# SAMENVATTING

MANAGERIAL ECONOMICS

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ACADEMIEJAAR '22-'23

# INHOUD

# LECTURE 1 – FOUNDATIONS

Managerial economics = THE PROBLEM OF THE MANAGER
→ company description, market analysis, service, R&D, marketing and sales, funding, …
→ **market definition, market demand, cost structure, product line, competition, innovation**

## DEMAND

- Market demand
  = quantity customers purchase for various prices → depends NOT on other consuments

  **Linear demand**: Q = a – bP ↔ P = A – BQ
  Gebreken: tijdskader, soorten goederen (normale/inferieure/luxe goederen, Giffengoederen)

- Firm's demand
  = how much a firm can sell given a price → depends on other firms

- Price elasticity (of demand)

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

  $|\varepsilon| < 1$ INELASTIC: P↑ Q↑
  $|\varepsilon| > 1$ ELASTIC: P↑ Q↓

- Cross price elasticity

$$\varepsilon = \frac{dQ_1}{dP_2} \cdot \frac{P_2}{Q_1}$$

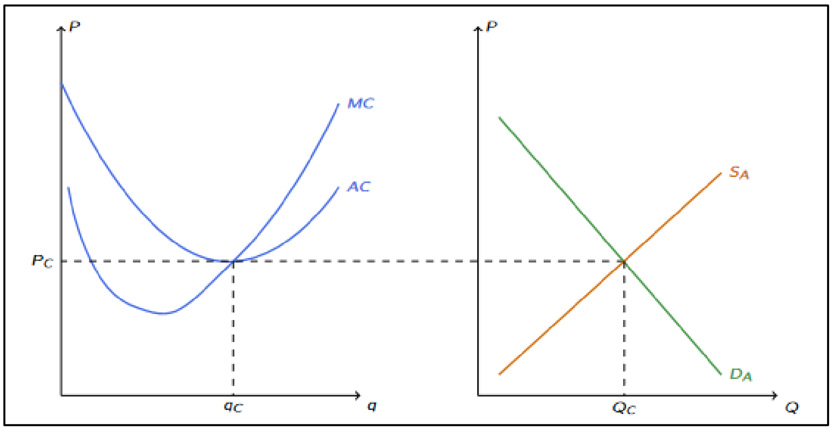
  $\varepsilon > 0$ SUBSTITUTEN
  $\varepsilon < 0$ COMPLEMENTEN

# PROFIT MAXIMALISATION: PERFECT COMPETITION & MONOLPOLY

## Perfect Competition

Firms and consumers are PRICE TAKERS

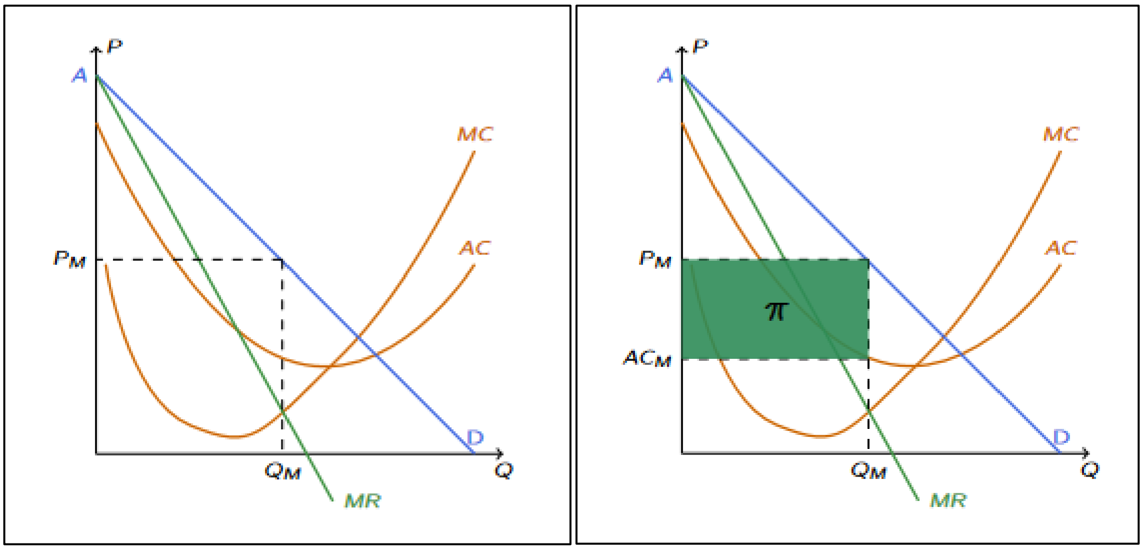
- Revenue: $P(Q) \cdot Q$
- Equilibrium: $MR = MC \iff S = D$ $\qquad MR = \frac{dR}{dQ} \qquad MC = \frac{dC}{dQ}$
- Profit: $\pi = R - C = \text{revenues} - \text{costs} \quad \Rightarrow \quad 0!$




## Monopoly

Monopolist is PRICE SETTER

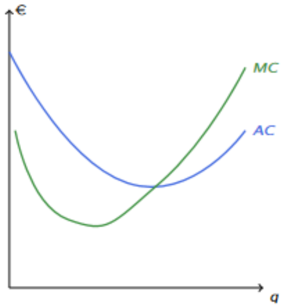
- Revenue: $P(Q) \cdot Q = AQ - BQ^2$
- Equilibrium: $MR = MC \not\Leftrightarrow S = D$ $\qquad MR = \frac{dR}{dQ} \qquad MC = \frac{dC}{dQ}$
- Profit: $\pi = R - C = \text{revenues} - \text{costs} = P^*Q^* - Q^*AC(Q^*)$




*Doe firms REALLY maximise profit? revenues ←→ profits, management, human conditions etc.*

# PRODUCTION AND COST

## COST STRUCTURES




- Total cost $C(Q) = fixed + variabel$
- Average cost $AC = C/Q$
- Marginal cost $MC = dC/dQ$

  $MC < AC$ $AC$ daalt

  $MC < AC$ $AC$ stijgt

  $MC = AC$ in het minimum van de $AC$-curve
- Sunk costs

  *Iemand heeft al een kaartje voor een concert besteld, maar wil uiteindelijk niet gaan. Hij kan dit kaartje echter niet verkopen. Rationeel gezien hoort deze persoon helemaal geen rekening te houden met het betaalde kaartje omdat de kosten hiervoor al gemaakt zijn en dus geen effect meer hebben op de beslissing om al dan niet naar het concert te gaan. Mensen neigen in zo'n geval echter toch vaak naar het concert te gaan, omdat ze redeneren dat het anders zonde van het kaartje (of anders gezegd, van het in het kaartje geïnvesteerde geld) zou zijn.*

## ECONOMIES OF SCALE

= SCHAALVOORDELEN, vergroten (productie)capaciteit

Scale economy index $S = AC/MC$

$S > 1$ VOORDEEL

$S < 1$ NADEEL

## ECONOMIES OF SCOPE

= SYNERGIEVOORDELEN, beter aanwenden capaciteit

*Een voorbeeld van synergievoordelen is het gebruik van vliegtuigen. Een passagiersvliegtuig dat van luchthaven Schiphol naar Rome vliegt en leeg terugkomt, is duurder dan hetzelfde vliegtuig dat op de terugweg vracht vervoert. Zowel de winst op de passagiersvlucht als de vrachtvlucht is hoger.*

Scope index $S = \frac{C(Q_1,0) + C(0,Q_2) - C(Q_1,Q_2)}{C(Q_1,Q_2)}$

twee verschillende kosten in rekening!

$S > 0$ VOORDEEL

$S < 0$ NADEEL

## MARKET STRUCTURE

= numbers and size distributions of firms

Measure structure:

- Summary
- Concentration curve
- Concentration ratios: $CR_4$ sum market share 4 largest firms
- $HHI = \sum s_i^2$ $s$ = market share

What's a market? …

Determinants

- Economies of scale
- Economies of scope
- Network externalities (willingness to pay etc.)

## DISCOUNTING

= Interest rate op een investering

PROFIT TODAY ←→ PROFIT TOMORROW

- General concept: sum of money $Y$, interest rate $r$ → na een jaar $Y(1+r)$

- Discount factor $R/(1+r)$
- Present value of $Z$ in one year is $RZ$

- Profit over the lifetime of a project: present value of project must be positive

## EFFICIENCY AND SURPLUS

Measure of wellbeing

- Consumer surplus, difference willing to pay and actually paid

$$CS = (P_{max} - P^*) \cdot Q^*$$

- Producer surplus, difference net sales and costs → PROFIT

$$PS = P^* \cdot Q^* - C$$

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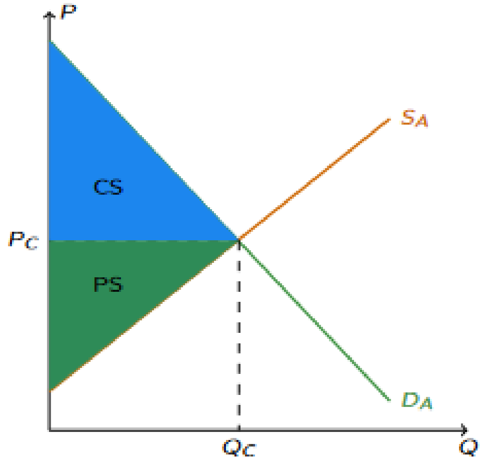
### PERFECT COMPETITION

Perfecte verdeling onder consument en producent

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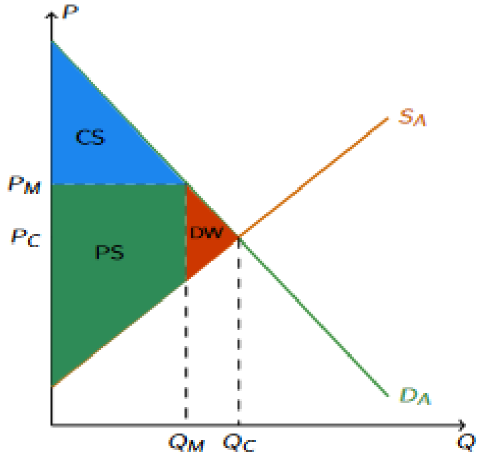
### MONOPOLY

Prijs is hoger dan evenwichtsprijs

- $PS > CS$
- Deadweight loss: verlies aan surplus

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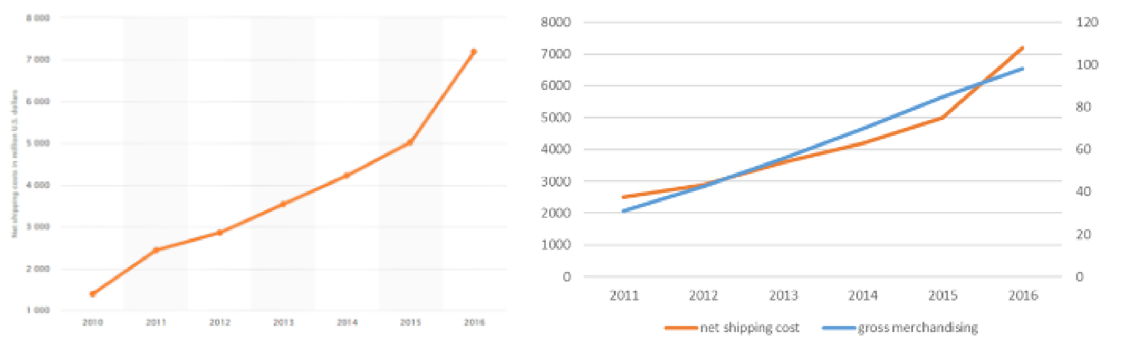
## MARKET STRUCTURE

- Amazon large, much market power in particularly markets
- Cherry picking: look too specific *"successful (in it's own market) → large company"*

## COST STRUCTURE




Net shipping cost    Net shipping cost & Gross merchandising

- $MC$ is low (no physical stores, just website and storage)
- Sunk costs are low (servers etc can be reselled)
- Economies of scale
  - Digital dimension: YES
  - Downstream (shipping etc.): NO amazon will invest in its own shipping service
- Economies of scope: YES

  Cloud computing *Cloudcomputing of clouddienst is het via een netwerk – vaak het internet – op aanvraag beschikbaar stellen van hardware, software en gegevens, ongeveer zoals elektriciteit uit het lichtnet.*

  Hierdoor kon Amazon in slechte jaren toch het hoofd boven water houden, ookal was dit slechts een nevenproduct van hun business.

# LECTURE 2 – OLIGOPOLY

## PRELIMINARY

### THE PROBLEM OF THE MONOPOLIST

**Question**: Profit maximalisation solved by setting price or quantity?

| **Quantity** | **Price** |
|---|---|
| Demand function (inverse): | Demand function: |
| $P = A - BQ$ | $Q = \frac{A}{B} - \frac{1}{B}P = a - bP$ |
| Cost function: | Cost function: |
| $C(Q) = cQ \quad \Rightarrow \quad MC = c$ | $C(Q) = cQ$ |
| Profit function: | Profit function: |
| $\pi(Q) = P(Q)Q - C(Q) = (A - BQ)Q - cQ$ | $\pi(P) = Q(P)P - cQ(P) = (a - bP)P - c(a - bP)$ |

*NOTE: $MR = MC$ works only through quantity setting, profit deriving works for both*

RESULT IS THE SAME:

$$P^M = \frac{a + bc}{2b} = \frac{\frac{A}{B} + \frac{1}{B}c}{2\frac{1}{B}} = \frac{A + c}{2}$$

***Zal niet meer gelden in oligopolie!***

### GAME THEORY

- Nash equilibrium: no player can benefit by changing strategy
- Procedure and goal:

A. Define each player's **objective function**

B. Define or derive each player's **strategies**

C. Derive best responses or the **best response function**

D. Find (characterize) the **equilibrium** of the game

## COURNOT – QUANTITY COMPETITION

### DUOPOLY

What does firm 2 given random output level firm 1:

- Demand firm 2 $P = (A - BQ_1) - BQ_2$
- Optimal quantity given $MC = c$

$$Q_2^* = \frac{(A-c)}{2B} - \frac{Q_1}{2}$$

Dit is ook wel de **reaction function**, deze is symmetrisch, dus $Q_1^* = \frac{(A-c)}{2B} - \frac{Q_2}{2}$

$Q_1 = 0$ → firm 2 produceert zoals een monopoly

$Q_1 \geq \frac{A-c}{2B}$ → firm 2 zal niet producerren, firm 1 gedraagt zich als een monopolie

- Equilibrium in duopoly: COURNOT – NASH EQUILIBRIUM
  = Snijpunt 2 reactiefuncties:

$$Q_1^* = Q_2^* = \frac{A-c}{3B}$$

Duopoly better than monopoly?

**Cournot-Nash, Monopoly and Competition**

The Cournot-Nash equilibrium generates an intermediate quantity and thus an intermediate price between Monopoly and Competition:

$$Q^M < Q^C < Q^{comp} \qquad p^M > p^C > p^{comp}$$

Price lower than monopoly, output less than perfect competition

→ market concentration = market power

**SUMMARY**

- In equilibrium each firm produces

$$q_1^C = q_2^C = \frac{(A-c)}{3B}$$

- Total output is, therefore,

$$Q^C = \frac{2(A-c)}{3B}$$

- Recall that demand is $p = A - BQ$
- So, the equilibrium price is :

$$p^C = A - B\frac{2(A-c)}{3B} = \frac{(A+2c)}{3}$$

- Profit of each firm is:

$$\pi_1 = \pi_2 = (p^C - c)q^C = \frac{(A-c)^2}{9B}$$

## OLIGOPOLY

Analoge opbouw, hier enkel resultaten

### N FIRMS – IDENTICAL COST STRUCTURE

- So, the equilibrium outcomes:

$$Q^C = \frac{N(A-c)}{(N+1)B}$$

$$p^C = A - BQ^C = \frac{A+Nc}{N+1}$$

- as the number of firms increases, prices tends to marginal cost

$$\pi_1^C = (p^C - c)q_1^C = \frac{(A-c)^2}{(N+1)^2 B}$$

- as the number of firms increases, profit of each firm falls

### N FIRMS – DIFFERENT COSTS

**Further results on the equilibrium:**

- Total output is:

$$Q^C = \frac{(2A - c_1 - c_2)}{3B}$$

- Price is:

$$p^C = A - \frac{(2A - c_1 - c_2)}{3} = \frac{A + c_1 + c_2}{3}$$

- Profit of firm 1 is:

$$\pi_1^C = (p^C - c_1)qc_1 = \frac{(A - 2c_1 + c_2)^2}{9B}$$

- Profit of firm 2 is:

$$\pi_2^C = (p^C - c_2)qc_2 = \frac{(A - 2c_2 + c_1)^2}{9B}$$

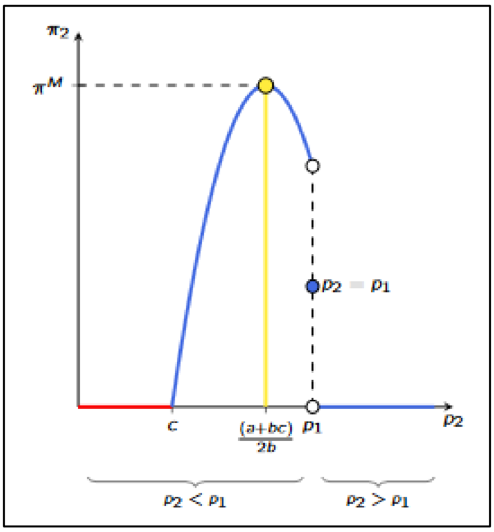
## BERTRAND – PRICE COMPETITION

What does firm 2 given random price firm 1?

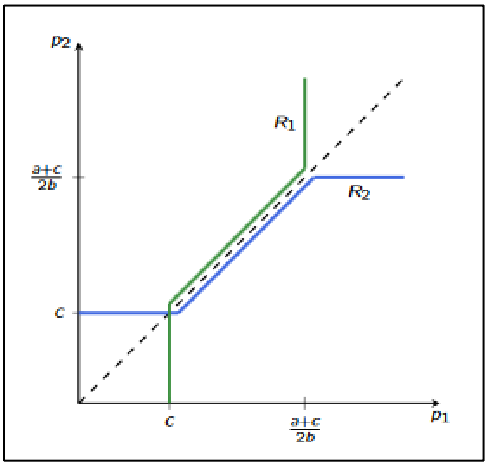
- Demand firm 2 (invers)

$$\begin{cases} Q_2 = 0 & P_2 > P_1 \\ Q_2 = \dfrac{a - bP_2}{2} & P_2 = P_1 \\ Q_2 = a - bP_2 & P_2 < P_1 \end{cases}$$

- Reactions of firm 2
    - $P_1 > \frac{a+bc}{2b}$: UNDERCUT, firm 2 sets monopoly price $\frac{a+bc}{2b}$
    - $P_1 = \frac{a+bc}{2b}$: UNDERCUT, firm 2 sets a slightly smaller price than firm 1
    - $P_1 < \frac{a+bc}{2b}$ bottom of undercuts: both $P_1$ and $P_2$ end at their marginal cost $c$




    - Reaction functions: equilibrium in $c$




discontinuity = key → winner takes it all: small undercut takes the whole market because of the discreet jump, this does not exist in Cournot! Because of this Bertrand is a much more aggressive model. There is a strong incentive to dominate the market.

- Asymmetric costs: $c_1 < c_2$
  - Firm 1 has advantage: $P_2 = c_2$ → firm 1 can UNDERCUT
  - Equilibrium: $\begin{cases} P_1^* = c_1 - undercut \\ P_2^* = c_2 \end{cases}$

- Increasing marginal costs
  - Undercut levert volledige markt op
  - Volledige markt bedienen niet rendabel door exploderende $MC$

- Capacity constraints
  Efficiency property of Bertrand breaks down when firms are capacity constrained:
  - capacity is less than needed to serve the whole market
  - no incentive to cut price to $MC$

**COURNOT VS BERTRAND**

- In **q-competition**, each firm has a moderate incentive to increase production ⇒ Increase of profits is *smooth* ⇒ **Market concentration matters** for Q and p

- In **p-competition**, firms have a strong incentive to slightly reduce price ⇒ Jump in profits ⇒ **Market concentration does not matter**, two firms are enough to get the outcome of perfect competition

## STACKELBERG – DYNAMIC COMPETITION

Dynamic: sequential game in stead of simultaneous! We study now Cournot with a **leader** and **follower**.

- Demand firm 2: $P = (A - BQ_1) - BQ_2$
- Reaction function firm 2: $Q_2^* = \frac{A-c}{2B} - \frac{Q_1}{2}$

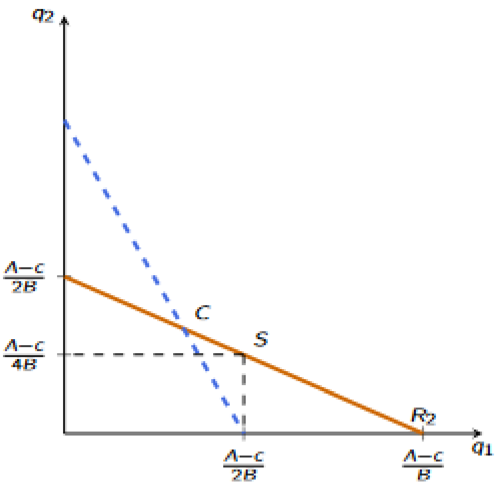
- Demand firm 1 GIVEN REACTION FIRM 2:

$$p = \frac{A+c}{2} - B\frac{Q_1}{2}$$

- So optimal output firm 1 and firm 2:

$$Q_1^* = \frac{A-c}{2B} \quad \Longrightarrow \quad Q_2^* = \frac{A-c}{4B}$$

**STACKELBERG VS COURNOT**




- Aggregate output is: $Q^S = \frac{3(A-c)}{4B}$
- Equilibrium price is: $p^S = \frac{(A+3c)}{4}$
- Firm 1's profit is: $\pi_1^S = \frac{(A-c)^2}{8B}$
- Firm 2's profit is: $\pi_2^S = \frac{(A-c)^2}{16B}$
- In Cournot, the quantities are: $q_1^C = q_2^C = \frac{A-c}{3B}$
- The Cournot price is: $p^C = \frac{A+2c}{3}$
- The Cournot profit is: $\pi_1^C = \pi_2^C = \frac{(A-c)^2}{9B}$
- Leadership benefits the market leader and consumers

*NOTE: firm must commit to its output choice, if not equilibrium = Cournot equilibrium*

**STACKELBERG VS BERTRAND**

No need to study Bertrand with a leader and follower. The outcome will be the same due to the undercuts.

# LECTURE 3 – PRODUCT DIFFERENTIATION

## INTRODUCTION

**Product differentiation**: consumers have different taste → product fits better than that of competitors, generates local market power

- **horizontal differentiation**: similar quality, different type of consumers
- **vertical differentiation**: quality ranking, consumers choose based by own willingness to pay

## HORIZONTAL DIFFERENTIATION – DIFFERENTIATION UNDER MONOPOLY

→ SPATIAL APPROACH

Letterlijk voorbeeld: ijskraampjes aan de kust, waar legt de verkoper zijn eigen kraam

Figuurlijk: hoe 'ver' wensen van consumenten uit elkaar liggen en waar de verkoper zijn kwaliteitsbalans moet leggen

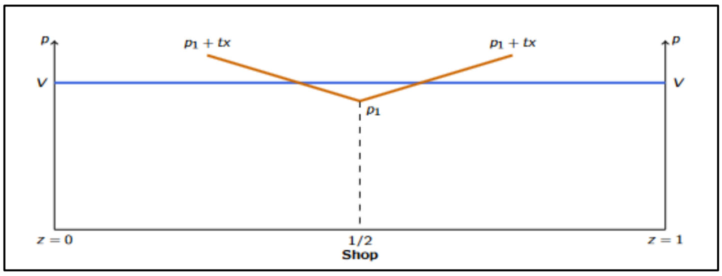
Locatie := geografische ruimte, tijd, productkarakteristieken

### ONE SHOP

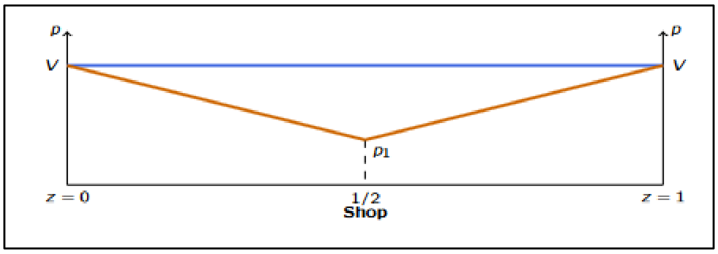
- assumptions
  - N consumers on one street of 1 km = product space
  - 1 unit each consumer, valuation $V$
  - Transport cost $t$ per km
  - Fixed cost $F$ for one shop
  - Marginal cost $c$

$$V - c - t > 0$$

- Valuation and costs → lineair met de afstand (transportkosten)

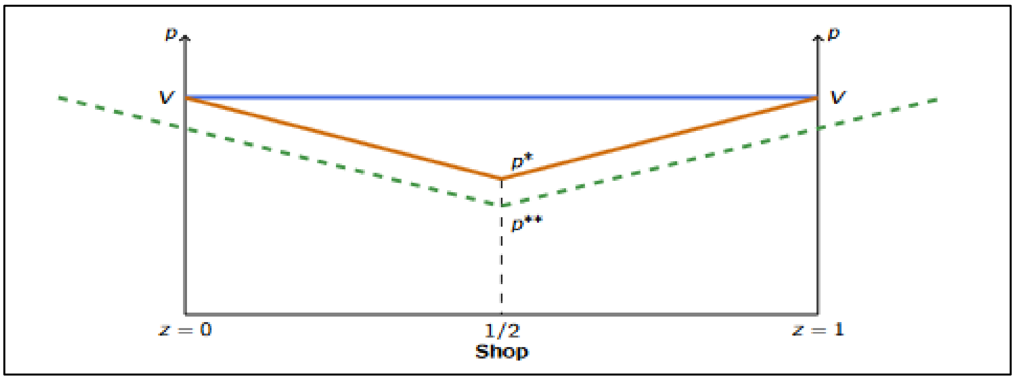



- Optimalisatie: marginale consumenten (V = transportkost + verkoopprijs) op uiteinde straat



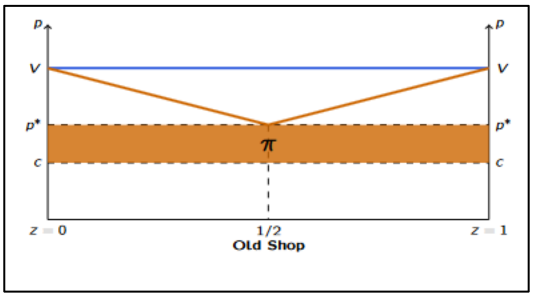

- Prijsbepaling MODEL:
  Consumenten in z = 0 of 1: $V - \frac{t}{2} - p = 0 \quad \Rightarrow \quad p^* = V - \frac{t}{2}$
  Winst:
  $$\pi(p) = Np - F = N\left(V - \frac{t}{2} - c\right) - F$$

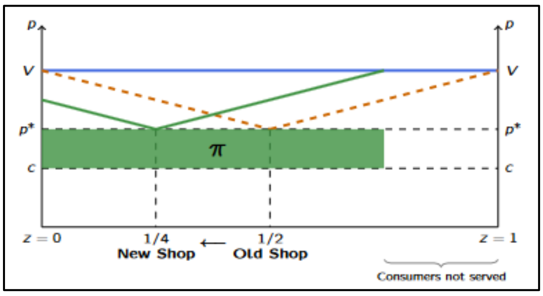
- Prijsbepaling MONOPOLIST:
  ANDERE PRIJS! → $p = \frac{V+c}{2}$
  Dit model houdt echter geen rekening met de realistische grenzen, er vallen mogelijks consumenten buiten de ruimte. Ga dit dus steeds na of dat de oplossing **interior** of **exterior** is.




- Oplossingsmogelijkheden:
  – INTERIOR: transportation costs are HIGH
  – EXTERIOR: transportation costs are LOW

- Centrale ligging:



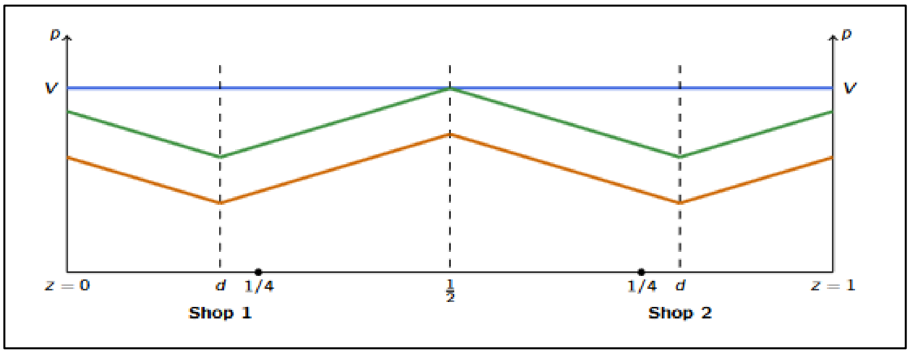



## TWO SHOPS – SAME MONOPOLIST

- $d$ = distance to nearest bound, we assume that the two shops move symmetrical to the center 1/2
- Other assumptions same to one-shop model

$d < 1/4$

- Valuation and costs → lineair met de afstand (transportkosten)
  → optimal cost function



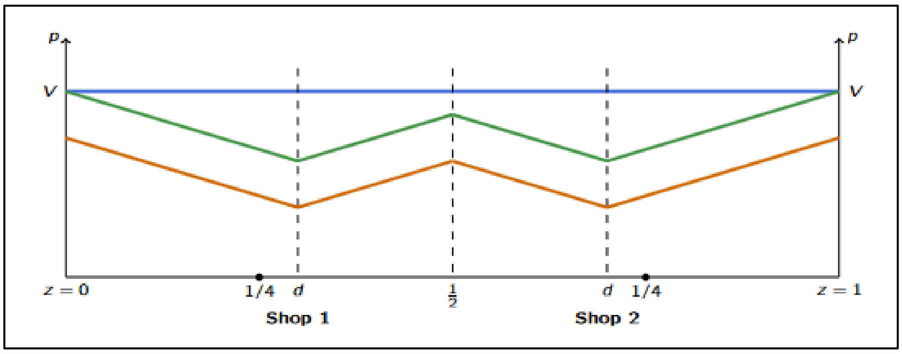

Winst:

$$\pi(p) = Np - 2F = N\left(V - \frac{t}{2} + td - c\right) - 2F$$

$$\frac{\partial \pi}{\partial d} > 0 \Rightarrow d \uparrow$$

$d > 1/4$

- Valuation and costs → optimal cost function

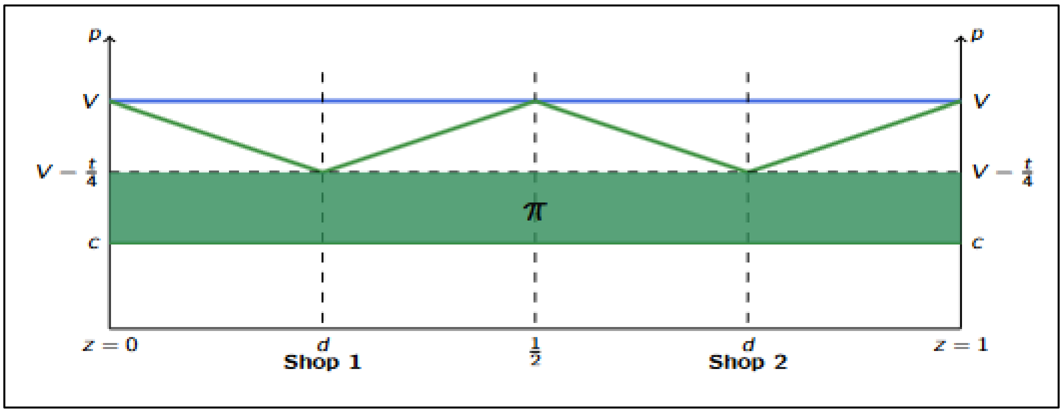



Winst:

$$\pi(p) = Np - F = N\left(V - \frac{t}{2} + td - c\right)$$

$$\frac{\partial \pi}{\partial d} < 0 \Rightarrow d \downarrow$$

CONCLUSIE: $d = 1/4$




- Prijsbepaling:
  Consumenten in z = 0, ½ of 1: $p^* = V - t/4$
  Winst:

$$\pi(N, 2) = N\left(V - \frac{t}{4} - c\right) - 2F$$

## EXTENDED AMOUNT OF SHOPS

| n=2 | n=3 | Any n |
|---|---|---|
| Shops are at $\frac{1}{4}$, $\frac{3}{4}$ from the left bound | Shops are at $\frac{1}{6}$, $\frac{1}{2}$ and $\frac{5}{6}$ from the left bound | Shops symmetrically located at a distance of $\frac{1}{n}$ |
| Price $p(N,2) = V - \frac{t}{4}$ | Price $p(N,3) = V - \frac{t}{6}$ | Price $p(N,n) = V - \frac{t}{2n}$ |
| Aggregate profit: $\pi(N,2) = N\left(V - \frac{t}{4} - c\right) - 2F$ | Aggregate profit: $\pi(N,3) = N\left(V - \frac{t}{6} - c\right) - 3F$ | Aggregate profit: $\pi(N,n) = N\left(V - \frac{t}{2n} - c\right) - nF$ |

But how many shops is ideal?

- More shops = better cover of product space
- More shops = more fixed costs

Trade of! Ideal amount for $n$ if:

$$\pi(N, n+1) > \pi(N, n)$$

$$N\left(V - \frac{t}{2n} - c\right) - nF > N\left(V - \frac{t}{2(n+1)} - c\right) - (n+1)F$$

$$n(n+1) < \frac{tN}{2F}$$

## VERTICAL DIFFERENTIATION

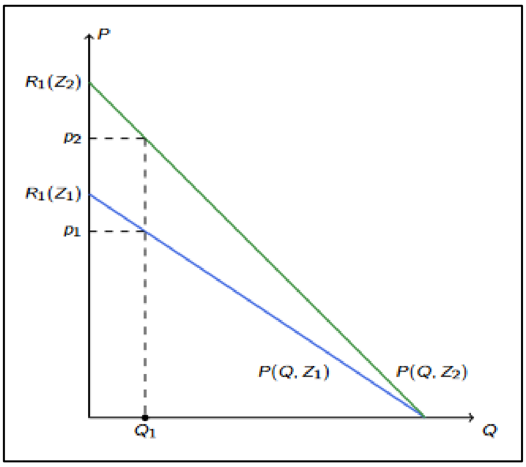
**Simple setting**: monopolist producing 1 good, what quality should it have?

- Adapting demand to quality:

$$P = p(Q, Z)$$

  $Z$ = quality → influences the reservation price

  demand curve for quality $Z_1 < Z_2$




- Problem of monopolist: choosing quantity AND quality

  demand:

$$P = Z(\theta - Q)$$

  cost structure:

$$MC(Q) = 0$$
$$C(Z) = \alpha Z^2 \;\Rightarrow\; MC(Z) = 2\alpha Z$$

  profit:

$$\pi(Q, Z) = Z(\theta - Q)Q - \alpha Z^2 \;\Rightarrow\; MR(Q) = Z\theta - 2ZQ$$

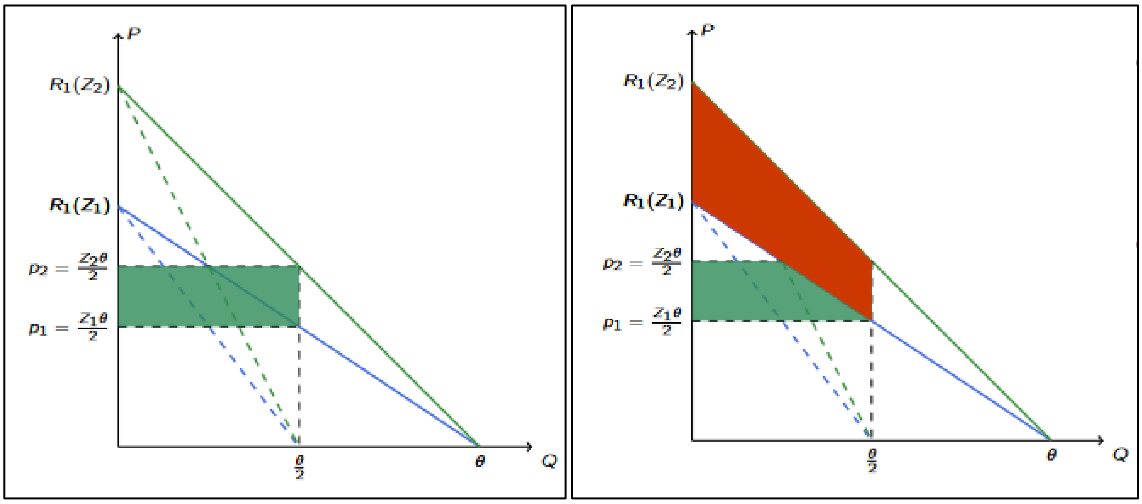
  - Solving for quantity:

$$MR = MC \;\Rightarrow\; Q^* = \theta/2$$
$$p^* = Z\theta/2$$

  - Solving for quality:

$$MR(Q^*, Z) = \theta^2/4$$
$$MR = MC \;\Rightarrow\; Z^* = \theta^2/8\alpha$$

- Surpluses for different quality level $Z_1 < Z_2$




Change in revenues and increase social surplus is area minus increase in quality costs.
Total social surplus = area + area

When the change in revenues > change in costs the product is below the optimal quality level.

## THE CASE OF THE NEWSPAPERS

We studied a monopolist: but offers a bigger market a better product? Study news paper market

- Formulas:

$$P = Z(\theta - Q) \qquad Q = \theta/2 \qquad P = Z\theta/2 \qquad Z = \theta^2/8\alpha$$

- Revenues: readers, advertisement
- Cost structure
  - MC: copy paper, ink, distribution
  - Fixed: staff → top-level journalists
- Product differentiation
  - Horizontal: given level of quality (ex: left-right wing readers)
  - Vertical: different levels of quality

Measurement of quality?

- Number of pages (max, average)
- Number of reporters (max, average)
- Number of Pulitzer Prize winners

Linear regression:

TABLE V
NEWSPAPER QUALITY AND MARKET SIZE

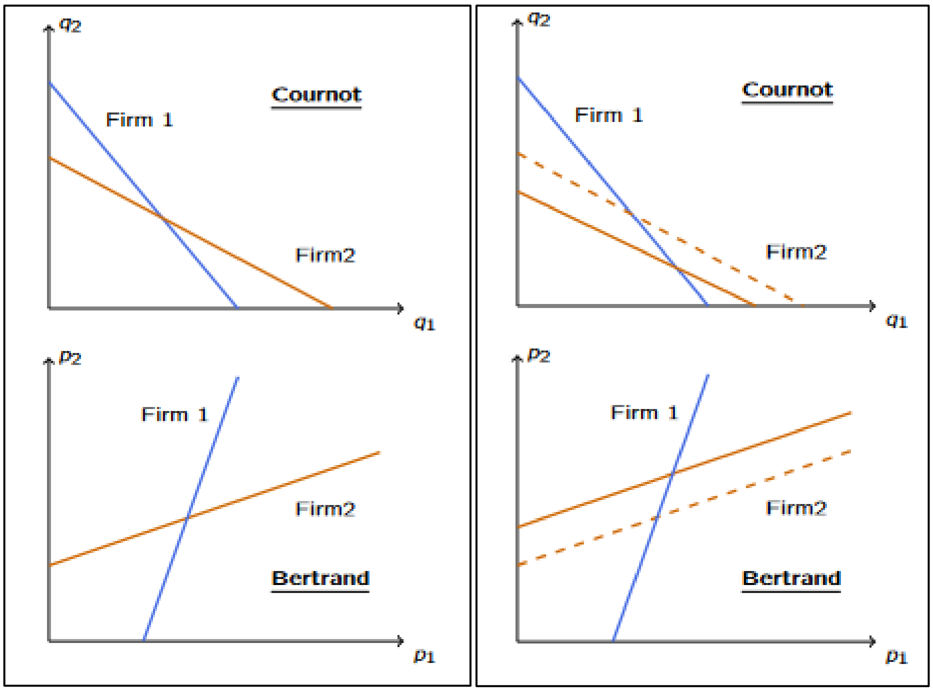
| Variable | Ave Log Pages | Ave Log Staff | Max Log Pages | Max Log Staff |
|---|---|---|---|---|
| ln(pop) | 0.208 | 0.475 | 0.287 | 0.560 |
| | (0.021) | (0.025) | (0.015) | (0.025) |
| Median Income | −0.001 | 0.009 | 0.005 | 0.012 |
| | (0.005) | (0.006) | (0.004) | (0.006) |
| % College | 1.106 | 0.900 | 1.025 | 0.961 |
| | (0.388) | (0.479) | (0.275) | (0.477) |
| % Young | 2.387 | 1.173 | 1.119 | 0.428 |
| | (1.115) | (1.380) | (0.790) | (1.375) |
| % Old | 2.480 | 0.183 | 1.982 | 0.006 |
| | (1.113) | (1.377) | (0.789) | (1.371) |
| Intercept | 2.591 | 2.611 | 3.165 | 3.010 |
| | (0.549) | (0.680) | (0.389) | (0.677) |

Results: larger market size drives higher quality: size increase with 10% → quality increase by 2-5%

# DIFFERENTIATION AND COMPETITION

## BERTRAND AND PRODUCT DIFFERENTIATION

What about competition between slightly different products: strategic complements and substitutes.




Different slopes reflects different forms of competition: firm 2 has cost increase

- Cournot: fall of function, less production and output firm 1 has to increase.
- Bertrand: rise of function, raising price and price firm 1 has to increase.

Strategic substitutes, use Cournot model: passive action, aggressive response, first mover advantage
Strategic complements, use Bertrand model: passive action and reaction, second mover advantage

## BERTRAND COMPETITION AND SPATIAL MODEL

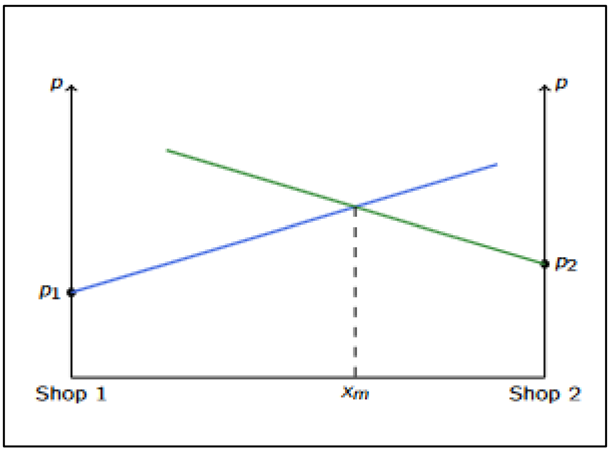
### FIXED LOCATION

- Assumptions:
  - N consumers on one street of 1 km = product space
  - Transport cost $t$ per km
  - Fixed cost $F$ for one shop
  - Marginal cost $c$

$$V - c - t > 0$$

  - 2 competing shops at the opposite ends of the street
  - 1 unit each consumer, valuation $V$
  - Each consumer buys the lowest full (transport included) price

- Full prize shop 1, full price shop 2 and marginal buyer at $x_m$




- Bertrand equilibrium:

  Determining $x_m$:

$$p_1 + tx_m = p_2 + t(1 - x_m) \Leftrightarrow \quad x_m = \frac{p_2 - p_1 + t}{2t}$$

  Demand firm 1:

$$D_1 = Nx_m = \frac{N(p_2 - p_1 + t)}{2t}$$

  Profit firm 1:

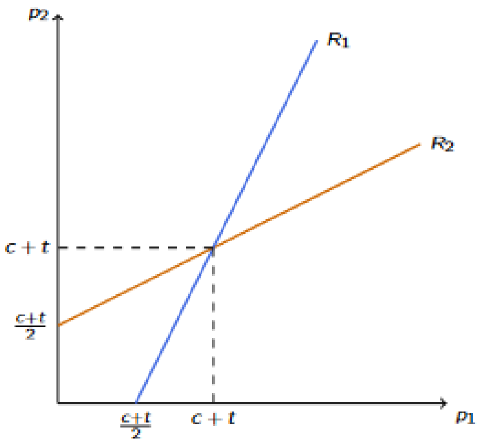
$$\pi_1 = N\frac{p_1p_2 - p_2^2 + tp_1 + cp_1 - cp_2 - ct}{2t}$$

$$\frac{\partial \pi_1}{\partial p_1} = MC_1 = \frac{N}{2t}(p_2 - 2p_1 + t - c) = 0 \ \Leftrightarrow \ p_1^* = \frac{p_2 + t + c}{2}$$

  Analogue:

$$p_2^* = \frac{p_1 + t + c}{2}$$

So the reaction functions look like:

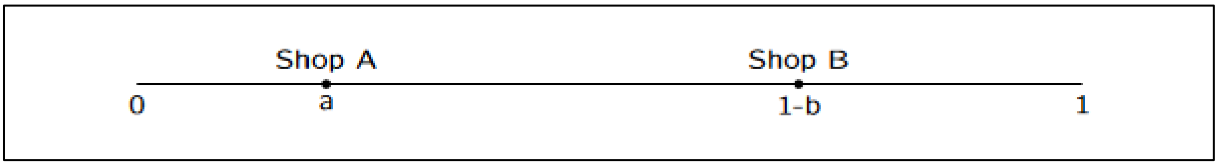



And an equilibrium can be found at $p_1^* = c + t = p_2^*$ with profit $\pi_1 = \pi_2 = Nt/2$

Note: $t$ is transport cost, but can be seen as the measurement of the value consumers hold on their preferred variety. $t$ large/small, competition is soft/hard and profit is increased/decreased

FLEXIBLE LOCATION

Tension: close to steal business or away to soften the competition?
→ sequential game: first location, then price




Backward induction:

- Price and product: profit shop A

$$\pi_A(p_A(a,b), p_B(a,b), a, b)$$
$$\frac{d\pi_A}{da} = \frac{\partial \pi_A}{\partial p_B}\frac{dp_B}{da} + \frac{\partial \pi_A}{\partial a}$$

- Location

$\frac{\partial \pi_A}{\partial a} > 0$ come closer, direct effect

$\frac{\partial \pi_A}{\partial p_B} > 0$ other should increase price, strategic effect

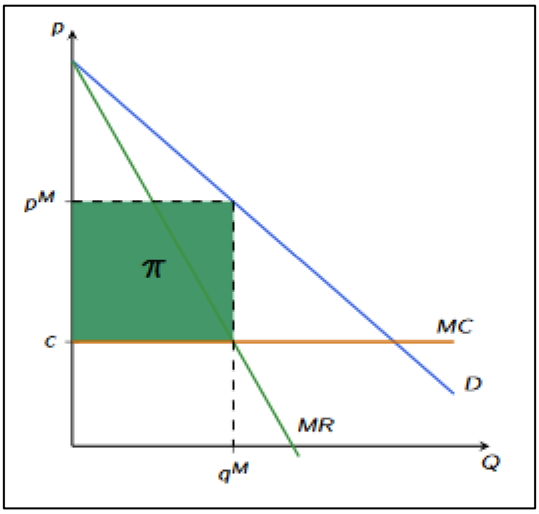
$\frac{dp_B}{da} < 0$ closer to rival = price reducing, strategic effect

Prefer strategic > direct: rivals price is very sensitive to my position → not strategic, no equilibrium

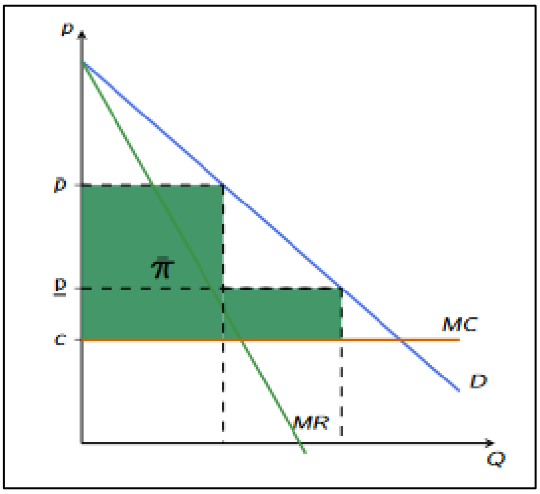
# LECTURE 4 – PRICE DISCRIMINATION

## INTRODUCTION

Classic monopolist model:




There are a lot of consumers that enjoy a big surplus and a lot consumers that won't buy.
→ adapt price to willingness to pay: very profitable for the monopolist and more costumers are served




Challenges to prince discrimination: identifying consumers, arbitrage

- First degree of price discrimination: personalized pricing
- Second degree: menu pricing
- Third degree: group pricing

## PERSONALIZED PRICING

= ideale scenario dat de monopolist exact weet hoeveel elke consument wil betalen en er geen enkele vorm van arbitrage mogelijk is, volledig afromen van consumentensurplus.

## THIRD-DEGREE PRICE DISCRIMINATION

### THIRD-DEGREE PRICE DISCRIMINATION

**Idee**: onderscheiden van groepen consumenten, per groep een uniforme prijs toekennen
example of groups divided by

- Demografics
- Timing of purchase
- Location

Pricing rule: consumers with low/high elasticity of demand should be charged a high/low price

#### EXAMPLE: HARRY POTTER SALES US VS. EU

Demand:

$$P_{US} = 36 - 4Q_{US}$$

$$P_{EU} = 24 - 4Q_{EU}$$

For both countries:

$$MC = 4$$

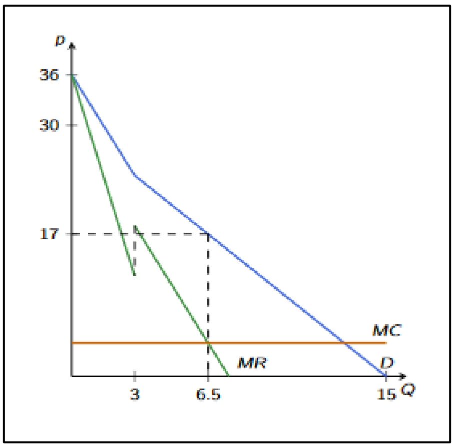
Aggregate demand:

$$Q_{US} = 9 - \frac{P}{4} \rightarrow P_{US} \leq 36$$

$$Q_{EU} = 6 - \frac{P}{4} \rightarrow P_{EU} \leq 24$$

NO PRICE DISCRIMINATION:

Dus enkel verkoop in US als $24 < P \leq 36$, anders is vraag gelijk aan som vraag US en EU.
→ discontinuïteit! Ook $MR \neq MC$ in beide markten afzonderlijk.




Aggregate profit:

$$\pi = (P - c)Q = 84.5\ mln$$

PRICE DISCRIMINATION:

- Equilibrium in US:

$$P_{US} = 36 - 4Q$$
$$MR_{US} = 36 - 8Q$$
$$P^*_{US} = 20$$

- Equilibrium in the EU:

$$P_{EU} = 24 - 4Q$$
$$MR_{EU} = 24 - 8Q$$
$$P^*_{EU} = 14$$

Aggregate profit:

$$\pi = (P_{US} - c)Q_{US} + (P_{EU} - c)Q_{EU} = 89\ mln$$

**Note**: since the demands are linear, the output will be the same, but the profits will rise

ELASTICITY:

2 markets, same $MC$, $MR_i = P_i\left(1 - \frac{1}{\eta_i}\right)$ $\eta_i$ = elasticity of demand

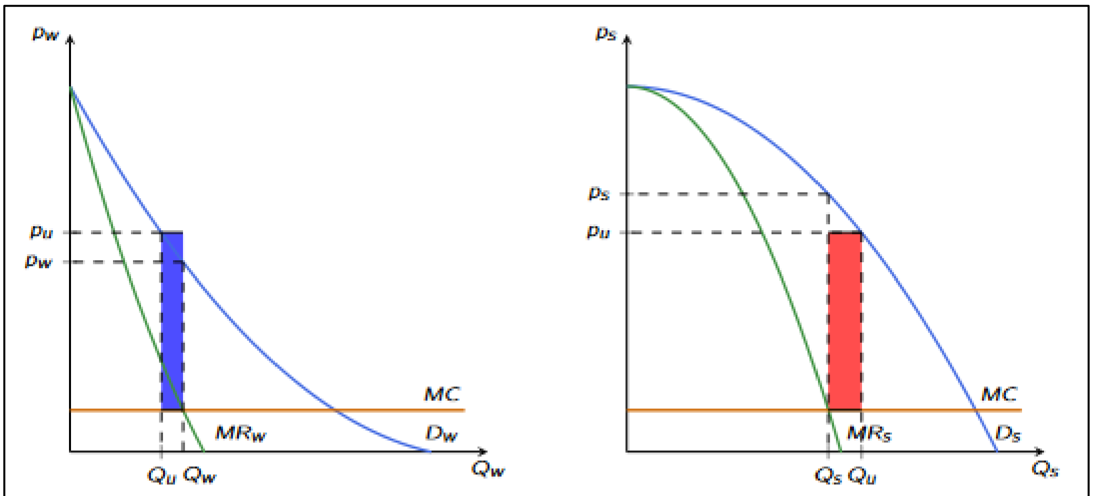
$$MR_1 = MR_2 \Leftrightarrow \frac{P_1}{P_2} = \frac{\eta_1\eta_2 - \eta_1}{\eta_1\eta_2 - \eta_2}$$

→ differentiation in elasticity!

## WELFARE ANALYSIS

Does third-degree price differentiation create welfare?

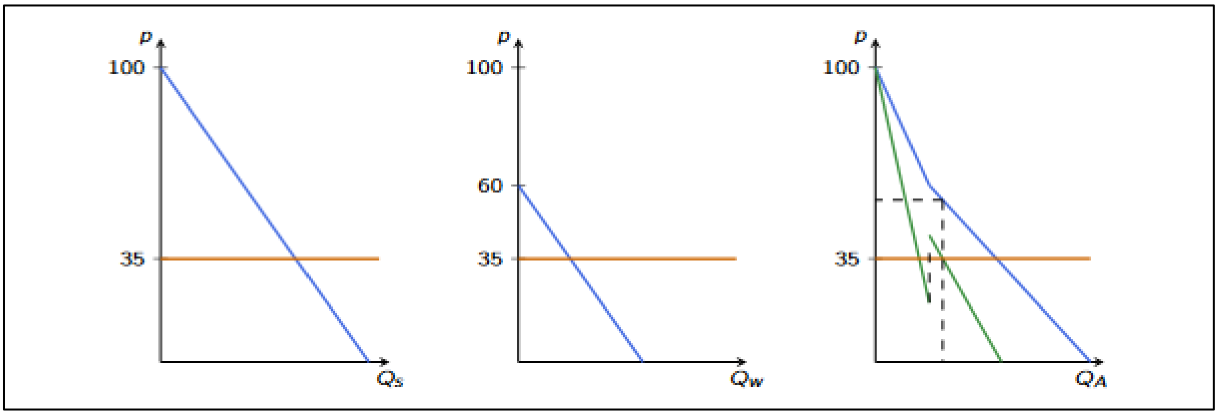
2 markets: weak (left), strong (right)
price differentiation: $p_w, p_s$
uniform pricing: $p_u$



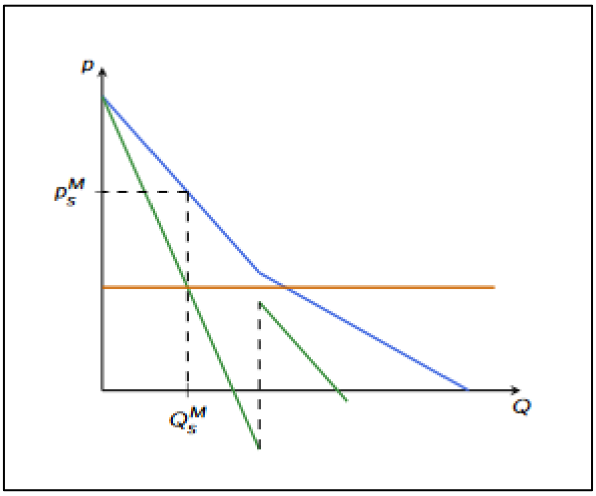
Maximum **gain** in surplus in the weak market
Minimum **loss** in surplus in the strong market

Difference in wealth $\leq$ gain – loss $= (p_u - MC)(\Delta Q_W + \Delta Q_S)$
→ only wealth increase if price discrimination creates extra output

Visual: strong and weak market together




What if weaker becomes more weak? Gap drops




→ only strong one served at monopoly price: fair?

# NON-LINEAR PRICING

## TWO-PART PRICING

= quantity discount for example, should be more profitable then third-degree pricing, seller is aware of the differences between his consumers

### EXAMPLE: JAZZ-CLUB

Type of consumers and demand: $V$ = demand for entry, $Q$ = drinks

- Old:

$$P = V_O - Q_O$$

- Young:

$$P = V_Y - Q_Y$$

And $V_O > V_Y$, cost of club $C(Q) = F + cQ$

### NO PRICE DISCRIMINATION

→ no entry fee (but still DEMAND for entry!)

- Aggregate demand

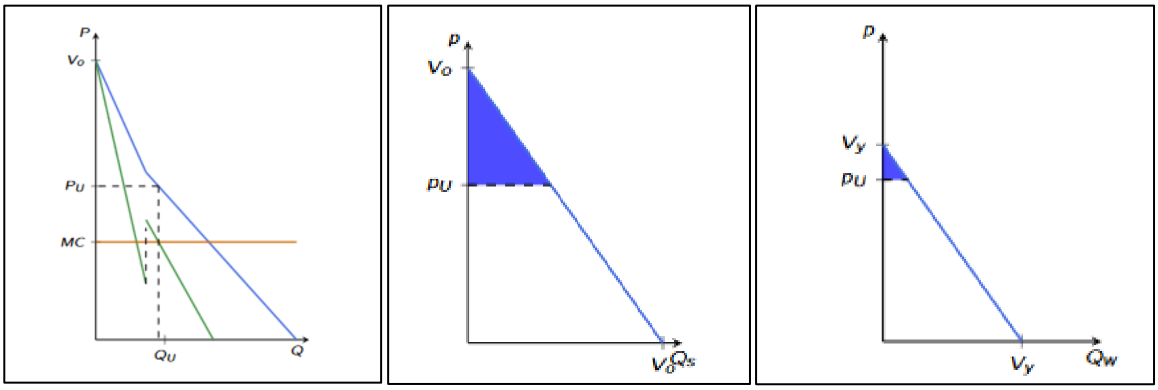
$$Q = (V_O + V_Y) - 2P$$

- Equilibrium:

$$MR = \frac{V_O + V_Y}{2} - Q \quad \text{en} \quad MC = c$$

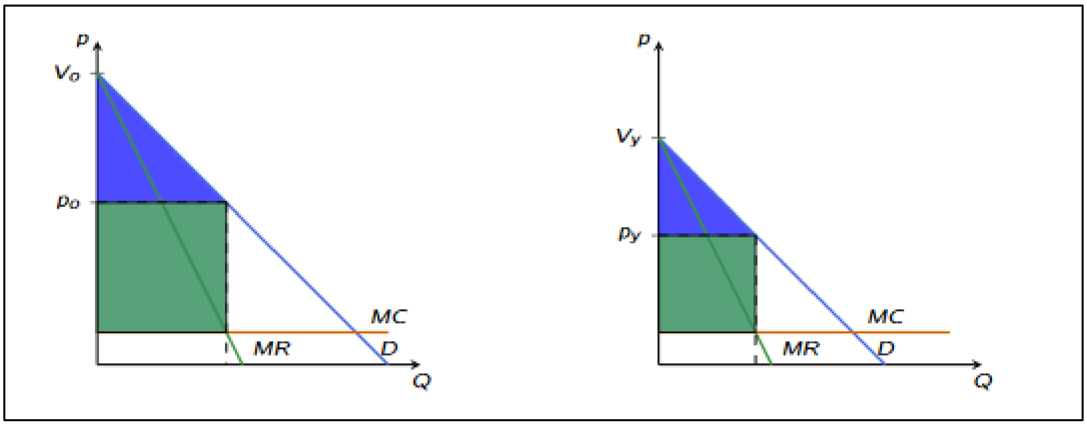
$$Q_O = \frac{3V_O - V_Y}{4} - \frac{c}{2} \quad \text{en} \quad Q_Y = \frac{3V_Y - V_O}{4} - \frac{c}{2}$$

$$\pi_u = (V_O + V_Y - 2c)^2$$




→ both types get consumer surplus

THIRD-DEGREE PRICE DISCRIMINATION
=group pricing for drinks




→ still both get surplus

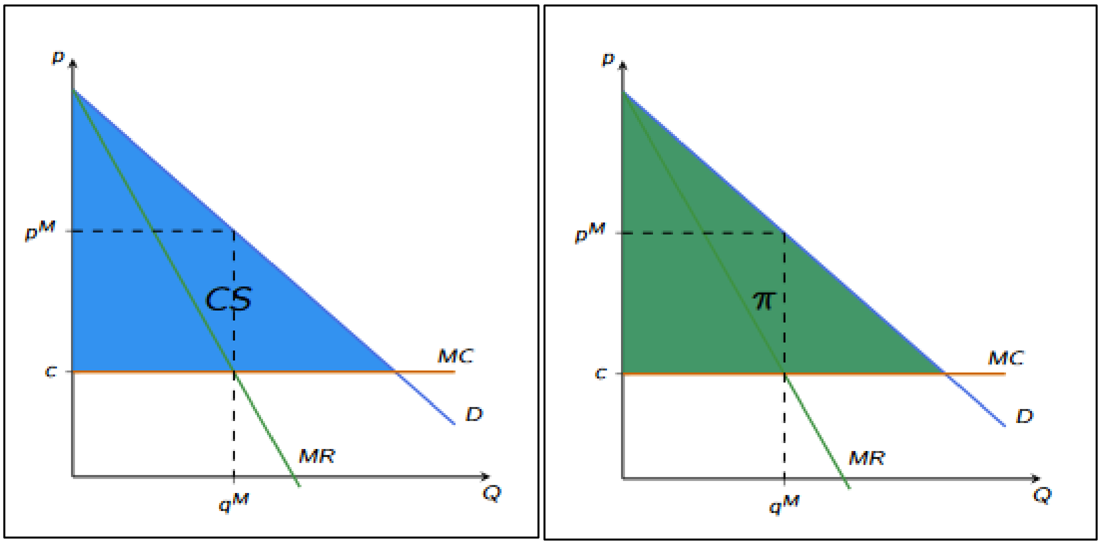
TWO-PART PRICING
= entry fee

$$E_O = CS_O$$

$$E_Y = CS_Y$$

→ still entering the club and buying the equilibrium price of drinks, fee extracts the remaining surplus

Sell unit price drinks to marginal cost, then extract the surplus by the entry fee




Extreme: drop price drinks below marginal cost and extract trough higher entry fee!

## Bundling & second-degree pricing

Let's see what happens if we cannot distinguish consumers from another.

### Example: high-valuation consumer pretends to be low-valuation consumer

- Demand high and low type

$$P_H = 16 - Q_H$$
$$P_L = 12 - Q_L$$

- Marginal cost $MC = 4$

### Two-part pricing

- High valuation:

$$Q = 16 - 4 = 12$$
$$CS = \frac{(16-4)\cdot 12}{2} = 72$$
$$drinks = 12 \cdot MC = 12 \cdot 4 = 56$$

PACKAGE $(€120, 12)$

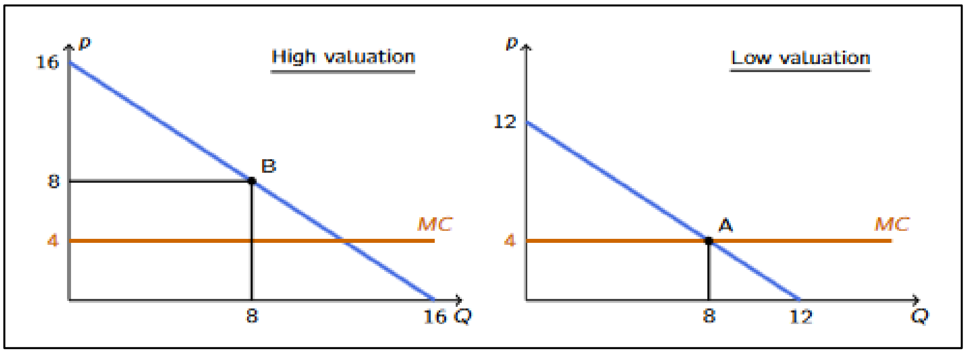
- Low valuation: same process
PACKAGE $(€64, 8)$

Surpluses:

- Low valuation: zero from own package, negative from high-valued package
- High valuation: zero from own package, **positive from low-valued package**

→ high-valuation customer will pretend to be low-valuation customer

### Second-degree pricing: menu




- Low-valuation package: $(€64, 8)$
  - Low-valuation consumer: surplus $8 \cdot 4 + (8 \cdot 8)/2 = 64$ → fully extracted
  - High-valuation consumer: surplus $8 \cdot 8 + (8 \cdot 8)/2 = 96$ → surplus of 32
- High-valued package needs change: give surplus of 32
= incentive-compatibility constraint
→ $(€120 - 32, 12) = (€88, 12)$

Low-valuation consumers will still not buy this high-valued package since their willingness to pay is 70 euro.

Profits:

- High-valuation consumers: $\pi = 88 - 12 \cdot 4 = 40$
- Low-valuation consumers: $\pi = 64 - 8 \cdot 4 = 32$

→ quantity discount? YES: high-valuation pays 7.33 per unit and low-valuation pays 8

Sometimes it is profitable for the monopolist to only serve the high-demand group: fair?

### Welfare analysis

Increase welfare needs increase in total output → similar tot third-degree price discrimination.

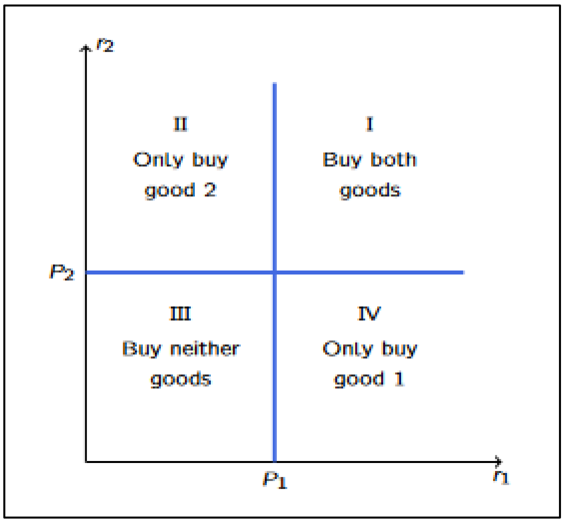
BUT: second-degree is more likely to increase output and so a better optieon

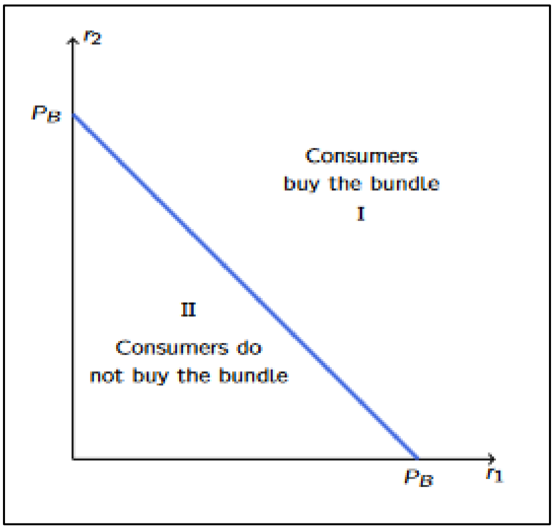
## BUNDLING PRODUCTS IN A PACKAGE

EXAMPLE: BLOCKBUSTER AND LESS-VALUED MOVIE

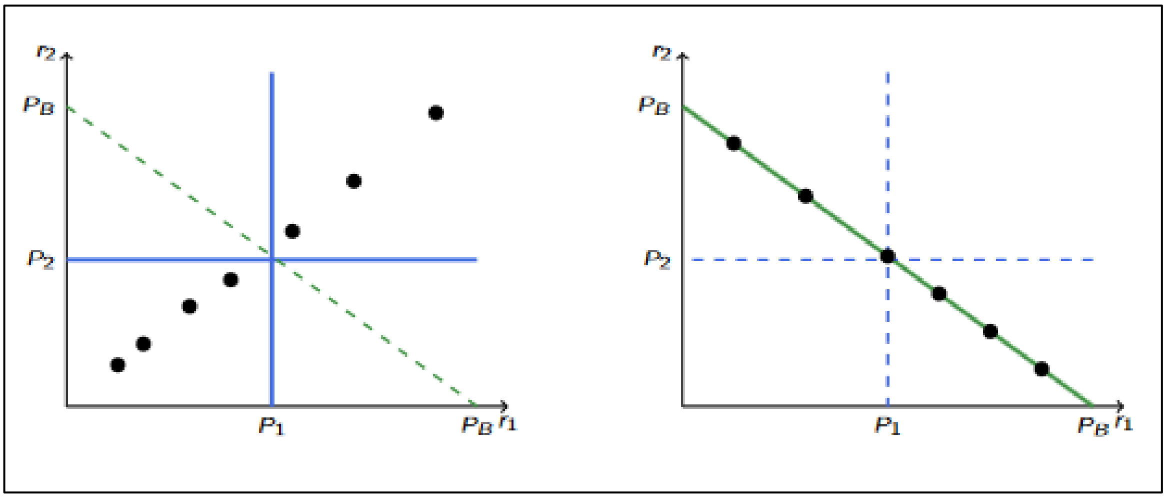
…

Decision graph when goods are sold separately vs. decision graph when goods are bundled




- Demand two goods are positive correlated:
  demand for product 1 raises demand for product 2
  → no extra results in bundling
- Demand two goods are negatively correlated:
  demand for product 1 lowers demand for product 2
  → all surplus can be extracted due bundling



# LECTURE 5 – HORIZONTAL AND VERTICAL RELATIONS

## INTRODUCTION

Market concentration → market power, but does mergers create market power?

| Benefiting consumers | Harming consumers |
|---|---|
| • Cost savings<br>• Search for synergies in operations<br>• Improved service to customers<br>• R&D complementarities<br>• . . . | • Increase market concentration<br>• Higher prices or more efficient pricing<br>• Less incentives to innovate<br>• . . . |

So they are both beneficial and in need for regulation: a government wants to prevent cartels or monopolist behaviour.

Types of mergers:

- Horizontal: 2 companies in the same market merge
- Vertical: a company buys another company that situates earlier in it’s supply chain
- Conglomerate: a company becomes a holding of different products

## HORIZONTAL MERGERS

→ this kind of merger holds a big risk to the market with perfect competition: a lot of examples when a merger is prohibit or approved

### MERGER THAT CREATES MARKET LEADER: COURNOT → STACKELBERG

- Pre merger:
  - 4 identical firms in Cournot Oligopoly
  - Demand $P = 150 - Q$
  - $MC = 30$
- Details merger: 3 companies merge → Stackelberg model

Calculations:

**Pre-merger**

$$q_i(4) = \frac{150 - 30}{5} = 24$$

$$P(4) = (150 - 24 \times 4) = 54$$

$$\pi_i(4) = (54 - 30) \times 24 = 576$$

**Post-merger**

$$q_L(2) = \frac{150 - 30}{2} = 60, \quad q_F(2) = 30$$

$$P(2) = (150 - 90) = 60$$

$$\pi_L(2) = (60 - 30) \times 60 = 1800$$

$$\pi_F(2) = (60 - 30) \times 30 = 900$$

- The profit of each firm pre-merger is $\pi_i(4) = 576$, combined is 1728
- The profit of the new market leader is $\pi_F(2) = 1800$

- The firm that does not participate into the merger also increases profits
- The final price in the market raises

Analysis:

- Increased market concentration: quantity reduces and final price increases
- Soften competition, boost profits
- Benefits for follower

General: N firms, 2 merge

- Leader has dominant position, follower loses
- More mergers triggered → consolidation of the market

## Merger that creates no market leader: Cournot → Cournot

- Pre merger:
  - 4 identical firms in Cournot Oligopoly
  - Demand $P = 150 - Q$
  - $MC = 30$
- Details merger: 3 companies merge → Cournot model: no leader

Calculations:

| **Pre-merger** | **Post-merger** |
|---|---|
| $q_i(4) = \frac{150-30}{5} = 24$ | $q_i(2) = \frac{150-30}{3} = 40$ |
| $p_i(4) = (150 - 30 \times 4) = 54$ | $p_i(2) = (150 - 40 \times 2) = 70$ |
| $\pi_i(4) = (60 - 30) \times 30 = 576$ | $\pi_i(2) = (70 - 30) \times 40 = 1600$ |

- The profit of the merged firms is $\pi_i(2) = 1600$, lower than the sum of the profits if they stayed independent $\sum_i \pi_i(3) = 576 \times 3 = 1728$
- So, from a **shareholder perspective**, the merger reduces value
- The firm that does not merge instead increases profits after the merger of the competitors

Analysis:

- Increased market concentration → BUT no possibility to step up to a larger size
- No leadership advantage, shareholder does not benefit

Not a reasonable option in the short run , but when a specific merger comes with re-organisation, downsizing of redundant units, repositioning etc. it can still be beneficial. These are real-world consequences and differ case to case.

Merger paradox:

Generalized: high market concentration after merger leads to smaller firm-size compared to combined size pre-merger), lower profit, higher prices, non-merging firms gain
→ why occur these mergers?

If the merge is extremely big, it can be beneficial, but it will likely be prevented by the government.

| | | | | | |
|---|---|---|---|---|---|
| N | 5 | 10 | 15 | 20 | 25 |
| $\bar{\alpha}(N)$ | 80% | 81.5% | 83.1% | 84.5% | 85.5% |
| M | 4 | 9 | 13 | 17 | 22 |

## MERGER AND COST SYNERGIES

"By merging we will generate cost synergies and the consumer will benefit" → higher prices though
→ a merger is profitable if there are cost savings

- Pre merger:
  - 3 different firms in Cournot Oligopoly
  - Cost structure: 2 firms $MC = 30$, third firm $MC = 30b,\ \ b \geq 1$
  - Demand $\qquad P = 150 - Q$
- Details merger: 3 companies merge → Cournot model: no leader

**Reducing fixed costs** (set $b = 1$):
Affecting fixed costs by rationalized distribution chain and reorganized production

$$\begin{cases} C_1 = F + 30Q_1 \\ C_2 = F + 30Q_2 \\ C_3 = F + 30Q_3 \end{cases} \Rightarrow \begin{cases} C_{12} = aF + 30Q_{12} \\ C_3 = F + 30Q_3 \end{cases}$$

where $1 < a < 2$, the relative size of the cost savings: smaller $a$ means more savings

- Pre-merger: $\quad \pi_i = 900 - F$ for all firms
  → $\pi_{12} = 1800 - 2F$
- Post-merger:
  New price because of new quantity output
  $$Q_i = \frac{A - c}{(N+1)B} = \frac{150 - 30}{3} = 40 \ \Rightarrow \ P = 70$$
  → $\pi_i = 800 - F$
  → $\pi_{12} = 1600 - aF$

So there is profit if $\qquad 1600 - aF > 1800 - 2F \ \Leftrightarrow \ a < 2 - 200/F$

In conclusion:

- Relatively important fixed costs: merger can be profitable even with limited cost savings
- relatively unimportant fixed costs: only well-designed mergers profitable if focus is only on fixed costs

**Reducing variable costs** (set $b > 1, F = 0$):

$$\begin{cases} C_1 = 30Q_1 \\ C_2 = 30Q_2 \\ C_3 = 30bQ_3 \end{cases} \Rightarrow \begin{cases} C_1 = 30Q_1 \\ C_{23} = 30Q_{23} \end{cases}$$

- pre-merger:

Outputs are:

$$q_1^C = q_2^C = \frac{90 + 30b}{4}, \quad q_3^C = \frac{210 - 90b}{4}$$

Profits are:

$$\pi_1^C = \pi_2^C = \frac{(90 + 3b)^2}{16}, \quad \pi_3^C \frac{(210 - 90b)^2}{16}$$

- post-merger: $\pi = 1600$, both merged and unmerged

So there is profit if:

$$1600 > \left(\frac{(90 + 3b)^2}{16} + \frac{(210 - 90b)^2}{16}\right) \Leftrightarrow b > \frac{19}{15}$$

In conclusion: merger is profitable if disadvantage $b$ is big enough!

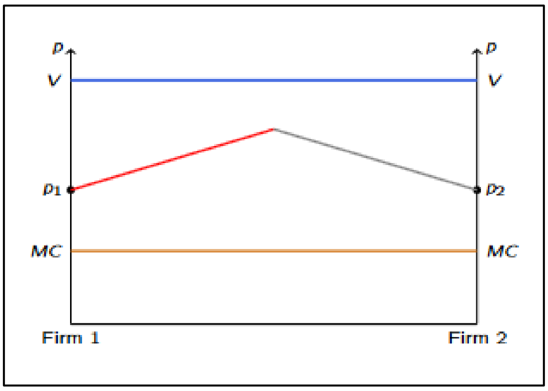
BUT in both cases: no guaranteed cost savings for consumers → wealth improvement should be the main goal, government needs to control that when approving mergers

## MERGER AND PRODUCT DIFFERENTIATION

Does product differentiations affect the profitability of the merger? We work again with a special model.

- Pre-merger:
  - 2 firms, located at the end points of the line
  - $MC = 30$
  - Preferred variety $V = 200$
  - Transportation cost $t = 100$

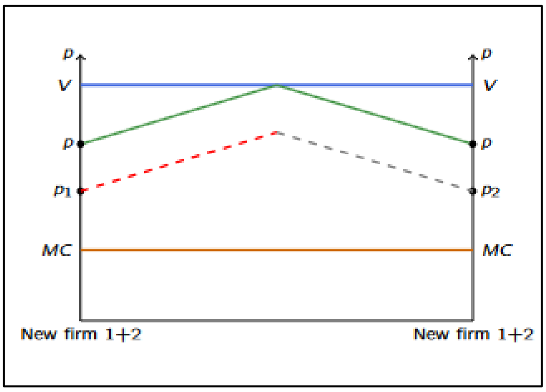
→ equilibrium price $p = 130$




- Post merger: two products offered by same company
  - Same production cost
  - No relocation

→ equilibrium price $p = 150$

This is because the price now can be coordinated by the monopolist and is balanced to the preferred variety

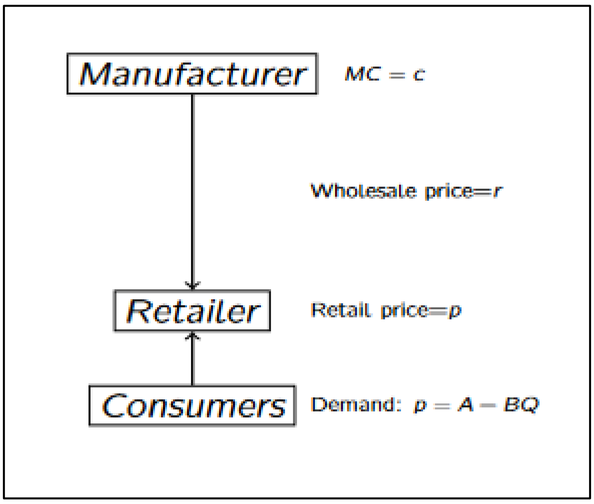


## VERTICAL MERGERS

Negative effects: market foreclosure

positive effects: remove market in efficiencies, coordination and market power takes away double marginalisation.

Model of the market (of a monopolist):

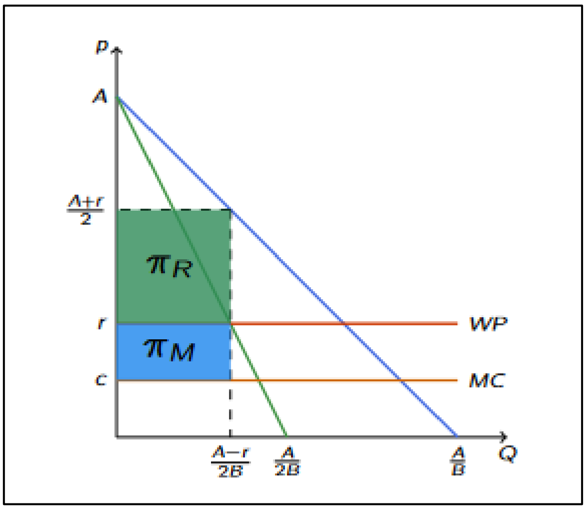



### INTERACTION BETWEEN RETAILER AND MANUFACTURER

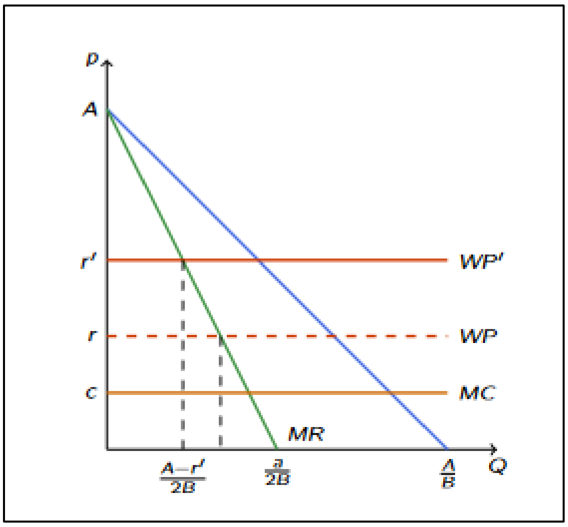
- The monopolist's/retailer's decision: profit maximizing output and so, price
  - → monopolist sells at $MR = WP > MC$
  - → profit to both manufacturer and retailer

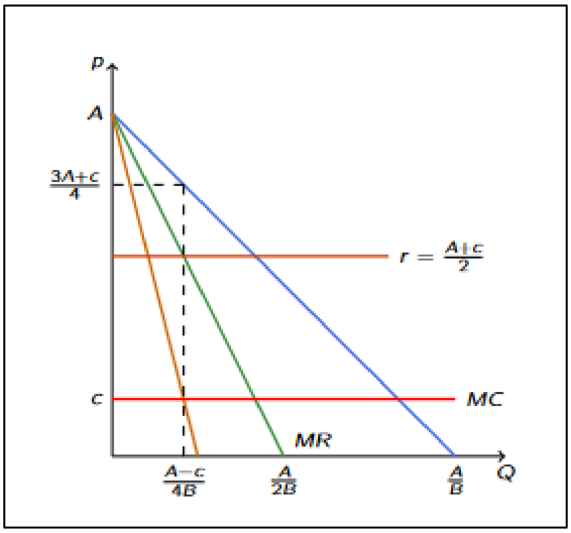
$$\pi_R = (p - r)Q = \frac{(A - r)^2}{4B}$$

$$\pi_M = (r - c)Q = \frac{(r - c)(A - r)}{2B}$$



- What if retailer sets a different price? What would be optimal?




→ for eacht different $r'$, there's a differen equilibrium output, determind by the crossing with the $MR$-curve → dirive **demand for the manufacturer**

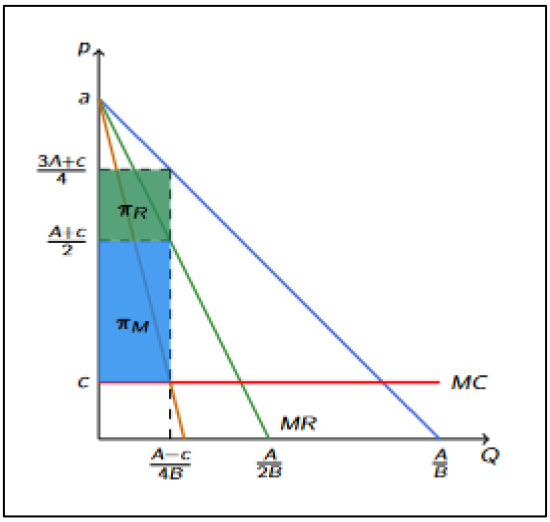
$$Q_M = \frac{A-r}{2B} \Leftrightarrow r = A - 2bQ_M$$

**Note:** this is the $MR$-curve for the reatailer!

→ we find now the optimal retail price $r = \frac{A+c}{2}$
and the final price for the consumer $p = \frac{3A+c}{4}$

→ profit is now

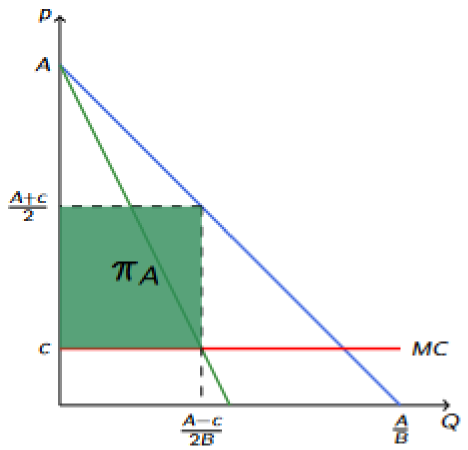
$$\pi_R = (p-r)Q = \frac{(A-c)^2}{16B}$$
$$\pi_M = (r-c)Q = \frac{(A-c)^2}{8B}$$



## Vertical merger

= manufacturer takes over retailer: downstream merge

→ result in monopoly: known model




- The vertical merge results in a monopoly with marginal cost $c$
- So, quantity and price are:

$$Q_A = \frac{A-c}{2B}, \quad p_A = \frac{A+c}{2}$$

- Profit is:

$$\pi_A = \frac{(A-c)^2}{4B}$$

Analysis:

**If firms do not merge**

$$Q = \frac{A-c}{4B}$$

$$p = \frac{3A+c}{4}$$

$$\pi_M = \frac{(A-c)^2}{8B}, \quad \pi_R = \frac{(A-c)^2}{16B}$$

**If firms do merge**

$$Q = \frac{A-c}{2B}$$

$$p = \frac{A+c}{2}$$

$$\pi = \frac{(A-c)^2}{4B}$$

The merger has **benefited both the consumers and the firms** (latter: value for joint shareholders)

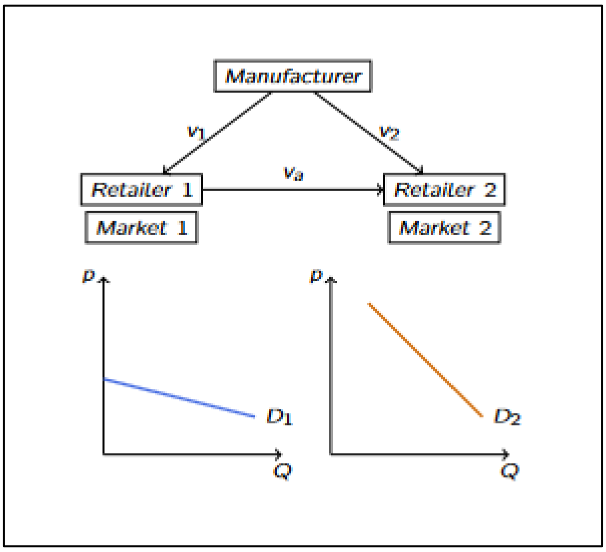
→ Why? Both prizing above marginal cost leads to double marginalisation. The merge corrects this market faillure

## VERTICAL MERGERS WITH COMPETITIVE MANUFACTURERS

So the manufacturer is no longer a monopolist, but has competitors. Now an input at marginal is obtained and the retailer gets all the integrated profit since there is only one monopolist.
→ mainly horizontal problem (competition), though price discrimination and vertical foreclosure has a role in vertical mergers.

## PRICE DISCRIMINATION

Manufacturer sells to different retailers: retailer 1 has more elastic demand and retailer 2 a less elastic demand → wants to set different prices $v_1 < v_2$




BUT there is arbitrage: retailer 2 offers to buy from retailer 1 at $v_1 < v_a < v_2$

→ if manufacturer merges with retailer 1 arbitrage is prevented

## VERTICAL FORECLOSURE

= eliminating competitors by merging upstream → not loved by the government!

## VERTICAL RELATIONS

## READY-MIX CONCRETE INDUSTRY: EMPIRICAL EXERCISE

- Technology: 2 level market structure
  - Cement
  - Water, sand, gravel
- Local market: sand and cement are expensive to transport, a firm is a monopolist in his region
- Two tensions: efficiency gains (merge pro), fear of foreclosure (merge con)
- Timeline:

- 1960s: market had relatively low consolidation ⇒ wave of vertical mergers
- Following the consolidation wave, shift in policy ⇒ 15 antitrust cases
- 1970s: wave of divestitures and no mergers
- 1980s rise of the *Chicago school* approach to antitrust ⇒ vertical integrations viewed much more favorably
- New wave of (vertical) mergers in the sector
- 1990s: New shift in antitrust, influenced by the work of Hart and Tirole (*post-Chicago*)
- Decline in the rate of vertical integration

Predictions:

- Foreclosure: increase price
- Efficiency: reduce price

→ apply linear regression

TABLE 5
PLANT-LEVEL TFP COMPARISONS

| | Within-Market Difference (1) | Change for Continuers (2) | Integrated vs. Unintegrated Entrants (3) | Integrated Entrants vs. Unintegrated Incumbents (4) |
|---|---|---|---|---|
| Observations | 8,555 | 2,439 | 2,025 | 6,104 |
| $R^2$ | .308 | .419 | .573 | .352 |
| Vertical integration indicator | .043* (.014) | .102 (.055) | .054 (.045) | .046* (.028) |

NOTE.—The table shows the results from regressing ready-mixed concrete plants' TFP levels on an indicator for the plant being in a vertically integrated firm. All regressions include market-year fixed effects.
* Significant at the 5 percent level.

Conclusion: efficiency gains over foreclosure effects → there will be some mergers and reduced prices

## Resale Price Maintenance (RPM)

Contractual arrangements:

- Restricting rights of retailer
- Restricting rights of manufacturer
- Restrictions and guidelines on pricing

Resale Price Maintenance (RPM) = agreement between manufacturer and retailer at a certain price

Recall double marginalisation:

- Downstream $MR = a - 2bQ$
  = upstream demand
- Upstream $MR = a - 4bQ$

→ chain of 2 monopolists have a downstream price that is way to high → RPM restricts to a joint-profit maximizing price, solves double marginalisation problem and prevents merger

# LECTURE 6 – ANTICOMPETITIVE BEHAVIOUR

## INTRODUCTION

Perfect competition: free entry and market power is transient, fugitive → not realistic

Market power can be a result of practices aimed at restricting competition: dominating the market by not letting any competitors in.

European antitrust = board that decides if free market is in danger or not:

- Punish collusion
- Punish abuse of dominant position, predation
- Oversee and decide on mergers

**Collusion** = agreement between parties to limit open competition

**Predation** = elimination of existing or potential rivals
→ entry deterrence belongs in this category

<u>EXAMPLE</u>

- Production **capacity** → over-investing in production capacity
- **Pricing** → prolonged below-cost pricing
- **Product line** → over-filling of the product space
- **Contracts** → contracts of exclusivity
- **Marketing practices** → bundling products to deter entry
- . . .

- Not all decision involving these dimensions managerial strategic decisions can be considered predatory, often it is just competition!
- However, it is important for managers to know:
  - What is **legitimate** (antitrust actions can be initiated by rivals' protests)
  - What is the (current) **orientation** of the competition authority

## ENTRY DETERRENCE BASED ON PRICE

= pricing low enough to prohibit entry or lead to rival's exit. In duopoly only one monopolist will survive.

**Predatory pricing**

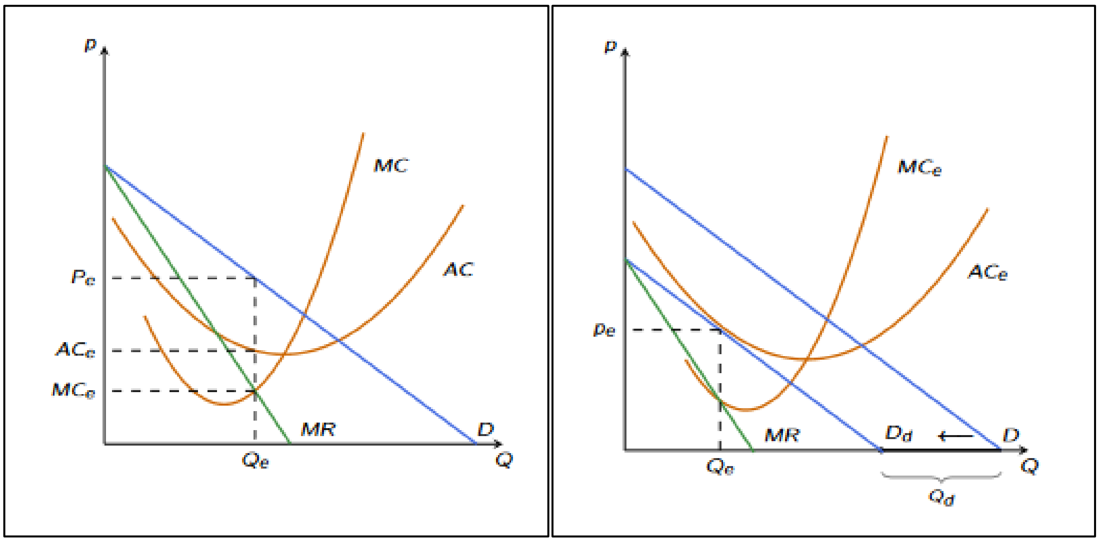
= prices so are low that firms are driven out → victim! Often legal actions

**Limit pricing**

= prices are so low that the entry is deterred

Model limit pricing:

- Market leader choses **output**: Stackelberg
  → large output choice
- Entrants production volume is not big enough to break even




$MC, AC$ cost curves of entrant: price above $AC$, then entrant can enter

Incumbent produces extra $Q_d$: residual demands shifts and entrant is deterred

- Similarly: market leader changes price

→ complex problem to the manager: price wars are costly

Model limit pricing based on sunk costs:

- Monopolist = incumbent $I$, entrant $E$
- Incumbent chooses quantity first $q_I$
- Entrant enters or not, when entering $q_E$
- Sunk costs $F$

Key elements: size market (positive for entrant), size entry, sunk, costs (negative for entrant)

<u>EXAMPLE:</u>

- Formulas

$$F = 225 \quad p = 100 - q_E - q_I \quad MC = 20$$

- Solving backwards: we maximalize the profit for the entrant and make conclusions for the incumbent

$$\pi_E = (100 - q_I - q_E)q_E - F$$

$$q_E^* = \frac{80 - q_I}{2} \Rightarrow \pi_E^* = \frac{(80 - q_I)^2}{4} - 225$$

Entering if $\pi_E^* \geq 0 \quad \Leftrightarrow \quad q_I \leq 50$

- Strategic options
  - Deter entry: $q_I = 50,\ \pi_I = 1500$
  - Accommodate entry: $q_I = 20,\ q_E = 20,\ \pi_I = 800$ → Stackelberg

  → here is deter entry profitable, changes in entry costs changes the scenario!

- $F = 625$
  - To deter entry: $q_I \geq 30$ (monopoly quantity is 40)
  - Deter entry
- $F = 25$
  - To deter entry: $q_I \geq 70$
  - Entry accommodation, block will cost the monopolist too much

**Note**: model works different if cost structures are not the same, the market size is also an important element: the high quantity should be credible

**Note**: if incumbent claims higher quantity than he can produce, entrant sees through and enters anyway, best action is now Cournot model

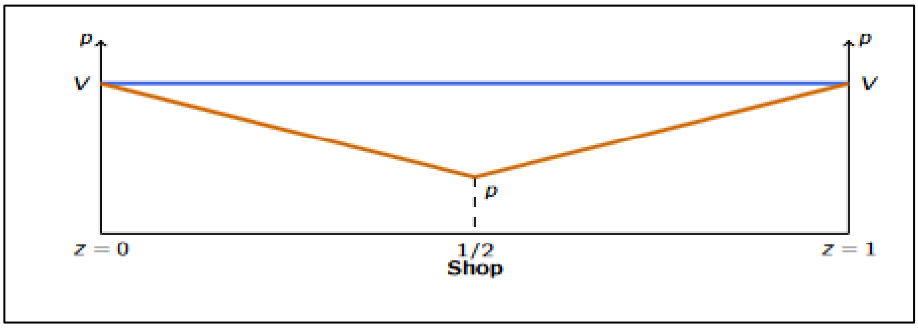
## ENTRY DETERRENCE BASED ON TIMING

### PRODUCT PROLIFERATION

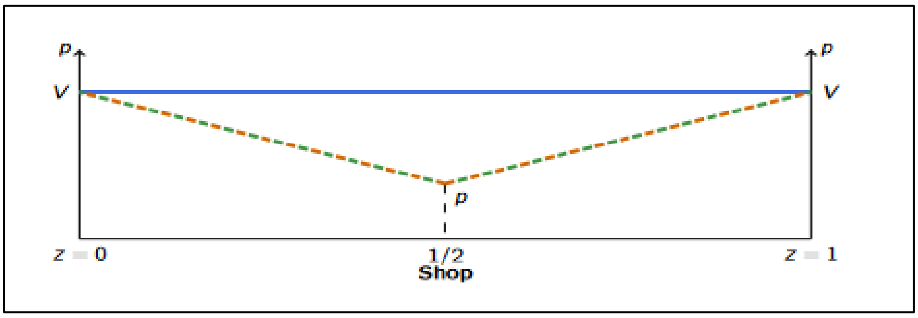
= bereidheid van de consument om product te wisselen

Again special model:

- Assumptions
  - Incumbent $I$, entrant E
  - No price competition
  - Choice = location
  - Production cost zero, fixed cost $\frac{p}{4} < F < \frac{p}{2}$
  - Low transportation costs
- Incumbent moves first, entrant decides location-based
- One product/shop

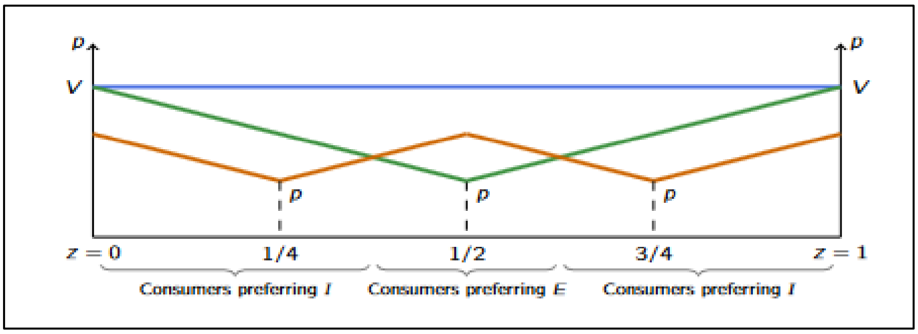



Best location incumbent is 1/2 $\pi_I = p - F > 0$




Also best place for entrant! Same profit $\pi_E = \frac{p}{2} - F = \pi_I$

- Two products/shops




If the entrant enters his profit will be below zero, because his market share is only 1/4

In conclusion:
optimal for incumbent to expand portfolio so the market share of the entrant will be reduced, the space is squeezed.

**Note**: if there is no thread of entry it is optimal for incumbent to only choose one product

## LONG-TERM CONTRACTS

Exclusivity contract locks-in a buyer and excludes competitors

- Assumptions:
  - Three agents: buyer, incumbent seller, entrant seller
  - 2 periods
  - Willingness to pay form buyer 100 euros
  - Cos incumbent 50 euros
  - Cost entrant between zero and 100 euros
  - Contract between buyer and incumbent: written period 1, covers period 2
  - Potential entering in period 2
- First case: no contract
  - Period 1: incumbent sells at 100 euros
  - Period 2:
    entrant enters if cost entrant below 50, competition entrant can not price above 50, but no pressure below either
    → Bertrand with asymmetric costs

  Surplus buyer: $100 - P = 100 - \left(\frac{1}{2}100 + \frac{1}{2}50\right) = 100 - 75 = 25$

  Expected profit incumbent $\pi = 25$

- Second case: with contract
  - Period 1: contract is written
    *in the 2nd period the incumbent commits to sell at $P = 75$ euros. The buyer must buy only from incumbent, else contract fee of 50 euros.*
  - Period 2:
    entrant can only enter if cost below 25, if he enters his price will be 25
    $P > 25$: buyer stays with contract, entrant kicked out
    $P < 25$: buyer breaks contract and pays fee

  Surplus buyer: at least 25

  Expected profit incumbent $\pi = 0.75 \cdot 25 + 0.25 \cdot 50 = 29.17$

In conclusion:

- Gain incumbent, no loss buyer
- Reduces probability of entry: ½ → ¼
- BUT: inefficient for welfare (there practices are punished

## BUNDLING: MICROSOFT VS. EU

Microsoft will bundle its software and exclude alternative media players