

TOPIC 1: MARKET STRUCTURE AND MARKET POWER

1.1. Competitors

Anyone that produces a substitute for a firm's product.

- Cross price elasticity: Measures the substitution degree of a product for another.

P.E. >1 – The demand is elastic, a change in price is reflected as an even major change in demand. The extent of the variation is higher as higher is the substitution degree of a product for another. We can say two firms are competing when a price increase by one firm, drives its customers to the other firm.

P.E. <1 – The demand is inelastic.

- The company can have several competitors and at different levels (either in input and output markets at the same time).

a. Direct Competitors – Strategic choice of one firm directly affects the performance (sales) of the other.

b. Indirect Competitors – Strategic choice of one firm affects the performance of the other because of a strategic reaction by a third firm (transitive effect).

e.g. Lexus → BMW → Jeep Grand Cherokee: Lexus decreases price, consequently BMW decreases its prices also. Although Jeep Grand Cherokee does not compete directly with Lexus it is also affected due to BMW reaction.

1.2. Substitutes

Two products are substitutes when they have:

- Similar performance characteristics

However : Products that belong to the same genre or fall under the same SIC (Standard industry classification) need (Classificação das Atividades Económicas) cannot be substitutes if their performance characteristics are vastly different.

e.g. Mercedes vs Hyundai (they have the same classification but we cannot consider them competitors).

- Occasion for use

They may share characteristics and serve the same needs.

However : they differ in the way they are used (they are not substitutes).

e.g. Milk vs Cola, although they are both beverages but they are used in different occasions/purposes.

- Sold in the same geographic area

The firm should identify the competitors in each different geographical area. Rather than rely on geographical demarcations, the firm should look at the flow of goods and services across geographic regions. We can define within the same market, regional markets.

Process:

- Find out where the customers come from: catchment area;

- Find out where the customers from the catchment area shop.
e.g. when some goods start being sold in internet, virtual competitors emerge.

However: Identical products in two different geographic markets will not be substitutes due to “transportation costs”. e.g. While cement has huge transportation costs, it competes in local markets (regional) – this is an opportunity to benefit from geographical price difference – “pasta de papel” is a very light material and so, cheap to transport, what makes its definition of market really broader (international).

1.3. Market Definition

1.3.1. Market: Set of suppliers producing the same product or a set of products that are close substitutes. The referred set of products that define a market must have very high cross-price elasticities of demand among them and very low cross price-demand elasticities vis à vis other products. Those who buy volume brands are much more price sensitive than luxury brands.

	Nissan Sentra	Ford Escort	Toyota Lexus	BMW 745i
Nissan Sentra	-6.5282	0.4544	0.0008	0.0000
Ford Escort	0.0778	-6.0309	0.0008	0.0000
Toyota Lexus	0.0002	0.0010	-3.0847	0.0322
BMW 745i	0.0001	0.0005	0.0926	-3.5151

a. Relevant Market

It includes all products that significantly limit the price of a product. The extent to which firms are able to increase their prices above normal competition levels depends on the possibility for consumers to buy substitute goods. e.g. plastic vs glass bottles.

< # substitute products → < elasticity of the demand curve → > P (find higher prices).

- Relevant Geographic Market
Imports and Transportation costs.

b. Difficulties when defining a market

- Product differentiation is usually due to small characteristics of the product. e.g. Diet coke belongs to cola market, light cola market and soft drinks market.
- The idea of competitors today is completely different from the one we had in the past. Sometimes we need to look outside the industry. e.g. go by car with 4 persons vs go alone by train.

1.3.2. Market Structure: # and characteristics of firms in a market.

a. Concentration in the market → Concentration Index

Simple measures to define the market are really useful to take antitrust decisions. It takes into consideration, the number and size of the firms.

b. Measuring Market Structure

- K-firm concentration ratio

Once you have defined the market and relevant players, we define their MS%. Combined share of the k largest firms in the market.

$$C_k = \sum_{i=1}^k s_i, s_i \text{ is the MS of firm } i \text{ and } C_k \in [k/n, 1]$$

Sort the companies by their order (1st, 2nd, ...). Then we sum the largest firms MS%, e.g. C_4 = 4 largest firms in the market. If companies are similar in terms of MS, we are dividing the market in n slices, each has 1/n. This is the minimum concentration ratio.

- Herfindahl Index

H equals the sum of the squared MS of all firms in the market. Gives more information than C_k ratio (usually this is not enough) as it is sensitive to changes in the sizes of the largest firms in the market. Usually only firms with MS larger than 0,01 are considered.

$$H \equiv \sum_{i=1}^n s_i^2, H \in [1/n, 1]$$

It can also be expressed as a function of the total number of firms in the market. Variance of the distribution of the firms' MS. The larger the dispersion of MS in the market, the larger H index.

$$H = n\sigma^2 + \frac{1}{n}$$

If all firms have equal/identical shares (symmetric market structure, $s_i = \frac{1}{n}$ for all i) then $\sigma^2=0$ and $H = \frac{1}{n}$. If the # of firms is held constant, then a higher variance due to a higher level of asymmetry between firms' shares (higher share dispersion) will result in a higher value of the H index \rightarrow > concentration. Sometimes an industry with less firms isn't necessarily more concentrated than one with less.

If a merger implies an increase in the concentration ratio of the market, competition and allocate efficiency decrease. Therefore we are going away of the perfect competition as collusion and market concentration increases.

- Numbers-equivalent of firms (Adelman)

It is the reciprocal (inverse) of the H index. It is useful to understand the concentration level and so if Herfindahl index is high or low. H index in a market with N identical firms is $\frac{1}{N}$. $NE = \frac{1}{H}$

e.g. $H = 1,25 \rightarrow NE = 8 \rightarrow$ Moderate Competition.

1.4. Perfect Competition

Many buyers and sellers, homogeneous and not differentiated products, perfect information, no transaction costs and free entry and exit (no sunk costs).

1.4.1. Key Implications

- Firms are “price takers” ($P=MR$)
- While in the short-run firms may earn profits or losses, in the long-run profits are zero.

1.4.2. Advantages

- Many small businesses are “price-takers” and decision rules for these firms are similar to those of perfectly competitive firms;
- It is a useful benchmark;
- Explains how governments oppose monopolies:
- Highlights the “danger” to managers of competitive environments: importance of product differentiation and sustainable advantage.

1.4.3. Output

As there are no barriers to enter the market, everyone enters, prices decrease and at a certain point $P=MC$ (socially efficient output) to maximize profits.

$$MR=MC \rightarrow MR=P \rightarrow P=MC$$

$$\text{Max } \pi = R(Q) - C(Q)$$

$$\frac{d\pi}{dQ} = 0 \Leftrightarrow MR=MC \Leftrightarrow R = P \times Q \rightarrow \text{Golden rule for profit maximization}$$

As here $MR = P$ (long-run zero profit situation), in equilibrium $MC = P$, $\frac{dR}{dQ} = P$.

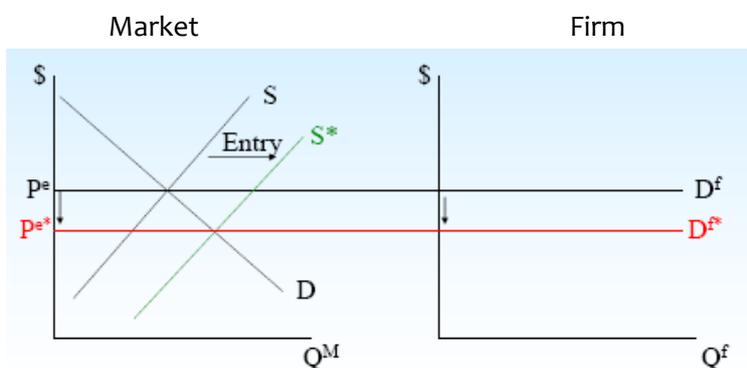
$P = \text{minimum AC}$: efficient plant size and zero profits \rightarrow Firms are earning just enough to offset their opportunity cost.

Sometimes there could be only two companies in the market and due to fierce competition, $MC=P$.

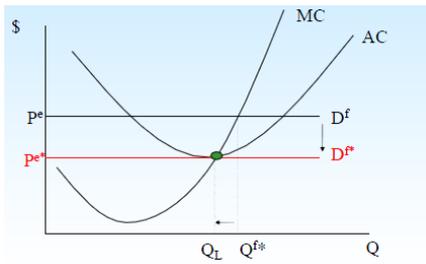
1.4.4. Long-run Adjustments

- If firms are price takers but there are barriers to entry, profits will persist;
- If the industry is perfectly competitive, firms are not only price takers but there is free entry and so other firms enter the market.

- Effect of entry on price



- Effect of entry on the firm's output and profits



1.4.5. Conclusions

Short-run profits → Entry → Increases market supply → Decreases the market price → Increases market quantity → Demand for individual firm's products decreases → Firm reduces output to maximize profit → Long-run profits are zero.

1.5. Monopoly

Single firm serves the "relevant market". No competitors. The demand for the firm's product is the market demand curve and firm has control over price (but the price charged affects the quantity demanded of the monopolist's product). If there are new ways of entering the market (Internet), monopoly ends.

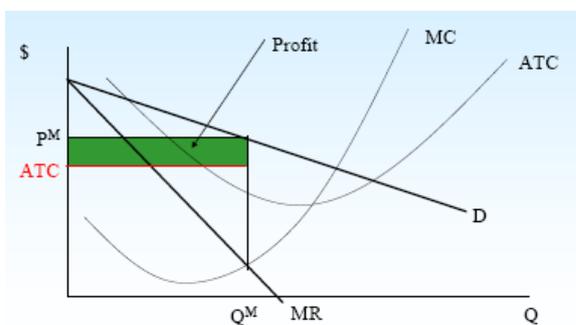
1.5.1. Natural sources of monopoly power

- Economies of scale
- Economies of scope

1.5.2. "Created" sources of monopoly power

- Patents and other legal barriers, e.g. licenses
- Tying contracts
- Exclusive contracts
- Collusion

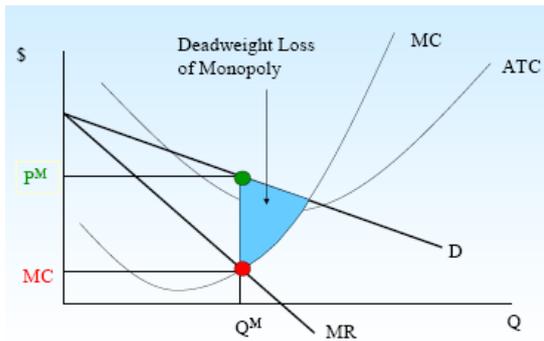
1.5.3. Profit maximization



Produce where $MR = MC$.
Charge the price on the demand curve that corresponds to that quantity.

1.5.4. Monopoly Disadvantages

- $P > MC$ → Too little output at a too high price → Deadweight loss of monopoly



1.5.5. Arguments for monopoly

The beneficial effects of economies of scale and scope on output and price may outweigh the negative effects of market power. Besides monopoly encourages innovation.

1.6. Oligopoly

Relatively few firms in the market, usually no more than ten. (Two firms – duopoly). The products offered can be either homogeneous or differentiated.

- Role of Strategic Interaction

What you do affects the profits of your rivals and vice-versa.

1.7. Cournot Model

Strategic Variable: Quantity.

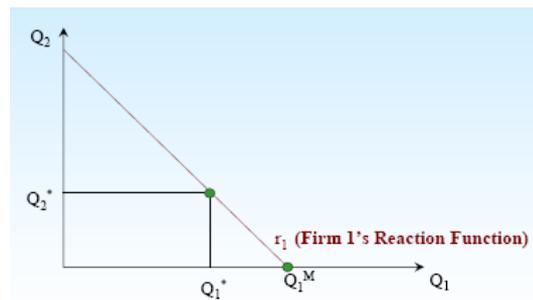
Few firms produce either homogeneous or differentiated products. Firms set output as opposed to price. Each firm believes their rivals will hold output constant (as a fixed output) if it changes its own output. Barriers to entry exist – you can have profits in a market with very few barriers. The decisions of production are made at the same time.

1.7.1. Reaction Functions

- Suppose two firms produce homogeneous products.

- Firm 1's reaction (best response) function is a schedule summarizing the amount of Q_1 firm 1 should produce in order to maximize its profits for each quantity of Q_2 produced by firm 2.

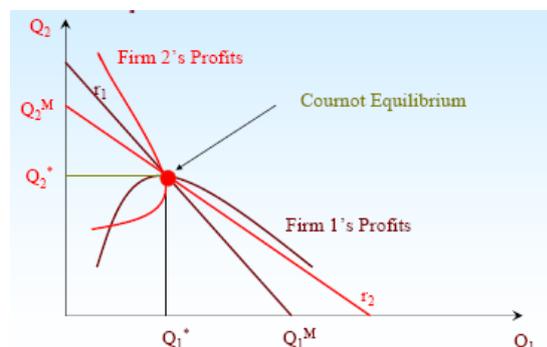
- Since the products are substitutes, an increase in firm 2's output leads to a decrease in the profit-maximizing amount of firm 1's product.



1.7.2. Cournot Equilibrium

- The output Q_1^* maximizes firm 1's profits, given that firm 2 produces Q_2^* .

- The output Q_2^* maximizes firm 2's profits, given that firm 1 produces Q_1^* .



- Neither firm has an incentive to change its output, given the output of the rival.

In equilibrium, each firm “thinks” rivals will stick to their current output and they do! Situation where each firm produces the output that maximizes its profits, given the output of rival firms. No firm can gain by unilaterally changing its own output.

$$\text{Max } \pi_i = P(Q_i, Q_j) \times Q_i - C(Q_i)$$

$$\frac{\partial \pi_i}{\partial Q_i} = \frac{\partial P}{\partial Q_i} \times Q_i + P(Q_i, Q_j) - \frac{\partial C}{\partial Q_i} = 0 \Leftrightarrow Q_i^* = f(Q_j)$$

→ Nash Equilibrium: Every firm is using the best strategy against the other firm strategy – $Q_1^* = Q_2^*$. Firms do not have incentive to deviate from this equilibrium.

1.7. Stackelberg Model

Strategic variable: Quantity.

Few firms producing differentiated or homogeneous products. Barriers to entry. Firm 1 is the leader which commits to an output before all other firms. Remaining firms are followers. They choose their outputs so as to maximize profits, given the leader’s output.

Sequential game: Leader plays at first place (set its production), follower observes and maximizes its profit.

First mover advantage: The leader in the end of the game may not end with higher profits vs followers. Although these are higher profits than the ones got in Cournot model. Followers end with lower profits than at Cournot model.

1.7.1. Stackelberg Summary

Stackelberg model illustrates how commitment can enhance profits in strategic environments. Leader produces more than the Cournot equilibrium output. Larger MS, higher profits. Follower produces less than the Cournot equilibrium output. Smaller MS, lower profits.

1.8. Bertrand Model

Strategic Variable: Price.

Few firms produce identical products at constant marginal cost. Each firm independently sets its price in order to maximize profits. Barriers to entry. Consumers enjoy perfect information and zero transaction costs.

Both firms are equally efficient. In some markets competition is so high that margins almost disappear. Price competition drives prices to zero – Aggressive Price Competition.

1.8.1. Bertrand Equilibrium

- Firms set $P_1 = P_2 = MC$

- If $MC < P_1 < P_2$, firm 1 earns $(P_1 - MC)$ on each unit sold, while firm 2 earns nothing. Firm 2 has an incentive to slightly undercut firm 1’s price to capture the entire market.

- Firm 1 then has an incentive to undercut firm 2’s price. This undercutting continues → Equilibrium: Each firm charges $P_1 = P_2 = MC$.

When firms have the same cost structure, price competition drives prices to the unit costs level and firms make zero profit. Therefore the industry equilibrium is independent of the firms number: $P = MC$ even if there are more than two competitors.

1.8.2. Bertrand Paradox

Even if there are only two competitors, prices will be set at the level of marginal cost (the perfect competition outcome). However, many industries look like Bertrand model but where prices are higher than marginal cost. This outcome might be due to capacity constraints, product differentiation and dynamic interaction.

1.9. Contestable Market

1.9.1. Key Assumptions

- Producers have access to same technology
- Consumers respond quickly to price changes
- Existing firms cannot respond quickly to entry by lowering price
- Absence of sunk costs

1.9.2. Key Implications

- Threat of entry disciplines firms already in the market
- Incumbents have no market power, even if there is only a single incumbent (a monopolist)

1.10. Price-Cost Margins and Concentration

Theory would predict that price-cost margins will be higher in industries with greater concentration (fewer sellers). There could be other reasons for inter-industry variation in price-cost margins (regulation, concentration of buyers and so on).

It is important to control for these extraneous factors if one need to study the relation between concentration and price-cost margin. Most studies focus on specific industries and compare geographically distinct markets.

For several industries, prices are found to be higher in markets with fewer sellers.

Four classes of market structure:

Structure	Herfindahl Index	Intensity of Price Competition
Perfect Competition	Usually < 0.2	Fierce
Monopolistic Competition	Usually < 0.2	Depends on the degree of product differentiation
Oligopoly	0.2 to 0.6	Depends on inter-firm rivalry
Monopoly	> 0.6	Light unless there is threat of entry

1.11. Lerner Index

Measure of market power and is defined as the weighted average of each firm's margin, with weight given by firms' MS.

$$L = \sum_{i=1}^N S_i \frac{P - MC_i}{P}, S_i = \frac{q_i}{Q} \text{ and } Q = \sum_{i=1}^N q_i$$

1.12. Economies of Scale and Concentration

Industries with large minimum efficient scales compared to the size of the market tend to have high concentration. The inter-industry pattern of concentration is replicated across countries. When production enjoys economies of scale, entry is difficult and hence profits are high.

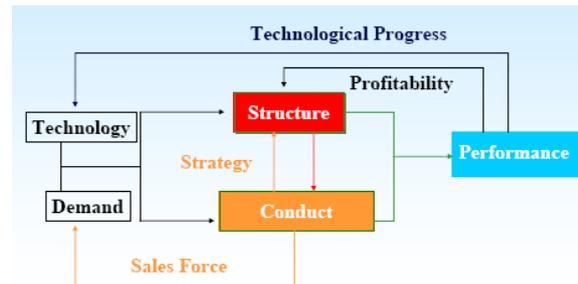
1.13. Bain Paradigm

Structure → Conduct → Performance

- Structure: Suppliers and buyers (number and size), product differentiation and entry conditions (minimum efficient scale, sunk costs and incumbents' reaction to entry).

- Conduct: Collusion, Strategic behavior (pricing (predatory), advertising and R&D (product differentiation) and vertical integration).

- Performance: Profitability and efficiency.



TOPIC 2: COLLUSION

2.1. Strategic Commitment

These are decisions that have long-run impact and are hard to reverse, e.g. installation of additional production capacity. These differ from tactical moves which are easy to reverse and have only a short-run impact, e.g. a store cutting the price on certain items (it's not sustainable to maintain low prices).

Necessary conditions for the commitment to achieve the desired result: to be visible, understandable and credible. To be credible, the commitment should be irreversible.

2.2. Commitment Value of Announcements

If a firm has an established reputation at stake, even announcement of intention to act can have commitment value. If the firm fails to match actions to words, its reputation will suffer. Smaller and newer firms cannot use announcements to indicate commitment. In general an announcement is not a credible threat and if it is not executed, they lose reputation.

2.3. Reversible and Irreversible Moves

Reversible moves are more likely to be matched by rivals than irreversible ones, e.g. airline industry supports – airlines quickly respond to price cuts by rivals than to moves like acquisition of another carrier.

2.3.1. Direct Effect

Following a certain strategy, it will have a direct impact in my firm (e.g. I decided to do a promotion and consequently my sales increase).

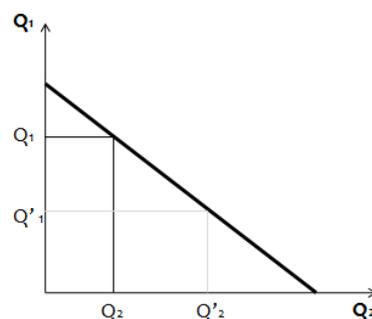
2.3.2. Strategic Effect

This is what happens when a firm reacts to my promotion, now maybe they are obliged to change prices also.

2.4. Strategic Complements

When a firm's action causes the rival to take the opposite action.

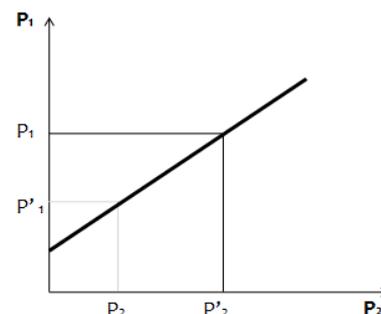
For example, in Cournot duopoly model one firm decision to increase output will cause the other to reduce its output. In this model, output decisions are strategic complements.



2.5. Strategic Substitutes

When a firm's action causes the rival to take the same action, then the actions are strategic substitutes.

For example, in Bertrand duopoly model one firm decision to increase the price will cause the other to increase the price as well. In this model, price decisions are strategic substitutes.



2.6. Two Effects of Commitments

A commitment may have a direct and a strategic effect on the firm's profitability. Direct effect is the change in the present value of profits assuming that the rival's tactics are unaffected by the commitment. The strategic effect is the further change in the present value of the firm's profits due to the rival adjusting its tactics.

2.7. Dynamic Price in Competition

Price competition can be viewed as a dynamic process. Decisions by a firm today will affect that firm's as well as its competitors behavior in the future. Dynamic competition can also occur in non-price dimensions such as quality.

2.8. Dynamic versus Static Models

Dynamic models can capture aspects of real world competition that the static models cannot. It is possible to incur short-term costs that are more than offset by long-term benefits (not captured in static models). It is also possible to see short-term profits (in a static model) followed by long-term negative effects. Static models cannot explain how firms can maintain prices above competitive levels without formal collusion. In other situations, even a small number of firms are sufficient to produce intense price competition. Dynamic models are useful in exploring such situations.

Static Models: Cournot and Bertrand

These models look at one time reaction to rival's move rather than all future opportunities and further behavior of the rival. Bertrand equilibrium: $P=MC$. Companies don't survive with a price above MC. Companies understand it's better to find a way to sustain high prices (is it possible to have outcomes when there are no agreements?). Can we find an equilibrium in a dynamic game which is different from the static one?

2.9. Cooperative Pricing

Firms would rather have their prices at monopoly levels than what is achieved under Cournot and Bertrand competition. The problem is that the market is a pie and everyone wants a slice. The only thing they can do is avoiding a price competition because if there is an intense competition, the pie shrinks and the market is not so attractive anymore.

Find a way: Explicit collusion. However in most countries (developed ones) explicit collusion to maintain prices at monopoly levels is illegal.

Cooperative prices occurs if prices persist above competitive levels without cooperative behavior from the firms. Firms do not talk with each other but try to reach an equilibrium. If firms compete for many periods and I understand if I decrease prices, my competitors will do the same, at the end of the day everyone loses except the consumer.

When rivals expect to play for many periods, there may be incentives against price competition. If one firm lowers the price, the MS may go up in the short-run. When the rival retaliates, the MS is back to the original level and the price is lower making both firms worse off.

When there are a small number of sellers, each seller will recognize that the profit from price cutting will be short lived (Chamberlin). The equilibrium result is the same as if there was explicit collusion to hold the prices above competitive levels.

2.9.1. Tit-for-Tat Strategy – “Olho por olho, dente por dente.”

When two firms compete over several periods, a tit-for-tat strategy may make cooperative pricing strategy. Since each firm knows that its rival will match any price cut, neither has an incentive to engage in price cutting. “We will not be undersold!” may mean higher prices through cooperative pricing.

2.10. Dynamic Price Competition

- Industry profit in each period: $\Pi(P) = (P-c) \times D(P)$
- We assume that $P^0 < P^M$
- Maximum industry profit: Monopoly profit $\rightarrow \Pi^M = (P^M - c) \times D(P^M)$
- Profit level when the market price is P^0 : Π^0
- We assume: $\Pi^M/n < \Pi^0$

Firms simultaneously set prices in each period of time. If all firms, but one (firm D), raise their prices to P^M , the firm that does not follow that strategy and sticks with the current price (keeps the entire market) makes higher profit P^0 – Prisoners' Dilemma situation.

2.10.1. Prisoners' Dilemma Situation

Everyone gets a share of the smaller pie. There is a firm that understands that if everyone increases prices and I do not, I'll get alone the entire market. However this will be only in the short-run till the answer of competitors. In long-run everyone stays with a piece of the small pie.

2.10.2. Grim Strategy

Is it possible to get the monopoly price as the outcome of a noncooperative game, without collusion among firms?

If all firms play the grim strategy:

In the first period each firm raises its price to P^M , the monopoly level. In each subsequent period, each firm observes past prices before setting its own price. If all firms have respected P^M then each firm will set P^M . If a firm observes its rival setting a lower price it punishes the deviation by reverting to P^0 .

A grim strategy is really strong, I am capable of maintaining my position against all the others. I will try to be cooperative and set a high price, P^M . If someone does not cooperate and lowers prices, I will do the same, revert to P^0 . However, if everyone cooperates they will have a share of the big pie – Π^M/n .

- Firm D deviates
Suppose that firm D sticks with current price P^0 whereas all other firms increase prices to P^M . Firm D assumes that all firms play according to the tit-for-tat strategy.
- Discounted present value of firm D's profit.

Deviates:

$$\Pi^0 + \frac{\Pi^0/n}{(1+i)} + \frac{\Pi^0/n}{(1+i)^2} + \dots = \Pi^0 + \frac{\Pi^0/n}{i}$$

Cooperates:

$$\Pi^M/n + \frac{\Pi^M/n}{(1+i)} + \frac{\Pi^M/n}{(1+i)^2} + \dots = \Pi^M/n + \frac{\Pi^M/n}{i}$$

However firm D will only cooperate if (condition for sustainable cooperative pricing).
Each firm must be sufficiently "patient".

Prices evolution when Firm D deviates

Period	1	2	3.....
Firm D	p^0	p^0	p^0
Other Firms	p^M	p^0	p^0

Profit evolution for Firm D

Period	1	2	3
Deviates	Π^0	Π^0/n	Π^0/n
Cooperates	Π^M/n	Π^M/n	Π^M/n

$$\frac{\frac{1}{n}[\Pi^M - \Pi^0]}{\Pi^0 - \frac{1}{n}\Pi^M} \geq i$$

2.10.3. Tit-for-Tat Pricing with many firms

The numerator is the annuity a firm will receive by cooperating. The denominator is the one time gain by not cooperating and inviting a tit-for-tat response from the rivals. When the condition is met, the present value of the annuity exceeds the one time gain from refusal to cooperate.

2.10.4. The "Folk Theorem"

In an infinitely repeated prisoners' dilemma game, any price at or above marginal cost and at or below monopoly price can be sustained if the discount rate is sufficiently small. Small discount rate makes the present value of the annuity from cooperative pricing larger and favors a cooperative outcome.

2.10.5. Coordination and equilibrium

In an infinite repeated game a collusive outcome can emerge as the equilibrium in an oligopoly. In order to achieve this outcome firms must solve a coordination problem. However coordination without explicit agreements or communication is very difficult.

- Solution

In order to have a collusive outcome we must have a strategy (like the grim strategy) that works as a Focal Point – each firm expects that all rivals will follow that strategy. There must be a way of giving signals to the other companies in order to them to understand the price level they should follow. If the government fixes the maximum price, it establishes a focal point that everyone will practice. It helps firms to have a collusive behavior.

Conventions and traditions make rivals intentions transparent and help with coordination.

2.10.5. Grim Trigger and Tit-for-Tar

Grim trigger strategy is to lower price to marginal cost indefinitely in response to rival's price cutting in one period. In tit-for-tat, the response lasts for only one period and future responses depend on future actions of the rival. Both of them are capable of sustaining cooperative pricing.

a. Tit-for-Tat

- The Superiority

It is easy to communicate: "We will not be undersold" or "Lowest price guaranteed". Easy to describe and to understand. Combines the properties of "niceness", "provocability" and "forgiveness".

- Misreads

When it is possible to misread rival's move tit-for-tat may not perform as well as more forgiving strategies. A firm may be able to observe rival's list price but not the effective price. A drop in the list price may be read as a price cut when effectively it may not be. A single misread will lead the firm to alternate between cooperative and non-cooperative moves. Any additional misreads can make the pattern of moves even worse. When there is a possibility of misreads, deferred response may be better than immediate response.

2.11. Market Structure and Cooperative Pricing

The easiness of achieving cooperative pricing may depend on certain aspects of market structure. Some such aspects are concentration, conditions that affect reaction speeds and detection lags, asymmetries among firms and price sensitivity of buyers.

a. Concentration

Cooperative pricing is more likely to happen in a concentrated market than in a fragmented market. In a concentrated industry, the typical firm gets a larger share of the benefits of higher prices. The deviator's short-term gain is smaller since it started with a larger MS. Thus, the more concentrated the market, the larger the benefits from cooperation and the smaller the cost of cooperation.

b. Conditions that affect reaction speeds

As the speed with which a firm can respond to the rival's moves increases, cooperative pricing becomes easier to sustain. If the price cuts can be matched instantaneously, cooperative pricing can be maintained for any discount rate. As the time interval for the short-term gain for the deviator is reduced, the present value of benefits from cooperation is more likely to exceed this short-term gain.

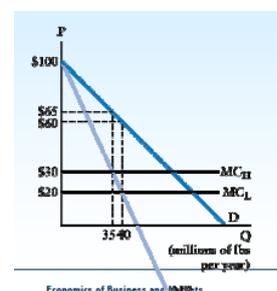
- Determinants of reaction speed

Lag in detecting price changes, frequency of interactions with the rival, ambiguity regarding which rival is cutting prices, inability to distinguish between price cuts by rivals and lower demand as the cause of drop in sales.

c. Relevant Structural Conditions

Lumpiness of orders, information availability regarding sales transaction, the number of buyers and volatility of demand and cost conditions.

- Lumpiness of orders: when orders are lumpy, the frequency of competitive interactions is reduced, e.g. lumpy orders in airframe manufacturing, ship building. Lag between orders makes the gain from price cutting more valuable relative to the cost imposed by rival's retaliation.
- Availability of information about sales transactions: deviations from cooperative pricing are easier to detect when the transactions are public than when they are private, e.g. transaction prices for gasoline sales are easily observable while they are not easily observable for automobile sales. Deviations from cooperative pricing are harder to detect when the products are custom made individual buyers than when they are standardized. Complex transactions may make misreadings more likely compared with simple transactions.
- Number of buyers: when firms set prices in secret, deviation from cooperative pricing is easier to detect if there are many small buyers than when there are a few large buyers. With a large number of buyers, it is harder to do secret price cuts.
- Volatility of demand: price cutting is harder to detect when demand conditions are volatile. When fixed costs are large, marginal cost declines rapidly with reduced output and monopoly price fluctuates a lot. With large fixed costs, cooperative pricing involves chasing a moving target.
- Asymmetries among firms and coordination problems: when firms are not identical cooperative pricing becomes more difficult. Firms differ in the incentives they face for cooperative pricing due to



different costs, different capacities and product qualities.

- Asymmetries in cost: the marginal costs are different for the firms and so are the monopoly prices preferred by each of the firms. Without a single monopoly price to serve as focal point, coordination becomes difficult. Differences in product quality can create similar obstacles to coordination.
- Asymmetries in capacity: small firms have stronger incentives to defect from cooperative pricing than their larger rivals because larger firms get a larger share of the benefits of cooperative pricing, they may weak incentives to punish small deviators and small firms have a large set of potential customers to attract by price cutting.

d. Effect of Buyer's Price Sensivity

Temptation to cut prices is more when buyers are very price sensitive. Horizontal differentiation reduces buyers' price sensivity and deters price cutting. When price sensivity varies across market segments, cooperative pricing will succeed/fail depending on the relative size of price insensitive segment.

2.11.1. Practices that facilitate cooperative pricing

Firms can facilitate cooperative pricing by price leadership, advance announcement of price changes, most favored customer clauses and uniform delivered pricing.

a. Price leadership

The price leader in the industry announces price changes ahead of others and others match the leader's price. The system of price leadership can break down if the leader does not retaliate if one of the follower firms defects.

- Two kinds of price leadership

Sometimes, the price leader may simply act as barometer of market conditions. Even without oligopolistic conditions, firms follow the price leader because they face the same changes in market conditions. Oligopolistic price leadership system may camouflage as barometric price leadership by firms taking turns to be the leader.

b. Advance announcements of price changes

Advance announcement reduces the uncertainty that the rival will undercut the firm. It also gives the firms to roll back the changes if the rival deviates from cooperative pricing.

c. Most favored customer clauses

Most favored customer clause allows the buyer to pay the lowest price charged by the seller. While this clause appears to benefit the buyer (a price cut to any other customer lowers the price for the most favored customer) it also inhibits price competition.

d. Uniform delivered pricing

When transportation costs are significant, pricing could be either uniform FOB (Free On Board) pricing or uniform delivered pricing. With the last one, the response to price cutting can be “surgical” and effective in deterring defection from cooperative pricing.

TOPIC 3: PRICING

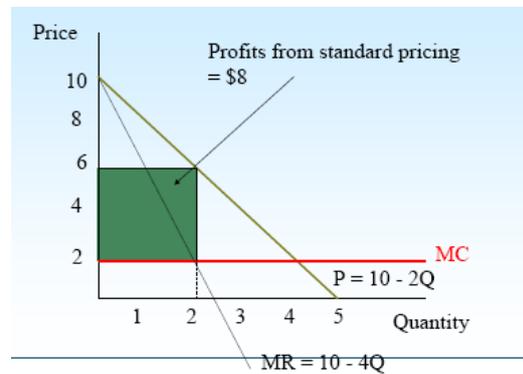
The firm tries to capture most of the value created by its own product.

Key factors: demand elasticity, costs, complement and substitutes, dynamics (loyalty, experience curve), information, psychological aspects and competition.

- Simple Markup Rule

$$MR = P \times \left[\frac{1+E_F}{E_F} \right] \Leftrightarrow P = \left[\frac{E_F}{1+E_F} \right] \times MC$$

The optimal price is a simple markup (margem de lucro) over relevant costs.



- Markup as a pricing strategy

Markup over average total costs, $mk = (P - ATC) / ATC$.

However this has a lot of problems like using ATC instead of MC.

- Market Segmentation

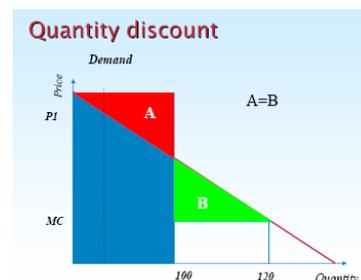
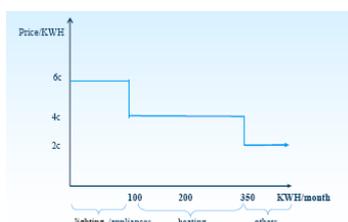
A pricing strategy depends upon costs, price sensitivity and competition. → If any of these factors varies depending on market segments, marketing strategies need to be differently applied. → Price Discrimination: Act of extracting the maximum WTP from each segment by charging low WTP < high WTP in a way that consumers in high WTP have no desire/ability to buy the product offered to those of low WTP.

a. Kinds of Price Discrimination

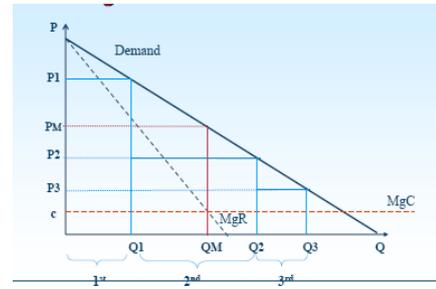
- 1st degree: Specific price for each customer. Charging the maximum amount each consumer will pay for each incremental unit. e.g. car dealership. Transaction costs and information constraints make this difficult to practice. Consumers cannot resell the good for this strategy to work.



- 2nd degree: Price depends on volume/bundle, e.g. menu pricing, volume discounts.



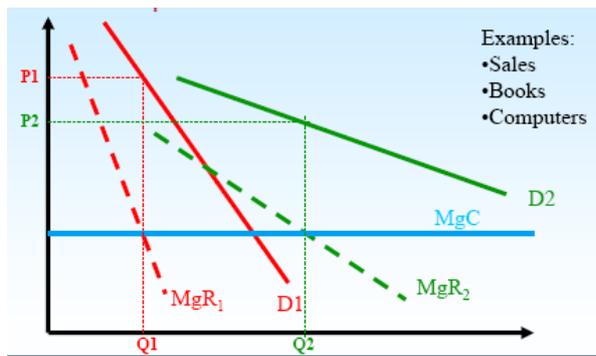
It is also called vertical differentiation and is widely practiced by firms selling physical goods to consumers with heterogeneous valuations. Vertical differentiation strategy is not optimal when the highest quality product has the best benefit-to-cost ratio.



- 3rd degree: Price specific to a segment, e.g. student discount for movies, ladies' night.

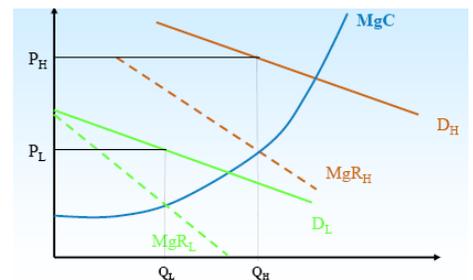
- ★ Suppose the elasticity of demand for Kodak film in the US is $E_U = -1.5$, and the elasticity of demand in Japan is $E_J = -2.5$
- ★ Marginal cost of manufacturing film is \$3
- ★ $P_U = [E_U / (1 + E_U)] \times MC = [-1.5 / (1 - 1.5)] \times \$3 = \$9$
- ★ $P_J = [E_J / (1 + E_J)] \times MC = [-2.5 / (1 - 2.5)] \times \$3 = \$5$
- ★ Kodak's optimal third-degree pricing strategy is to charge a higher price in the US, where demand is less elastic

a.1. Intertemporal pricing discrimination



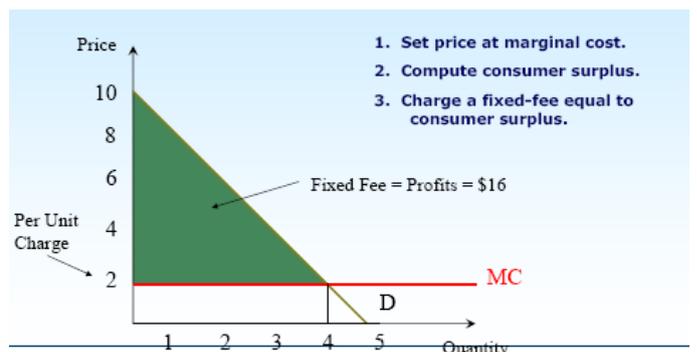
a.2. Peak-load pricing

When the demand during peak times is higher than the capacity of the firm, it should engage in peak-load pricing. As it is not possible to adjust supply throughout the time, we adjust demand.



a.3. Two part-pricing

When it is not possible to charge different prices for different units sold and demand information is known, it is possible to practice fixed fee and a per unit charge.

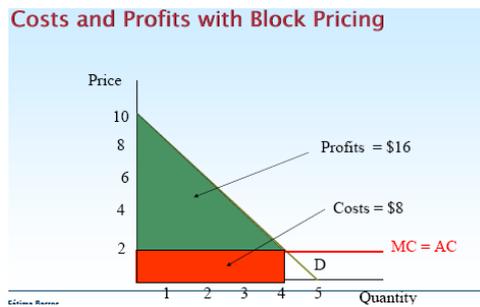
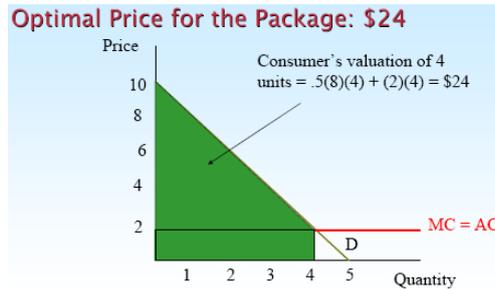


- ★ **Separation:** $P = MgC$ and
 - ✓ $T_L = s_1 + s_2 + s_3$
 - ✓ $T_H = s_1 + s_2 + s_3 + s_4 + s_5 + s_6$
- ★ **Uniform Tariff:** trade-off between a too high tariff (light users will exit the market) and a too low tariff (it will be adopted by heavy users)
 - ✓ 1^a hip.: $T = s_1 + s_2 + s_3$ e $P = MgC$; H users gain surplus $= s_4 + s_5 + s_6$ and Profit $= 2 * T$
 - ✓ 2^a Hip: $T = s_1$ e $P > MgC$; Profit $= 2 * (s_1 + s_2) + s_3 + s_4$
 - ✓ Firm's profits increase iff $s_4 > s_3$.

a.4. Block pricing

Packaging multiple units of a product together and selling them as one package.

e.g. $P = 10 - 2Q$; $C = 2Q$



a.5. Commodity bundling

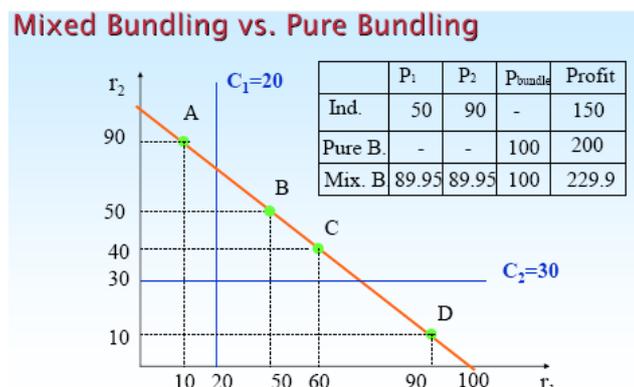
The practice of bundling two or more products together and charging one price for the bundle. There is pure bundling and mix bundling.

	Film A	Film B
Theater X	\$12 000	\$3 000
Theater Y	\$10 000	\$4 000

Solution:
 Separated Prices: $P_A = \$10\ 000$; $P_B = \$3\ 000$;
 $TR = 2x(\$10\ 000 + \$3\ 000) = \$26\ 000$
 Bundle: $P_{bundle} = \$14\ 000$; $TR = 2x\$14\ 000 = \$28\ 000$

	Film A	Film B
Theater X	\$12 000	\$4 000
Theater Y	\$10 000	\$3 000

Solution:
 Separated prices: $P_A = \$10\ 000$; $P_B = \$3\ 000$;
 $TR = 2x(\$10\ 000 + \$3\ 000) = \$26\ 000$
 Bundle: $P_{bundle} = \$13\ 000$; $TR = 2x\$13\ 000 = \$26\ 000$



a.6. Cross-subsidies

Prices charged for one product are subsidized by the sale of another product. May be profitable when there are significant demand complementarities effects.

b. Main conclusions

- 1st degree price discrimination, block pricing and two-part pricing permit a firm to extract all consumer surplus.
- Commodity bundling, 2nd degree and 3rd degree price discrimination permit a firm to extract some (but not all) consumer surplus.
- Simple markup rules are the easiest to implement, but leave consumers with the most surplus and may result in double-marginalization.
- Different strategies require different information.

TOPIC 4: PRODUCT DIFFERENTIATION

Company concentrates on creating a highly differentiated product line and marketing program so it comes across as the class leader industry. Products fulfilling the same need, do not have identical features.

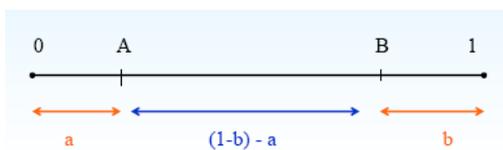
4.1. Horizontal vs Vertical Differentiation

4.1.1. Horizontal Differentiation: It's variety. Products are different according to features that make them more attractive for certain group of consumers than for others. With the same price, different customers buy different products, e.g. blue is not better than red, it is different.

- Hotelling Model

Introduces differentiation in one dimension – the distance between the consumer location and the firm location. Geographic location is a differentiator factor as it implies transportation cost. Direct costs – bus ticket, indirect cost – opportunity cost of time.

Indifferent Consumer Location: x^*

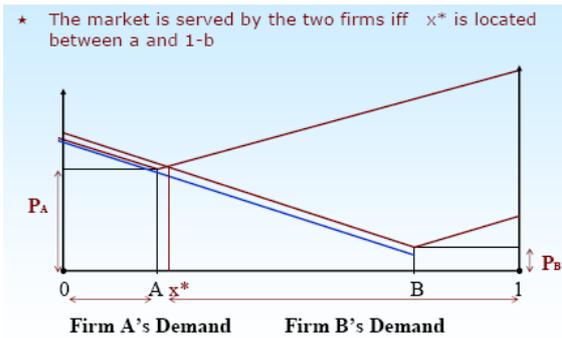
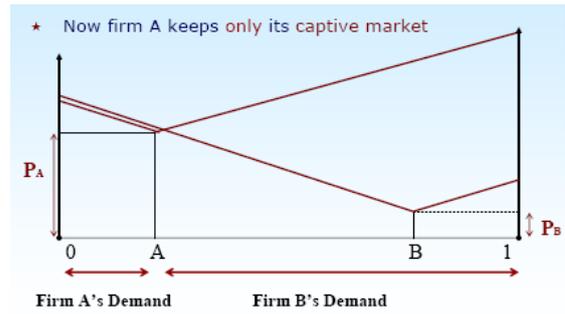
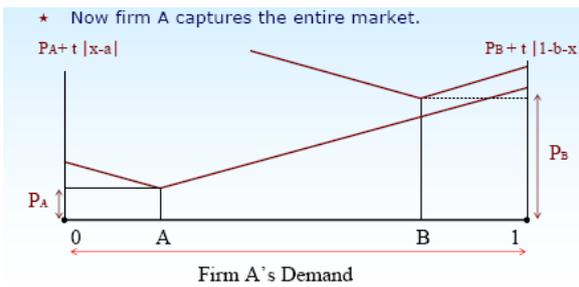
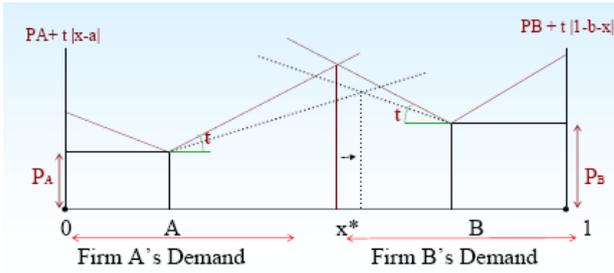


$x^* = \frac{P_B - P_A}{2t} + \frac{1-b+a}{2}$, when $a \leq x^* \leq 1-b$, x^* is the frontier between consumers that buy from firm A and from firm B.

Condition for $a < x^* < 1-b$:

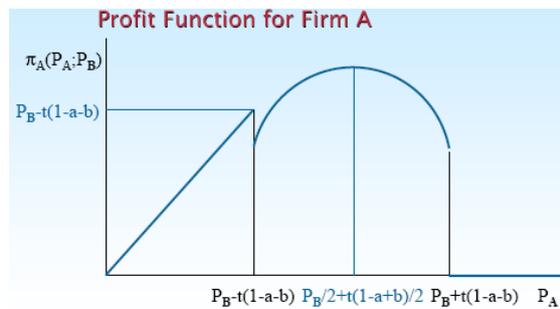
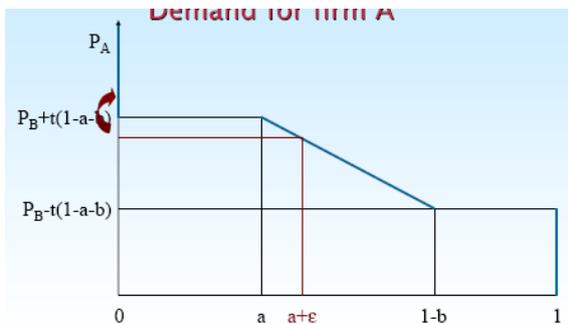
$$x^* = (P_B - P_A) / 2t + (1-b+a) / 2; \quad x > a: P_A < P_B + t(1-b-a); \quad x < 1-b: P_A > P_B + t(1-b-a);$$

$$a < x < 1-b \text{ if } P_B - t(1-b-a) < P_A < P_B + t(1-b-a)$$



Demand for firm A:

$$\left\{ \begin{array}{l} q_A = 0 \text{ if } P_A > P_B + t(1-b-a) \\ q_A = (P_B - P_A) / 2t + (1-b+a) / 2 \text{ if } P_B + t(1-b-a) \geq P_A \geq P_B - t(1-b-a) \\ q_A = 1 \text{ if } P_A < P_B - t(1-b-a) \end{array} \right.$$



- Nash equilibrium for a price game

Is a pair (P_A^*, P_B^*) such that P_A^* is the best response against P_B^* and vice-versa. Suppose that $a = 1-b$, that is, assume that both firms are located on the market center. In this case the model is equivalent to the Bertrand model and there exists a unique equilibrium given by: $P_A^* = P_B^* = c = 0$. There is no differentiation.

If prices are fixed by a regulator,

Prices are identical and independent to firms' locations, $P_A = P_B = P$. Which will be the equilibrium location for each firm? Indifferent consumer $\rightarrow x^* = (1-b+a)/2$.

Which is the Nash Equilibrium?



If the firm B is located to the right of the central point ($1-b > 1/2$) then the firm A's best response is to relocate to the left of firm B's location. But

then the best response of firm B is to relocate to the left of firm A's location. The Nash equilibrium in location is the market center $a = (1-b) = 1/2$. If there is no competition in prices firms tend to locate in the center of the variety space with a minimal product differentiation. \rightarrow Minimum Differentiation Principle.

- Two stages game

1st stage: firms choose their respective location in a non-cooperative way.

2nd stage: firms choose their prices, given the location chosen in the first stage of the game, in a non-cooperative way.

We solve the game backwards: we start by analyzing the non-cooperative price equilibrium taking locations as given.

- Price equilibrium for given firms' location

$$P_A^* = t(1 + (a-b)/3)$$

$$P_B^* = t(1 + (b-a)/3)$$

The pair (P_A^*, P_B^*) is a price equilibrium if firms' locations respect the following conditions:

$$\left(1 + \frac{a-b}{3}\right)^2 \geq \frac{4}{3}(a+2b)$$

$$\left(1 + \frac{b-a}{3}\right)^2 \geq \frac{4}{3}(b+2a)$$

If $a=b$ (symmetric locations) then those conditions imply that $a \leq 1/4$ and $b \leq 1/4$.



- Quadratic transportation costs

If we consider quadratic transportation costs we can show that each firm will choose to locate in one end of the market. \rightarrow Maximum Differentiation Principle.

Intuition: when firms are located far apart they reduce the intensity of price competition and gain market power.

4.1.2. Vertical Differentiation: It's quality. Products can be ordered according to their objective quality. The firms with higher quality products can set higher prices and if they don't do that, consumers will all choose them in detriment of the low quality ones.

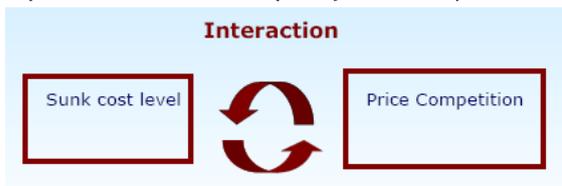
TOPIC 5: ENTRY BARRIERS

5.1. Entry decision

Expected profits post-entry > Sunk costs of entering the market.

Prices depend on sunk costs level but only in an indirect way because those costs influence the entry decision.

Equilibrium structure (entry decision):



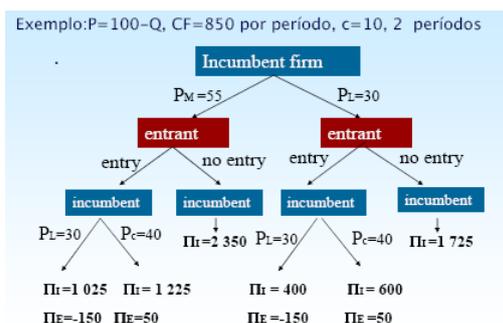
Competition must be anticipated so as the retaliation of the incumbent firms.

- Bain: There are entry barriers if in the long-run incumbent firms can set $p > \min AC$ without attracting new entries.
- . The technology pattern and consumers' tastes that characterize an industry tend to be similar across countries.
- Sutton: In general industry concentration is lower in countries where the market size (sales volume) is high.
- Stigler: Entry barriers are defined as the costs that might be incurred by the entrants but have already been incurred by the incumbents (cost asymmetry).

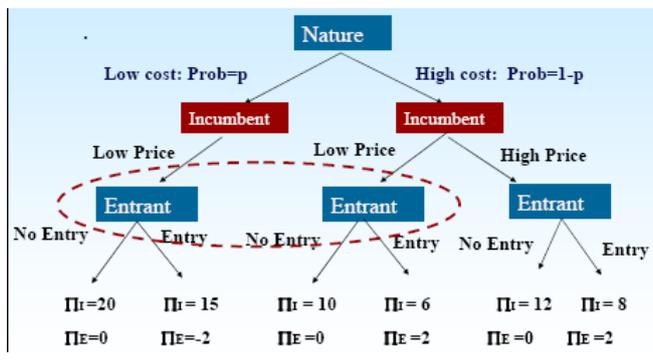
5.2. Entry barriers

Legal, structural, strategic.

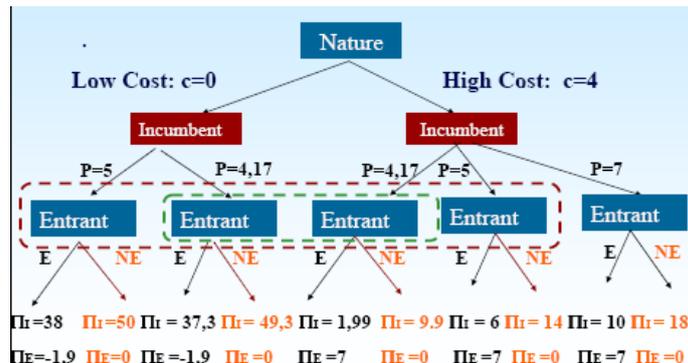
- Strategic: entry occurs when a new firm starts to produce and sell \neq entry by acquisition.
- . Two types of threat to incumbents: reduction of the pie share (entrants take away MS) and reduction of the pie size (intensify competition – introduction of new products and prices decrease).
- . Limit price – the incumbent firm deters entry setting a pre-entry low price. It can be a failure when it is implicit that entrant has irrational expectations about the incumbent's post-entry price policy. It works if the incumbent has a cost advantage and sets $P < \min AC_{\text{Entrant}}$ and if the entrant faces uncertainty about the rival's cost or about demand.



Entrants uncertainty about incumbents' costs.



Uncertainty and signaling



- Predation: Practices that have rivals' exit as the main goal. Price below cost to injure rival firms and thus induce their exit is called predatory pricing. Predatory \neq Aggressive prices.
- . The Long Purse or deep pockets – a predatory pricing strategy can be successful if the prey is financially constrained and cannot stand a long price war.
- . Reputation: Sometimes profit losses associated to a predatory strategy are the price to pay to build a reputation that in the future no entry in other markets will take place (when firms operate in different geographical markets).
- . Chain Store Paradox
- . Fighting Brands – the incumbent introduces a new brand with under cost prices and specifically designed to compete with the prey's product, keeping this way, his own brand untouchable.

Real threat to entrants: Incumbent's excess capacity.

Example: excess capacity to discourage entry (II)

Cap. K	50	60	70	80	90	100
Q_I	50	60	70	80	90	90
P_M	75	70	65	60	55	55
Π_M	1650	1700	1650	1500	1250	950

Example: excess capacity to discourage entry (III)

Incumbent K	50	60	70	80	90	100
Entrant K*	35	30	25	20	15	10
$Q_I + Q_E$	85	90	95	100	105	110
P	57.5	55	52.5	50	47.5	45
Π_I	775	800	775	700	575	400
Π_E	512.5	350	212.5	100	12.5	-50

5.2.1. Market classification according to entry barriers

- Blocked entry: the incumbent firm does not need to adopt any strategy to deter entry.
- Accomodated entry: if structural barriers are low and strategies for entry deterrence are not efficient or costs to deter entry are higher.
- Blockaded entry: the incumbent firm can use strategies to block entry. These strategies are useful if the incumbent firm can increase price once it remains monopolist or this strategy changes entrant expectations about the nature of post-entry competition.

5.2.2. Summary

Entry Costs	Incumbent Firm	Reaction to threat of entry
Very high	Set monopoly capacity	Ignore
Very low	Choose capacity	Take into account entrants' reaction curve
Intermediate	Choose capacity large enough	Induce entrant to enter

5.3. Cournot equilibrium

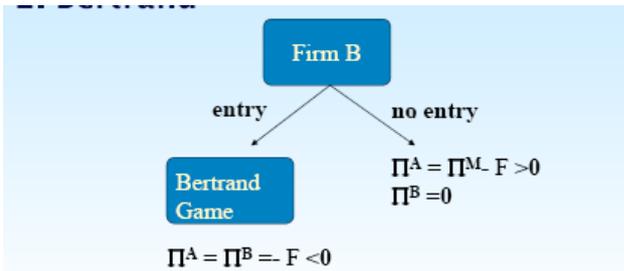
$$\max_{q_i} \pi_i = q_i \left(\frac{S}{N + \sum_{j=1}^N q_j} \right) - cq_i$$

$$\frac{\partial \pi_i}{\partial q_i} = 0 \therefore q^* = \frac{(N-1)S}{N^2 c} \quad e \quad P = \frac{Nc}{N-1}$$

$$\pi_i = (p - c)q_i^* = \frac{S}{N^2}$$

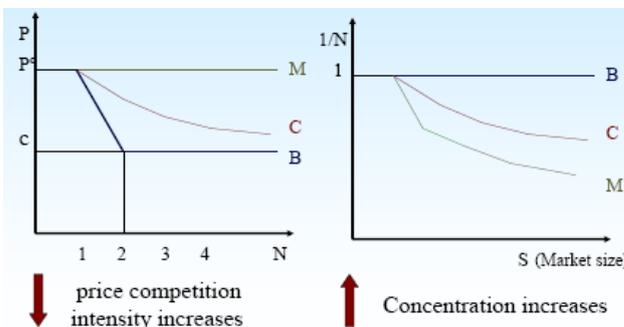
When market size increases relatively to setup costs ($S/F \uparrow$), the market structure becomes more fragmented ($N^* \uparrow$). Concentration \downarrow .

5.4. Bertrand equilibrium

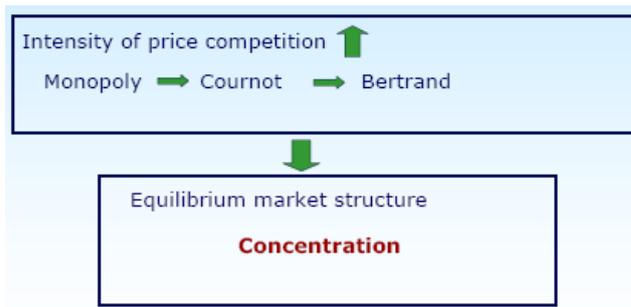


For any level of sunk costs $0 < F < \Pi^M$ there is a unique subgame perfect equilibrium where firm A is monopolist and firms B stays out of the market.

5.5. Monopoly (cartel)



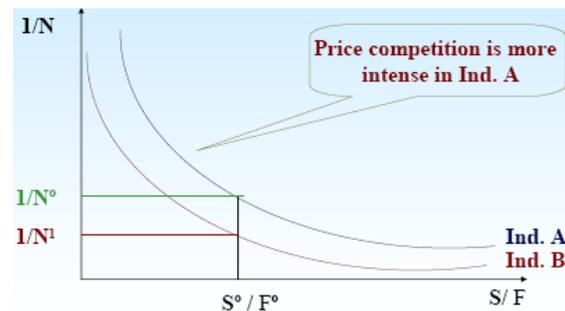
5.6. Conclusions



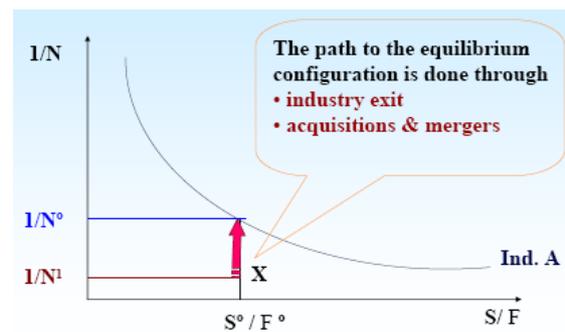
There is a lower bound for the concentration level that can be sustained as an equilibrium. The concentration decreases when market size increases. If two markets are similar in terms of setup costs (entry costs) but price competition is more intense in one of these markets

then the lower bound for concentration in this industry is relatively higher.

Paradox: very intense price competition leads to a more concentrated equilibrium structure.



Exogenous factors that can change results: product differentiation and competition policy.



TOPIC 6: ADVERTISING

6.1. Classification of goods

Search good (product's features are known before the purchase) vs experience good (product's features are known only after the purchase).

6.2. Classification of advertising

- Informative: Builds primary demand (useful for new products). Selling the idea, why it is good to have a certain product.
- Persuasive: Builds secondary demand (useful for competitive industries). Focus on specific details/attributes of your product. Tries to convince consumers that ours is better than competition in order to steal their customers.
- Reminder: Maintains "top of mind" awareness. For seasonal purchases/budgets. (Useful for industry leaders, builds brand loyalty). Claims "Don't forget about us!"

6.3. Stylized effects

Profitability of an industry \Leftrightarrow Advertising intensity

In equilibrium advertising is a signal of high quality.

6.4. Optimal level of advertising

Dorfman-Steiner formula: $\frac{A_i}{P_i Q_i} = \frac{\eta_i}{\epsilon_i}$

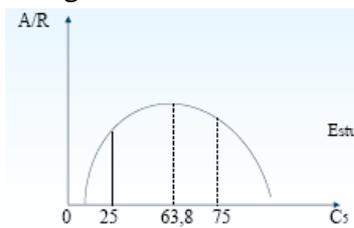
$\eta_i = \frac{\partial Q_i}{\partial A_i} \times \frac{A_i}{Q_i}$ and $\epsilon_i = -\frac{\partial Q_i}{\partial P_i} \times \frac{P_i}{Q_i}$. The advertising-to-sales ratio is greater, the greater the advertising elasticity of demand and the lower the price elasticity of demand (or the greater the price-cost margin).

6.5. Dynamic Analysis

The advertising impact on demand has an intertemporal effect – the current advertising level affects not only the current but also the future demand. It increases the value of a long-term asset, the brand, which affects the future demand.

6.6. Market structure and advertising intensity

> number of firms \rightarrow < concentration \rightarrow effects that determine advertising intensity: each firm's margin decreases (-); each firm captures a lower share of the demand increasing effect of advertising (-); each firm captures a larger share of the demand (+); net effect is ambiguous.



The advertising intensity increases until intermediate concentration levels and then starts to decrease.

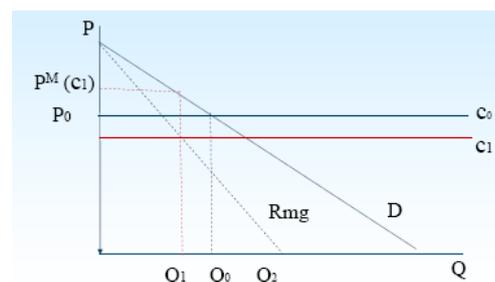
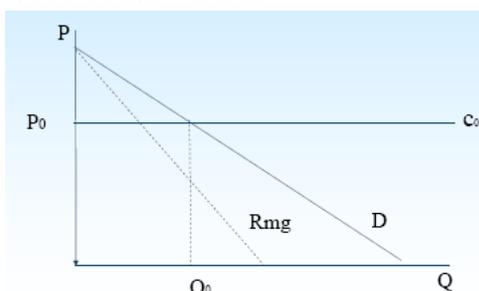
Advertising \rightarrow Gives info about product's characteristics \rightarrow Increases product differentiation \rightarrow Decrease in price competition.

HOWEVER when Advertising \rightarrow Gives info about product's price \rightarrow Increases price competition.

6.7. R&D

- Innovation: development, adoption and commercialization of new processes, products and organizational structures.

- Process Innovation:

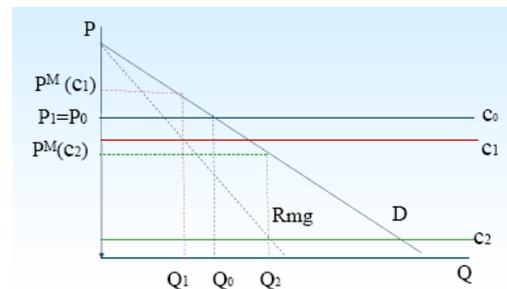


A company is able to decrease its production costs to $c < c_0$. If $P^M(c)$ is the monopoly price

when the unitary cost is c : the innovation is not drastic if $P^M(c) > c_0$ and it is drastic if $P^M(c) < c_0$.

Non-drastic innovation

A cost-reduction is not sufficiently high to allow the company to practice monopolist price. So it will practice $P_1 = c_0$, it stays alone in the market and sells Q_0 . A small innovation does not change the market price neither the quantity demanded. The company which innovates sells to all the market and makes a profit of $(c_0 - c_1) Q_0$.



Drastic innovation

The innovation implies a big reduction of the costs and therefore the company is able to be alone in the market and practice the monopolist price. A big innovation allows a price reduction and an increase in the quantity sold. What distinguishes a big from a small innovation depends on the demand and the market structure, besides the costs' reduction itself.

- Innovation Race

The innovation timing is crucial. The company that discovers first a new product or process wins due to the patent, the monopoly profits and also because consumers see the innovator as a high quality producer.