^2 \pi(q)}{\partial q^2} = \frac{\partial MR}{\partial q} - \frac{\partial MC}{\partial q} < 0$$

# Monopoly (Marginal Revenue)

$$MR = \frac{\partial(p(q)q)}{\partial q} = \underbrace{\frac{\partial p(q)}{\partial q}}_{\text{slope of the demand } (<0)} q + p(q)$$

$$MR < p(q)$$

- Thus, MR is always smaller than the demand.

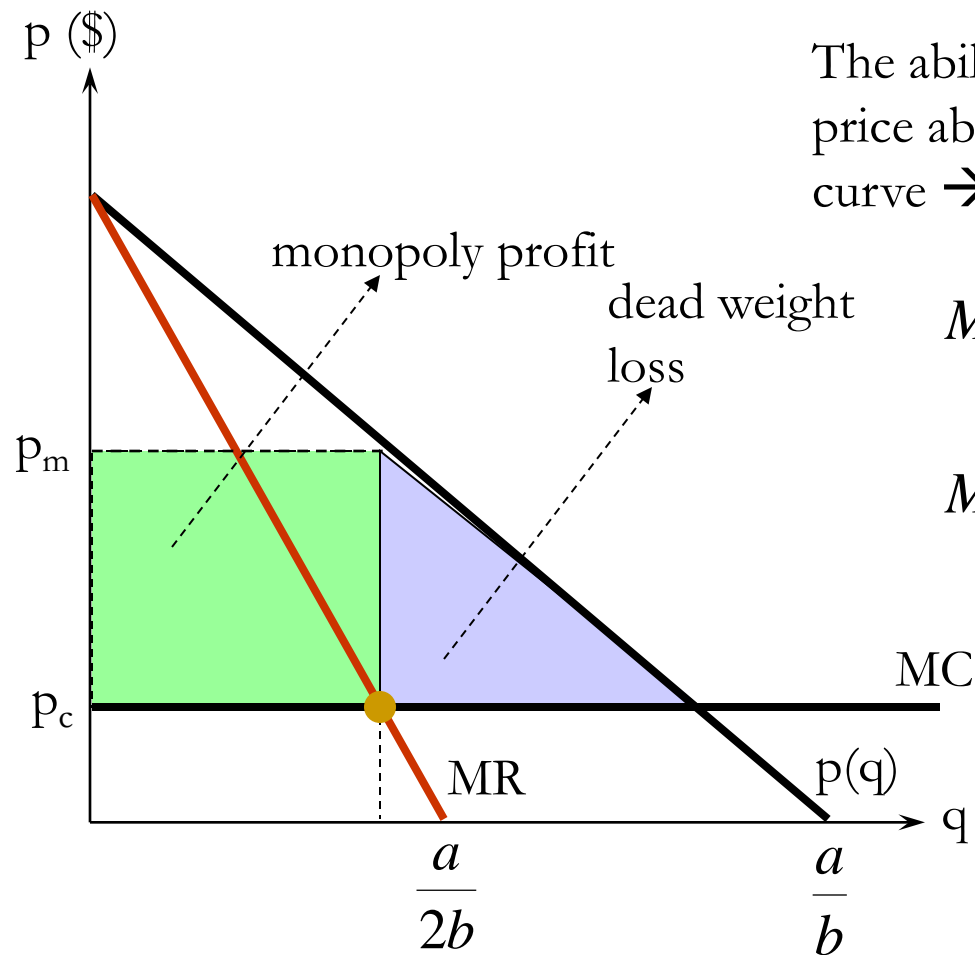
$$\text{If } p(q) = a - bq$$

$$MR = \underbrace{\frac{\partial p(q)}{\partial q}}_{\text{slope of the demand } (<0)} q + p(q) = -bq + a - bq = a - 2bq$$

$$p(q) = 0 \text{ then } q = a/b$$

$$MR = 0 \text{ then } q = a/2b$$

# Monopoly



The ability of the monopoly to charge price above MC depends on the demand curve  $\rightarrow$  elasticity of the demand.

$$MR = p + \frac{\partial p}{\partial q} q = p \left( 1 + \frac{\partial p}{\partial q} \frac{q}{p} \right)$$

$$MR = p \left( 1 + \frac{1}{\varepsilon} \right) \quad \text{with} \quad \varepsilon = \frac{\partial q}{\partial p} \frac{p}{q}$$

# Monopoly

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

- $MR > 0$  if the demand curve is elastic ( $\varepsilon < -1$ ).  $MR < 0$  if the demand curve is inelastic ( $-1 < \varepsilon < 0$ ).
- We can write the profit max condition ( $MR = MC$ ) as:

$$MR = p \left( 1 + \frac{1}{\varepsilon} \right) \quad \text{and} \quad MR = MC$$

$$p \left( 1 + \frac{1}{\varepsilon} \right) = MC \quad \rightarrow \quad \frac{p - MC}{p} = -\frac{1}{\varepsilon}$$

- The left hand side is the **price-cost margin**  $\rightarrow$  the indicator for **market power**  $\rightarrow$  also known as **Lerner Index**.
- The monopoly price is close to  $MC$  (competitive price) when the demand is very elastic, and it increasingly exceeds  $MC$  when the demand becomes less elastic.

$$\text{if } \varepsilon = -2 \text{ then } \frac{p - MC}{p} = \frac{1}{2} \rightarrow p = 2MC$$

$$\text{if } \varepsilon = -100 \text{ then } \frac{p - MC}{p} = \frac{1}{100} \rightarrow p = 1.01MC$$

# Monopoly

- Thus, when the demand is inelastic ( $-1 < \varepsilon < 0$ ), it is not possible to meet the profit maximizing condition

$$\text{if } \varepsilon = -1/2 \text{ then } \frac{p - MC}{p} = -\frac{1}{-1/2}$$

thus  $p = -MC$ , which is not possible.

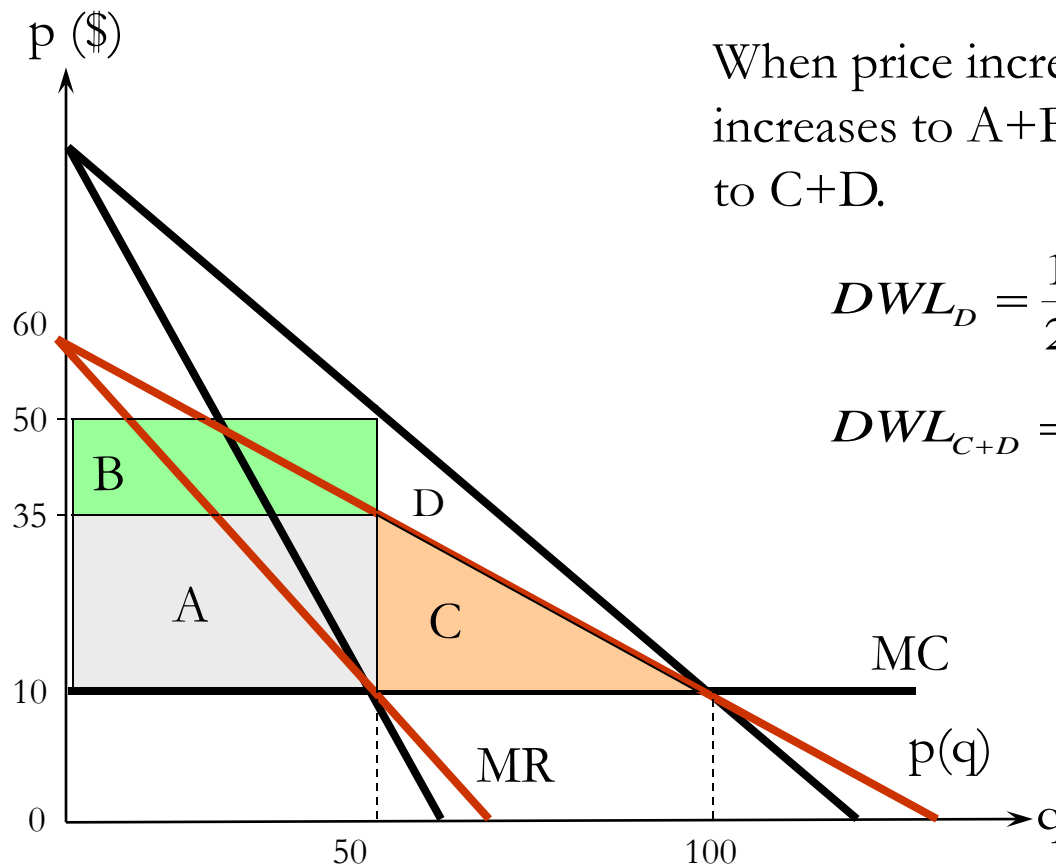
- Hence, a monopoly never operates on the inelastic portion of the demand curve.
- If it is the case  $\rightarrow$  it can increase profit by raising its price until it operates in the elastic portion of the demand curve.

## Monopoly (Dead Weight Loss)

- Monopoly brings about dead weight loss (DWL)  $\rightarrow$  the triangle area  $\rightarrow$  the size of the DWL varies with the demand elasticity  $\rightarrow$  as the demand becomes more inelastic, DWL increases.



# Monopoly (Dead Weight Loss)



When price increases, the monopoly profit increases to  $A+B$ , but DWL also increases to  $C+D$ .

$$DWL_D = \frac{1}{2}(100 - 50)(50 - 35) = 375$$

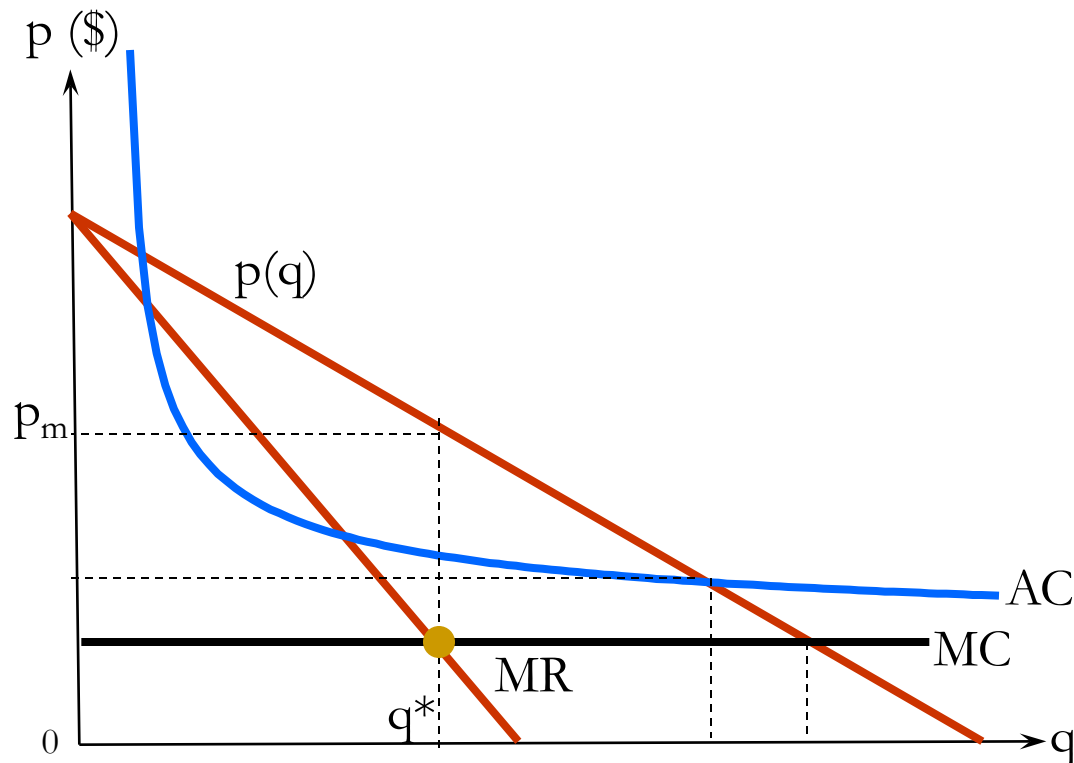
$$DWL_{C+D} = \frac{1}{2}(100 - 50)(50 - 10) = 1000$$

So monopoly is always bad?  
Benefits  $\rightarrow$  R&D (patent)

# Monopoly (Natural Monopoly)

- A natural monopoly arises when the firm's technology has economies-of-scale large enough for it to supply the whole market at a lower average total production cost than is possible with more than one firm in the market.

$$c(q) < c(q_1) + c(q_2) + \dots + c(q_n) \quad \text{with } n \text{ firms}$$



# Dominant Firm with a Competitive Fringe

- What happens to monopoly if there are entry by higher-cost firms? What happens if a lower-cost firm enters a market with many price-taking firms?
- A Dominant firm (price setter) vs. several small competitive firms (price takers) → Intel vs. other smaller producers of microprocessors.
- Why some firms may be dominant than others:
  - Dominant firms may have lower costs (more efficient) than fringe firms.
  - Dominant firms may have a superior product → due to reputation or advertising.
  - A group of firms may collude and collectively act as a dominant firm → cartel.
- Whether or not a dominant firm can exercise full market power in the long-run depends on the number of firms that can enter the market and how are their relative production costs.

# Dominant Firm with a Competitive Fringe

Year	iPod Mkt Share (Units)	iPod Mkt Share (\$ Vol)	Y/Y MP3 Spending
2004	56%	71%	-
2005	72%	83%	131%
2006	72%	85%	17%
2007	70%	84%	-4%

Source: NPD & PJC

Source: <http://apple20.blogs.fortune.cnn.com/2008/01/29/beyond-the-incredible-shrinking-ipod-market/>

# Dominant Firm with a Competitive Fringe



source: Hitwise and <http://www.marketingpilgrim.com/2007/05/google-market-share-up-again.html>

# Dominant Firm with a Competitive Fringe

Top 10 social networks in the UK, June 2008

Rank	Website	Domain	June 08 market share	May 08 market share	June 07 market share
1	Facebook	www.facebook.com	45.29%	42.88%	15.75%
2	Bebo	www.bebo.com	25.04%	26.82%	33.50%
3	MySpace	www.myspace.com	14.75%	15.28%	29.37%
4	Windows Live Spaces	spaces.live.com	1.59%	1.49%	0.82%
5	Friends Reunited UK	www.friendsreunited.co.uk	1.55%	1.44%	2.64%
6	Club Penguin	www.clubpenguin.com	0.83%	0.95%	0.80%
7	Yahoo! Groups	groups.yahoo.com	0.81%	0.83%	1.69%
8	Nasza Klasa	www.nasza-klasa.pl	0.75%	0.72%	0.00%
9	Faceparty	www.faceparty.com	0.74%	1.17%	3.22%
10	Tagged	www.tagged.com	0.72%	0.48%	0.45%

Note: Data is based on UK Internet visits to a custom category of social networking sites

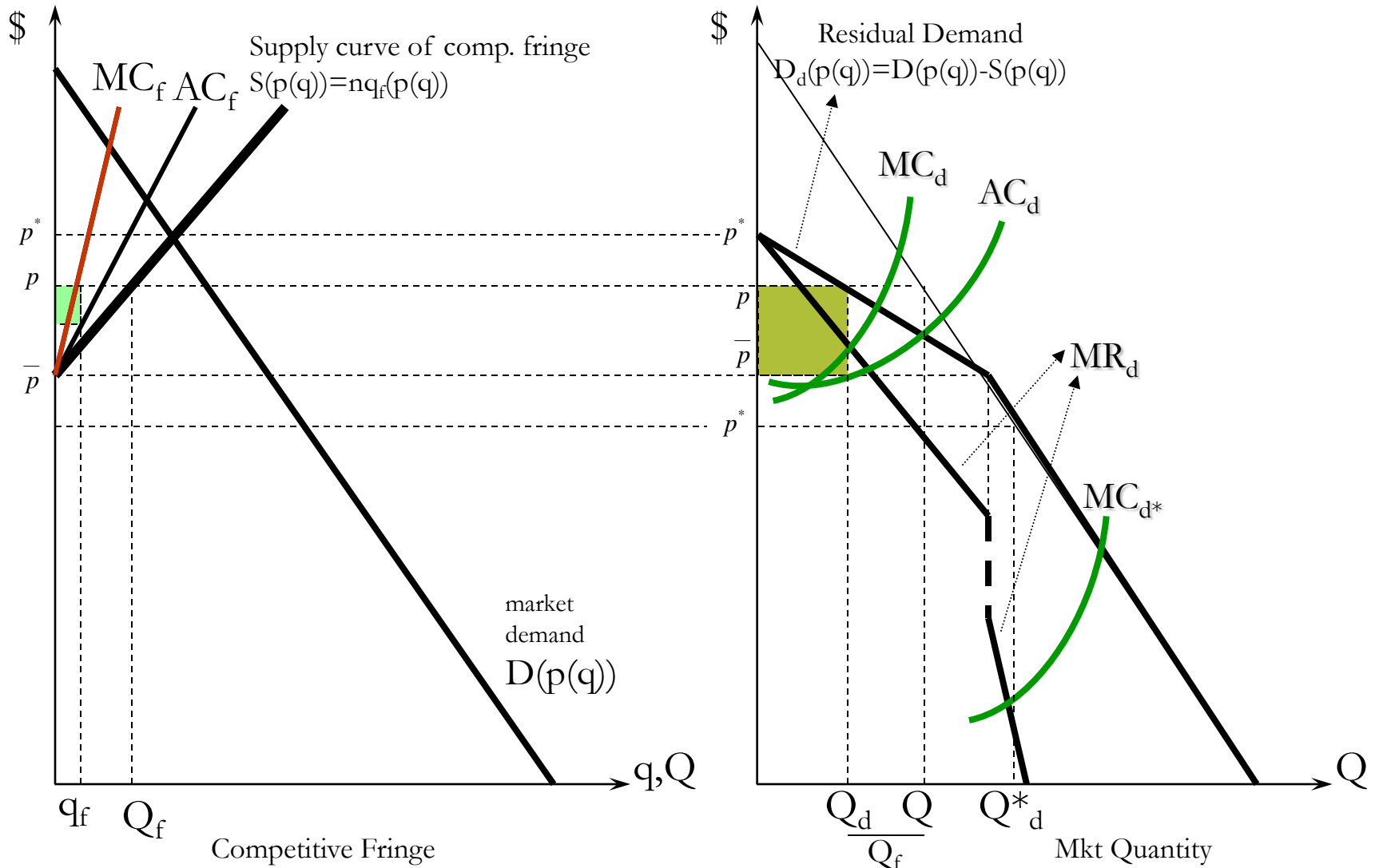
Source: Hitwise

# Dominant Firm with a Competitive Fringe

## ■ The No-Entry Model

- A **dominant firm** and a **competitive fringe**, in which **no** additional fringe firms can **enter** the market.
- Assumptions:
  - There is one large dominant firm with lower production costs than other firms.
  - All firms except the dominant firm is price takers.
  - The dominant firm knows the market demand curve and can predict how much outputs the competitive fringe will produce..
  - All firms produce homogeneous product.
- The dominant firm must consider the reaction of the comp. fringe to its action → with comp. fringe it will make lower profit than the full monopoly profit → **the presence of fringe hurt the dominant firm and benefits consumers.**

# Dominant Firm with a Competitive Fringe



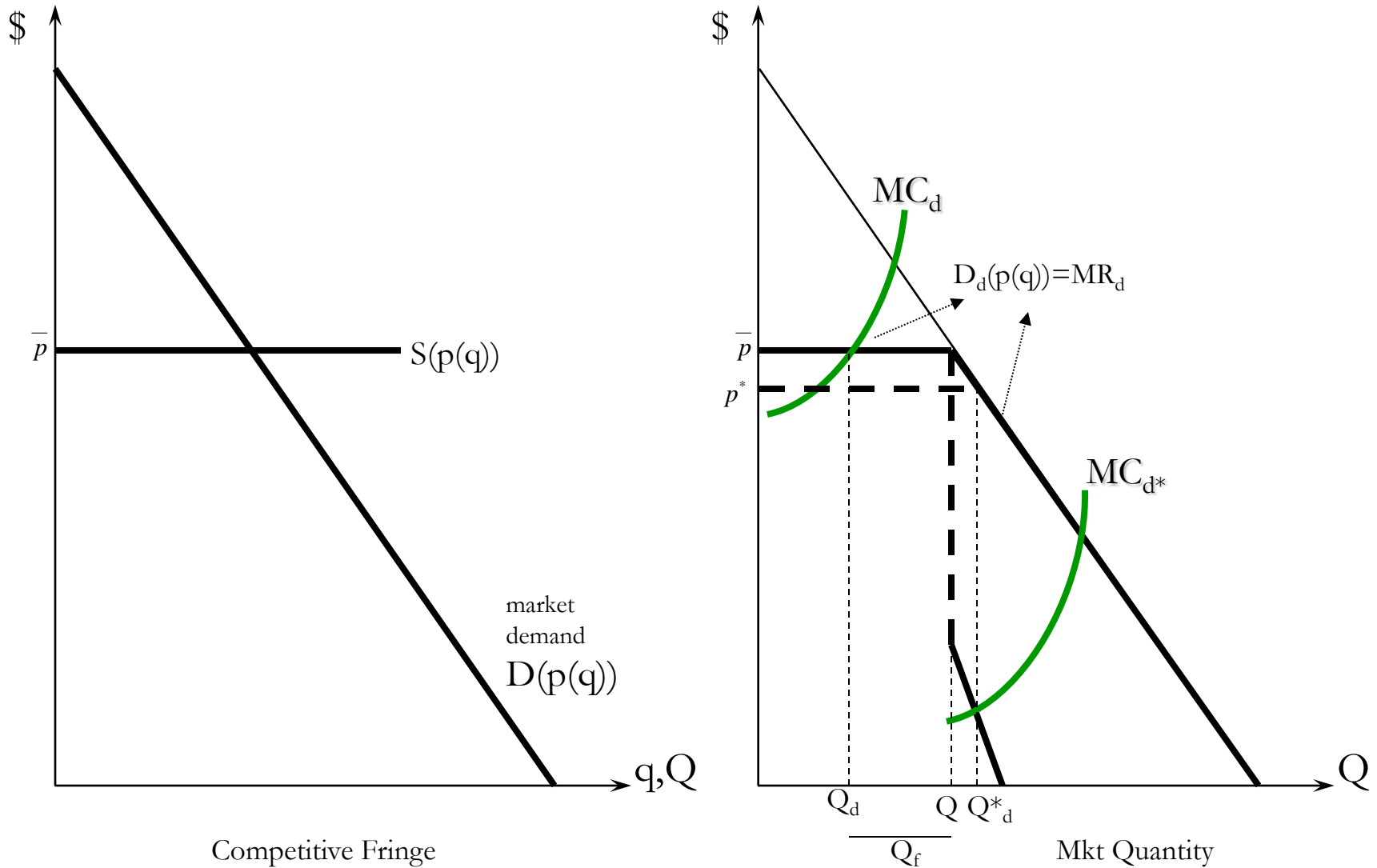


# Dominant Firm with a Competitive Fringe

## ■ The Model with Entry

- ❑ If unlimited entry is possible, a dominant firm cannot set as high a price as it can if entry is limited (prevented).
- ❑ We retain all assumptions except that we now allow an unlimited entry by competitive fringe firms.
- ❑ The fringe firms cannot make profits in the LR → either break-even or exit.
- ❑ If fringe firms flood into a market when there are profit opportunities, the dominant firm cannot charge a price above the min. AC of a fringe firm → the dominant firm earns positive profit, fringe firms break even.

# Dominant Firm with a Competitive Fringe



# Dominant Firm with a Competitive Fringe

## ■ Mathematical Analysis

Total costs of a fringe firm  $\rightarrow C_f(q_f)$

AC of a fringe firm  $\rightarrow AC_f = \frac{C_f(q_f)}{q_f}$

MC of a fringe firm  $\rightarrow MC_f = \frac{\partial C_f(q_f)}{\partial q_f} = C'_f(q_f)$

Profit a fringe firm  $\rightarrow \pi_f = pq_f - C_f(q_f)$

- Recall  $\rightarrow$  a fringe firm is a price taker  $\rightarrow$  can sell as much as it wants at the going price but it cannot influence the price  $\rightarrow p = \text{constant}$ .

$$\text{Max}_{q_f} \pi_f = pq_f - C_f(q_f)$$

First order condition for max,

$$\frac{\partial \pi_f}{\partial q_f} = p - C'_f(q_f) = 0 \rightarrow p = C'_f(q_f)$$

Second order condition for max,

$$\frac{\partial^2 \pi_f}{\partial q_f^2} = -C''_f(q_f) < 0 \text{ thus } C''_f(q_f) > 0$$

# Dominant Firm with a Competitive Fringe

## ■ Mathematical Analysis

Note  $Q_f = nq_f$ ; and  $Q = Q_d + Q_f$

Thus,  $p(Q) = p(Q_f + Q_d)$

Totally differentiating the f.o.c.

$$p(nq_f + Q_d) = C_f'(q_f)$$

$$p' \cdot n \cdot dq_f + p' \cdot dQ_d = C_f'' \cdot dq_f$$

Rearranging:

$$\frac{dq_f}{dQ_d} = \frac{\underbrace{-p'}_{<0}}{\underbrace{np' - C_f''}_{<0}} < 0$$

- Thus, as  $Q_d$  increases,  $q_f$  will fall. The dominant firm will solve:

$$\Pi_d = p(Q_d + Q_f(Q_d))Q_d - C_d(Q_d)$$

# Dominant Firm with a Competitive Fringe

## ■ Mathematical Analysis

$$\Pi_d = p(Q_d + Q_f(Q_d))Q_d - C_d(Q_d)$$

$$\text{f.o.c. } \frac{\partial \Pi_d}{\partial Q_d} = p(Q_d + Q_f(Q_d)) + p'(Q_d + Q_f(Q_d))Q_d \left[ 1 + \frac{dQ_f}{dQ_d} \right] - C_d'(Q_d) = 0$$

Recall that:

$$\frac{dq_f}{dQ_d} = \frac{-p'}{np' - C_f''} \quad \text{and} \quad Q_f = nq_f \quad \text{thus} \quad \frac{dQ_f}{dQ_d} = \frac{-np'}{np' - C_f''}$$

$$\left( 1 + \frac{dQ_f}{dQ_d} \right) = \left( 1 + \frac{-np'}{np' - C_f''} \right) = \frac{\underbrace{-C_f''}_{<0}}{\underbrace{-C_f''}_{<0} + n \underbrace{p'}_{<0}} > 0$$

- This ratio is **positive** and can be verified to be **smaller than 1** (given that  $p' < 0$ ).

$$\text{If } Q_f = 0, \text{ thus } \frac{\partial Q_f}{\partial Q_d} = 0$$

$$\frac{\partial \Pi_d}{\partial Q_d} = p(Q_d) + p'(Q_d)Q_d - C_d'(Q_d) = 0 \rightarrow \text{monopoly profit condition}$$

# Antitrust Policy on Monopolization

- Recall → monopoly power creates inefficiencies (DWL), although there may be some benefits (economies of scale-efficiency and R&D) as well.
- Exercise of monopoly power is usually subjected to antitrust policy.
- Examples: **AT&T** (1982) and **Microsoft** (2002)

## AT&T

AT&T was a holding company controlling 22 local distribution telephone companies, Bell Long Lines Division, Western Electric, and Bell Labs. Its control on the telecommunication industry was the result of a combination of government regulation, vertical integration and aggressive competitive practices.

The complaints → AT&T monopolized the industry by adopting strategies; 1) keeping out independent equipment manufacturers from AT&T markets by solely purchasing all equipments from AT&T's subsidiary, Western Electric and 2) preventing competition by not giving access to independent carriers from interconnecting with the AT&T systems.

US Justice Dept → ordered AT&T to be broken up into → allowed to keep Western Electric, Long Lines and Bell Labs but must divest its 22 local operating companies.

# Antitrust Policy on Monopolization

## Microsoft

In 1998, the US Dept. of Justice filed an antitrust action against Microsoft with allegation that Microsoft had abused and exercised monopoly power in the market for PC operating systems. Windows has 90% market share. Microsoft tied its browser (Internet Explorer) with Windows such that it restricted the market for competing browsers.

Microsoft argued that Windows and IE are inextricably linked and the browser is an integral part of the operating system. In June 2000, DC judge Thomas Penfield Jackson ruled that Microsoft was a monopolist in the market for Intel-compatible PC operating systems. It should be **broken up** into 2 companies, i.e. one to produce the OS and one to produce other software.

Upon appeal, the court affirmed the previous finding of Microsoft's monopolization but overturned the ruling that Microsoft should be broken-up. In Dec 2002, the US Dept. of Justice reached a final settlement agreement with Microsoft → restricts some of Microsoft's actions and establishing monitoring system to ensure compliance, in addition of monetary damages.