OLIGOPOLY

Non collusive models

Definition

In an oligopoly the number of firms is relatively small. What better defines it is the term "**interdependence**": each firm must determine its price or output, while making assumptions about its rivals' likely reactions to its own actions.

Conjectural variations are the assumptions of a firm about the reactions expected from its rivals in response to its own actions.

There are different models for the determination of output, assuming the absence of collusion. We will see the following:

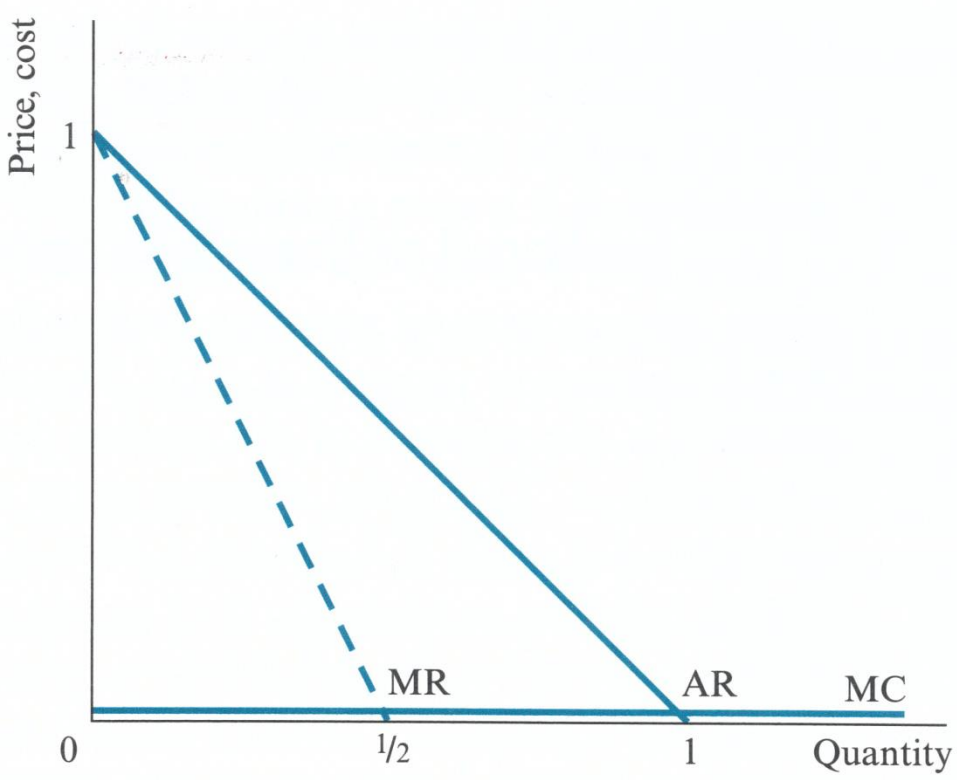
1) Cournot's duopoly model;
2) Stackelberg's duopoly model.

Furthermore, we will see the following model for the determination of price

1) Bertrand's duopoly model.

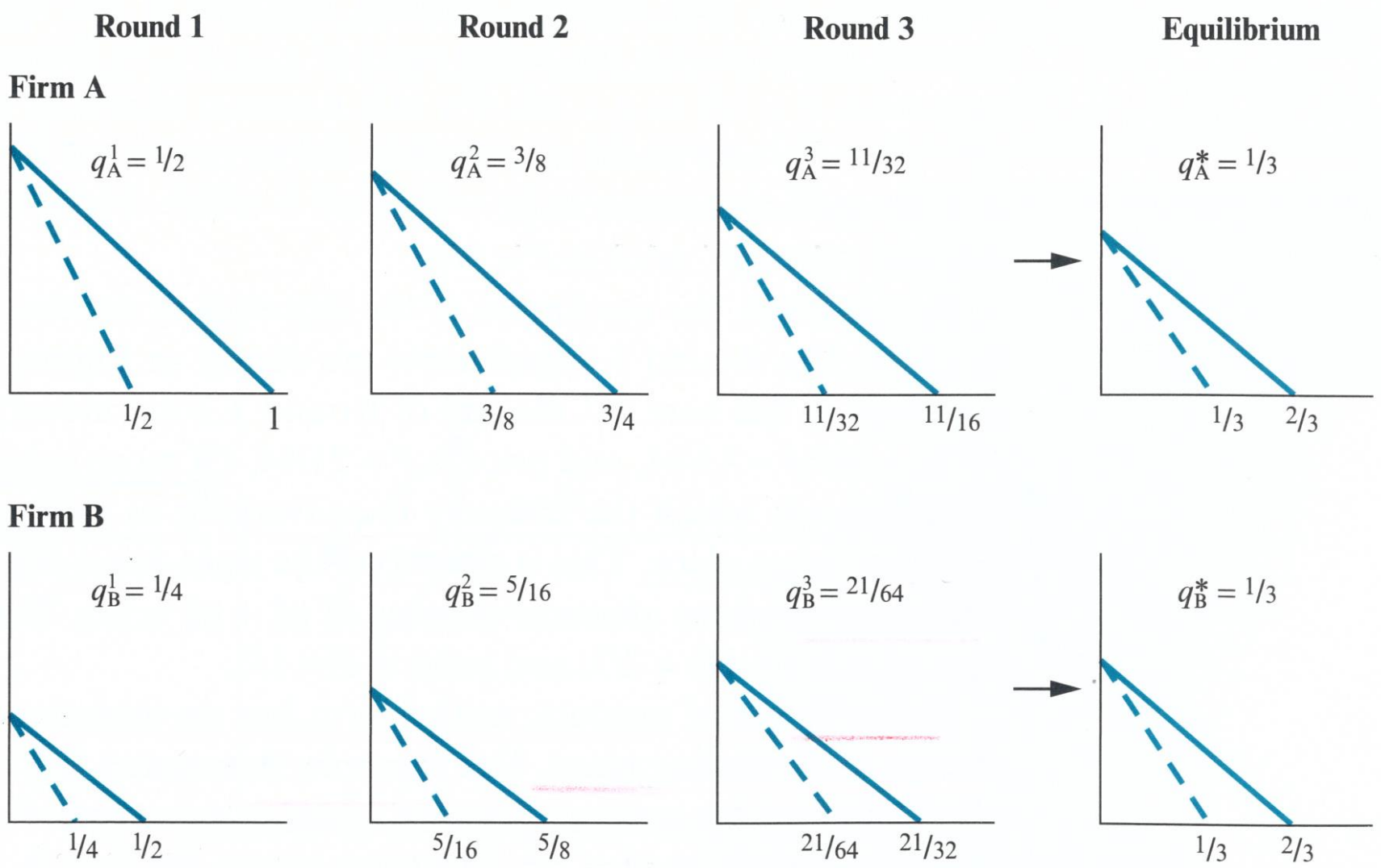
Non collusive models
a) Cournot: assumptions

1. Two-firm oligopoly producing the same identical product;
2. Firms have market power;
3. Unsurmountable barriers to entry;
4. No marginal costs;
5. Market demand (AR) is assumed linear;
6. Firms chose the output level that maximises profit;
7. **No conjectural variation**: each firm assumes that the other firm will not react (i.e. will not adjust its output) to its decision. Equilibrium is reached by means of a series of actions and reactions.



Non collusive models
a) Cournot: functioning

- Each firm acts independently (no collusion) and maximises its profit like a monopolist (MR=MC).
- Firm A is the first to set the output that maximises its profit and it is initially monopolist.
- Firm B subsequently sets the output that maximises its profit with a residual demand curve in comparison with firm A.
- With a sequence of decisions of A and B the market arrives to an equilibrium in which no firms have incentive to modify their own output, given those of the rival (Nash Equilibrium).



Round 1:
A= 1 => 1/2
B = ½ => ¼

Round 2:
A= 4/4 - ¼ = 3/4 => 3/8
B = 8/8 - 3/8 = 5/8 => 5/16

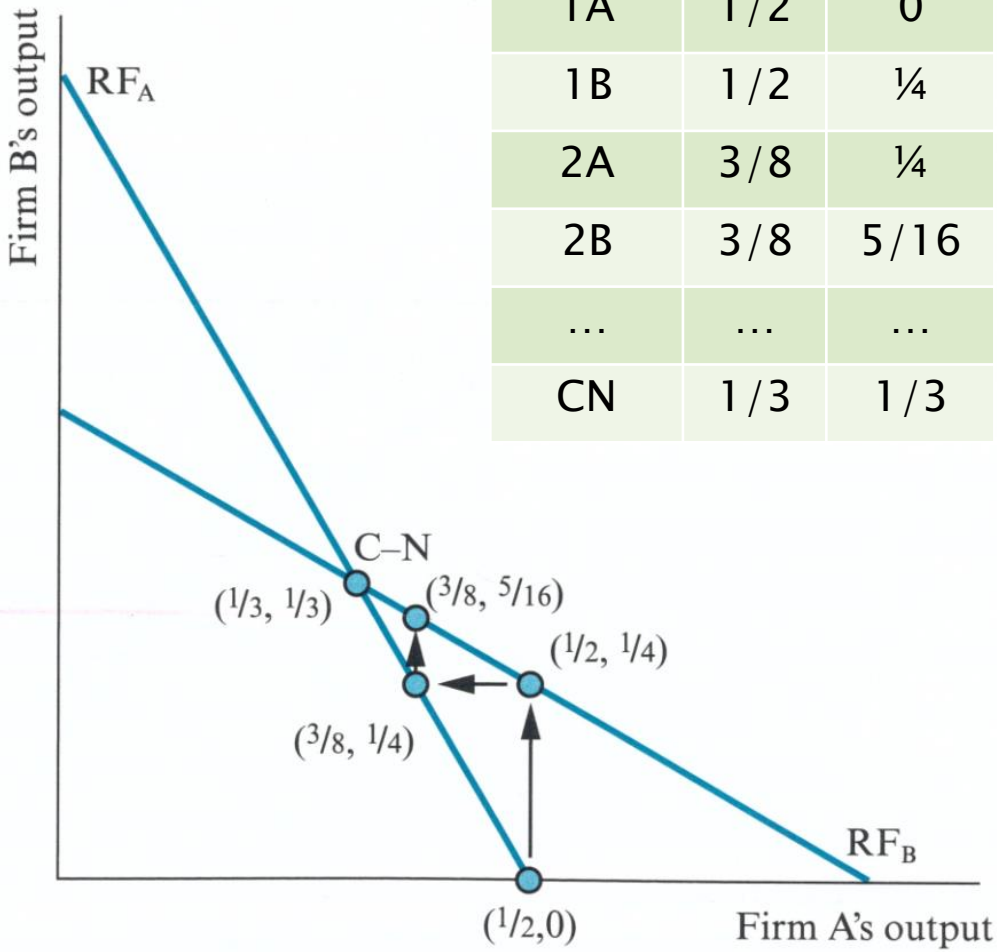
Non collusive models a) Cournot: reaction functions

The Cournot model can be represented by means of *reaction functions* of A e B firms.

The *reaction function of firm A* indicates the optimal output level of firm A for each output level of firm B.

The two reaction functions (that are the same for two identical firms) intersects only in one point, in which both firms maximise their profit, given the rival's behaviour: **Cournot-Nash equilibrium**

Round	A	B
1A	1/2	0
1B	1/2	¼
2A	3/8	¼
2B	3/8	5/16
…	…	…
CN	1/3	1/3



Non collusive models
a) Cournot: pros and cons

Pros

- It introduced the use of mathematical techniques to solve economic problems
- It identifies an equilibrium located between the extremes of monopoly and perfect competition
- It can be used as benchmark for further discussion

Cons

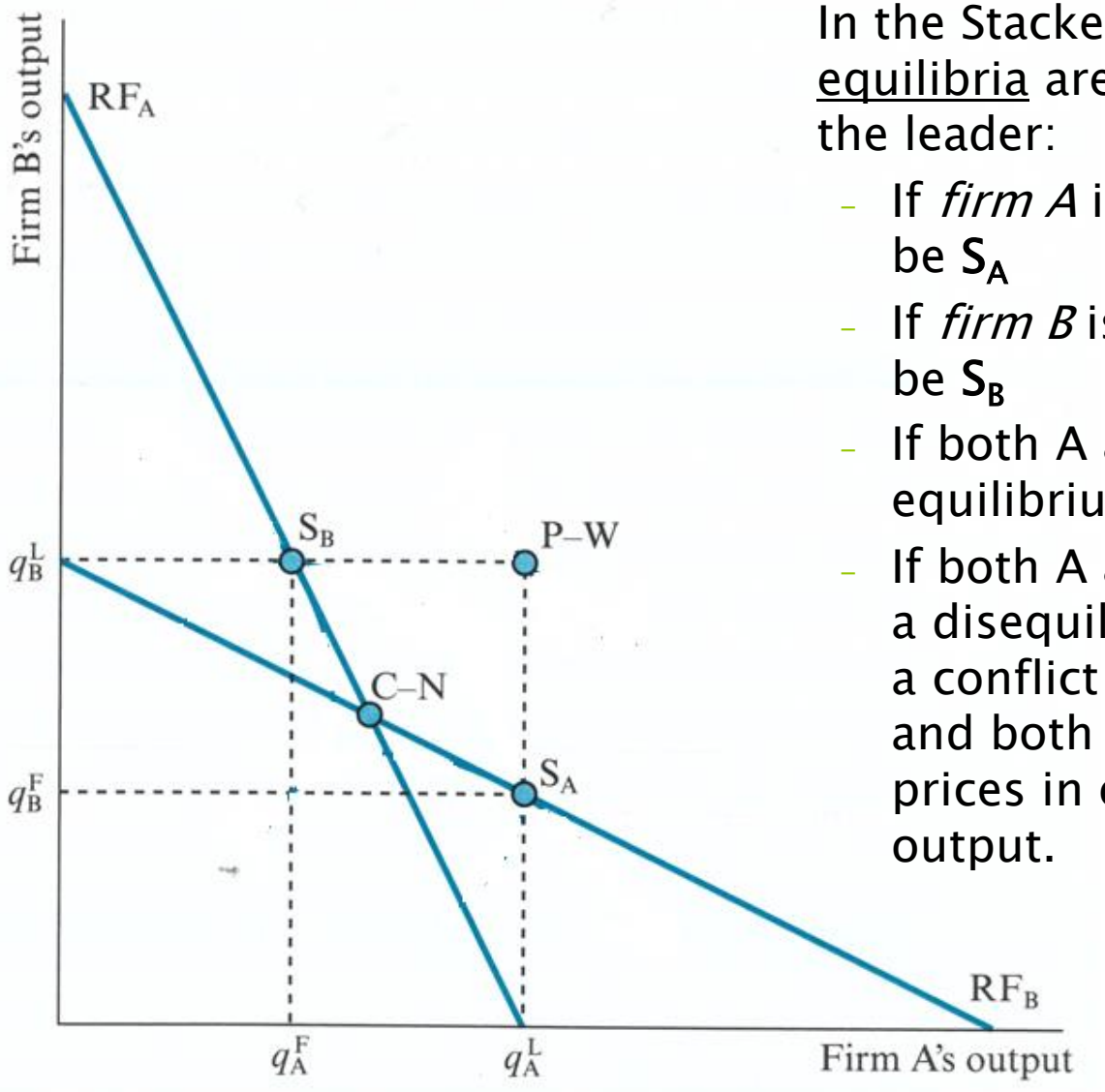
1) The **zero conjectural variation assumption**, according to which each firm believes that the rival will not change its own production level, appears to be quite unrealistic. Each time either firm adjusts its own output on the basis of the zero conjectural variation assumption. But on each occasion this turns to be false, because the other firm does react changing its output. No learning.

2) It ignores the possibility for firms to look for cooperative or collusive solutions.

Non collusive models
b) Stackelberg: the leader-follower model

- Same assumptions of the Cournot model, a part from the zero conjectural variation assumption, which is dropped **for one** of the two firms. For example firm A knows that firm B will always choose an output level on its reaction function (that firm A knows).
- The possibility of exploiting an information advantage for only one of the two firms can be interpreted as a **first-mover advantage**: the firm is the first to enter the market and the first to choose the output level.
- This implies that in certain markets there are leader firms (with high market shares) and followers (with lower market shares).
- The model represents such an advantage by the fact that firm A knows the reaction function of firm B and **chooses the output maximising its profit among the values on the firm B's reaction function** (for example in Sa).

Cournout-Nash equilibrium and Stackelberg equilibria



In the Stackelberg model, different equilibria are possible, according to who is the leader:

- If *firm A* is the leader, equilibrium will be **S_A**
- If *firm B* is the leader, equilibrium will be **S_B**
- If both A and B are *followers*, equilibrium will be **C–N** (Cournot)
- If both A and B are *leaders,* there will be a disequilibrium in **P–W** (*Price War*): it is a conflict point with overproduction, and both firms are forced to cut their prices in order to sell the additional output.

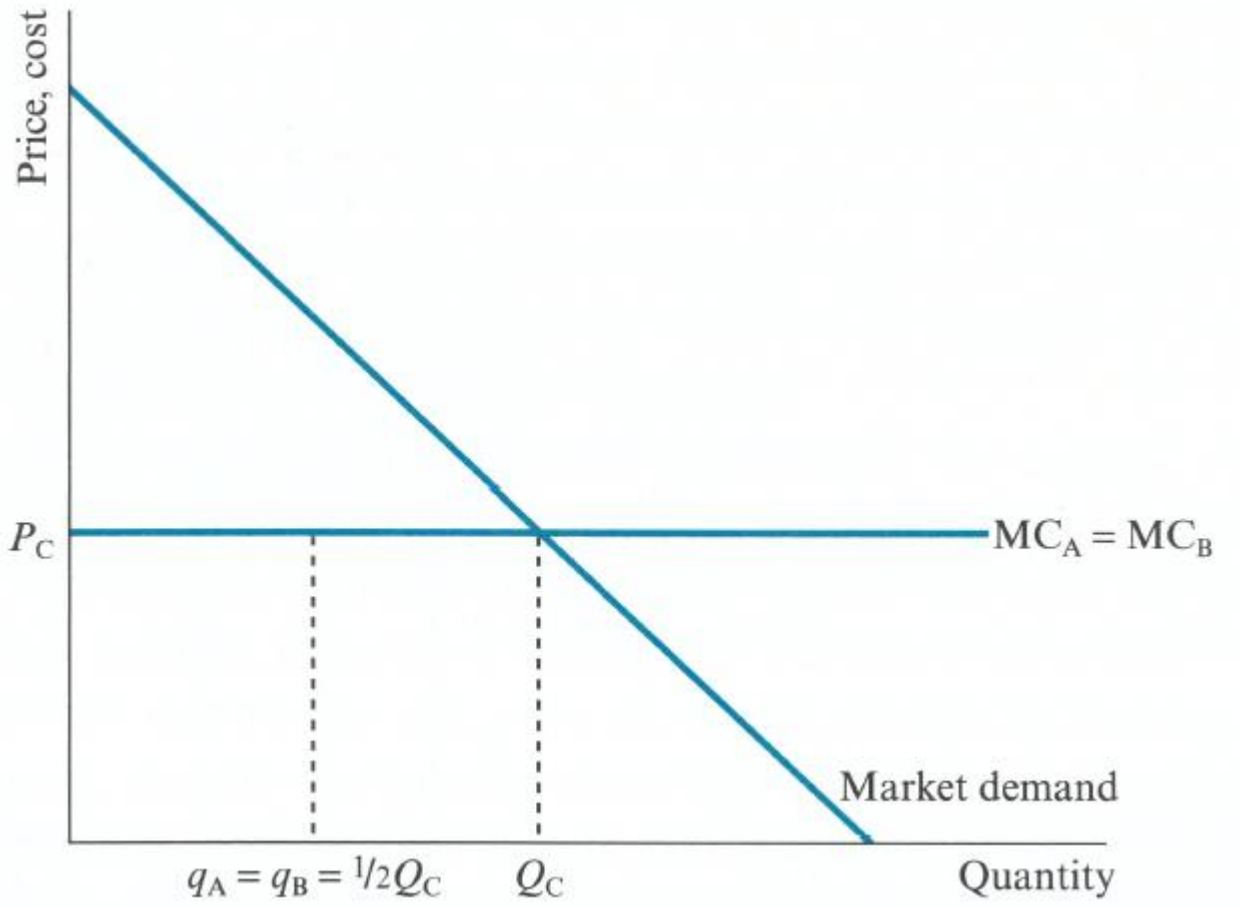
Non collusive models
a) Bertrand: assumptions

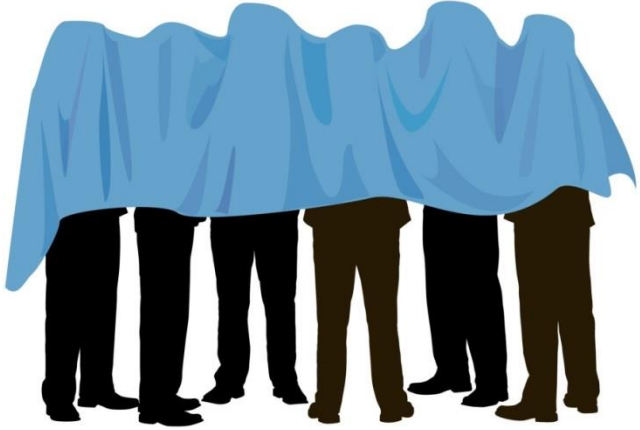
1. Two **identical firms** (homogeneous product and same horizontal marginal cost function $MC_A = MC_B$).
2. Firms do not set the output, but the **price.**
3. **Zero conjectural variation assumption on prices**: each firm assumes its rival will stick to the rival's current price.
4. **No transaction costs**. Customers do not have to bear any additional cost to flow to the firm with the lowest price.
5. Firms take their decisions on price **sequentially**.
6. Firms choose the price that maximises their profit: if firms produce goods with the same quality level, consumers will buy from the firm with the lowest price (with perfect information)
7. Each firm can gain all of the rival's customers with a **minimum price reduction**.

Non collusive models
a) Bertrand: equilibrium

- **Round 1**: firm A sets the price p1 at the monopoly level PM. Then firm B arrives, and it will set the price considering that:
  - Its sales will be equal to zero if $p_2 > p_1$;
  - if $p_2 = p_1$ for consumers it is the same to buy from firm A or firm B. The two firms shares out the whole market demand.
  - if $p_2 < p_1$ it will gain all of A's customers. Under the zero conjectural variation assumption this will be B's choice.
- **Round 2**: A will behave exactly like B (setting the price fractionally below p_2).
- The **process ends** when price has fallen to the perfectly competitive level $\mathbf{p_c = MC}$, where there is no incentive for either firm to cut price any further. The price and total quantities are the same of perfect competition because each firm produces $q_A = q_B = 1/2\ Q_{c.}$ By increasing the price, even fractionally, the firm would lose all customers and by further decreasing the price the firm would gain all of rival's customers but it would have losses.

Non collusive models
a) Bertrand: equilibrium





OLIGOPOLY

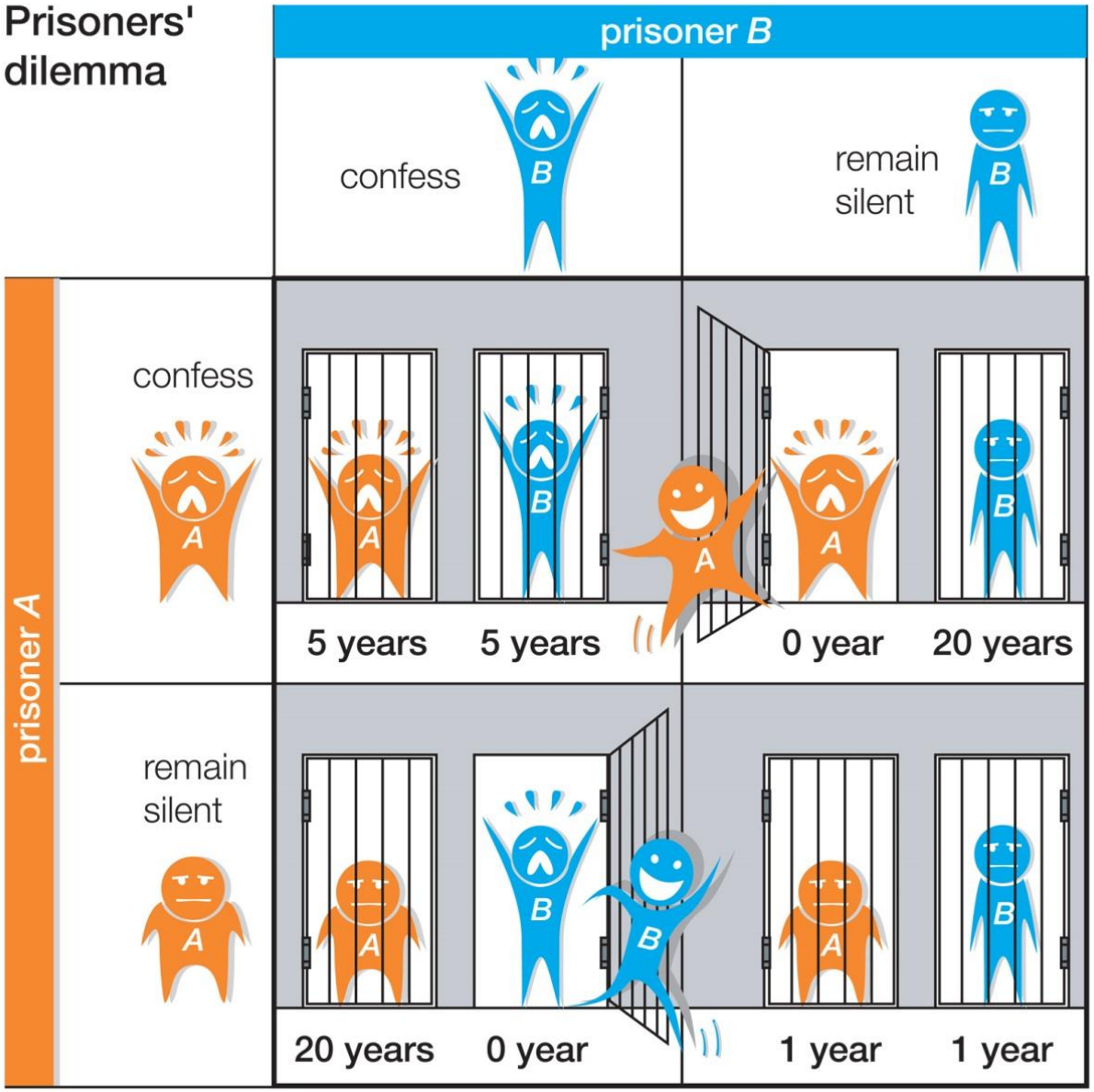
Collusive models

Game theory

Game theory: approach to decision-making under conditions of uncertainty.

Game: situation where two or more players have to choose between a number of possible actions. Interdependence is the key defining characteristic of a game.

The prisoner's dilemma



In a game there is a **dominant strategy** when, no matter what B selects, it is best for A to choose a behaviour rather than the other.

The optimal outcome is cooperative and it can be achieved only if there is a good communication between the players or with very high trust levels between them.

Collusion

Definition: set of actions aimed at fixing collaboration agreements among firms (defining a precise behavioural line) in order to promote the collective interest of members.

It can be aimed at increasing profitability, but also at easing competitive pressure and creating a manageable operating environment.

In some cases the uncertainty and risks associated with independent action can induce firms to participate in some form of collusive arrangement.

It can be:

- **tacit**: no formal agreement and no direct communication between firms (it can develop through personal contacts, live-and-let-live attitudes, group ethos, etc.)
- **Explicit**: formal, verbal or written contracts defining rights, obligations, sanctions, fines, etc.

Collusion: modalities

1. Setting **prices** / **quantities** of offered goods;
2. Defining the maximum price for **supplies** that they purchase;
3. Restricting the amount of **information** that consumers can know about their products through advertising, for example not sharing technical information on the products;
4. Trying to **eliminate new competition** by buying them out or restricting their access to sales venues and suppliers.
5. "**conscious parallelism**": it is the result of a general feeling among competitors that they should charge the same price for similar goods. For instance, if one petroleum company raises its prices for gasoline due to increased production costs, other petroleum companies may follow even if they face no increased production costs of their own. This allows them to increase their profit margin without fear of being undercut by the first company. It is not strictly collusion because it does not come as a result of any actual agreements between firms. It is a situation that produces the same results of collusion without any actual consultation taking place

Examples

- 2007: The European Commission handed out a massive €750 million in fines to Siemens (396 m.) , Alstom, Areva, Schneider Electric, Fuji Electric, Hitachi, Mitsubishi Electric, Toshiba and AE Systems. ABB Group was a whistleblower and escaped without any fine. Regulators found that the companies manipulated bids for contracts and fixed prices in the market for gas-insulated switchgear (equipment is used to control the flow of energy in electricity grids). The cartel exchanged information on offers from customers and operated a quota system for the division of work. Code names were used for both companies and individuals.
- 2007: The European commission imposed fines on Heineken €219.3m, Grolsch €31.65m and Bavaria €22.85m for operating a price fixing cartel in the Netherlands. InBev escaped without a penalty because it provided "decisive information" about the cartel which operated between 1996 and 1999 and others in the EU market. Firms tried to cover their tracks by using code names and abbreviations for secret meetings to carve up the market for beer sold to supermarkets, hotels, restaurants and cafes. The price fixing extended to cheaper own-brand labels and rebates for bars.

Examples

- 2012: The South African Competition Commission has called for six oil companies – Shell, BP, America's Chevron, France's Total and domestic producers Sasol and Engen – to stand before the South African Competition Tribunal for collusion. An investigation that begun in 2009 revealed that the six companies have kept diesel prices artificially high, using the South African Department of Energy's maximum price guideline as their benchmark. The Commission accused the firms of "extensive exchanges of commercially sensitive information", such as monthly fuel sales, to enable them to "track each other's sales and to align their strategies in the market". The investigation found that confidential information exchanges had been occurring since the 1980s, and from 2005, went through the South African Petroleum Industry (SAPIA).
- 2014: Apple Inc. and Google Inc. are accused of secretly agreeing not to hire each others' employees. The $324.5 million deal was part of a case that originally involved several of Silicon Valley's biggest companies.
- 2014: Italian antitrust authorities said on Wednesday that they had fined two Swiss pharmaceutical companies, Novartis and Roche Holdings, a total of $250 million for colluding to keep doctors from prescribing a relatively inexpensive eye treatment in favor of a more expensive drug.

... AND MANY MORE

Different collusion forms
The cartel: reasons.

It is an association of independent firms in the same industry that imposes restraint upon competition. Firms may decide to collude for many reasons:

1) to fully exploit the market power
2) for self-defence, easing competitive pressure through unified action, in order to:
   a) reduce the entrepreneurial risk deriving from changes in consumers' tastes and in competition (for ex. not introducing new products on the market);
   b) exchange information, in order to decrease the risk linked to the investment in new plants. All firms have the interest that each firm invests wisely, because wrong choices could translate in price-cutting or other panic measures that could threaten the overall industry stability;
   c) cope with poor performances : the poor performance of firms in a certain sector for long periods of time may induce firms to set price agreements aimed at maintaining profits high.

Different collusion forms
The cartel: features and problems

Usually the price is determined by the total offered quantity (in its intersection with demand): the price is determined by the behaviour of all producers. With a limited number of firms all supplying a basically homogeneous product, if **all firms** reduce their output the price may grow and firms can realise abnormal profits (collective interest): firms in the cartel behave as they were **one** monopolistic firm.

Each firm has an incentive to decrease output only if all firms do the same (so as to make the price grow up to the monopoly level).

If all firms increase the output the system goes toward a perfect competition model.

Problems:

a) Cartels are highly unstable because each firm can increase its profit by increasing its output level (***free riding)***
b) If outside firms are attracted by the relatively high cartel price and barriers to entry are not sufficiently high, the new entrants will cause an increase in output and a consequent decrease in prices, destroying the cartel
c) It is difficult to establish the criteria to determine output quotas and to divide profits

There are different types of cartels: on prices, on total sectorial output, on the allocation of areas or customers, on sales conditions, etc.

Different collusion forms
Factors favouring the cartel formation

1. Degree of seller concentration: in industries with a small number of firms (high concentration) it is easier to detect opportunistic behaviours and to coordinate with each other.
2. Similar cost functions: if a firm, differently from the others, faces a decreasing average cost function, it may be reluctant to diminish its output. Or again, a smaller firm wanting to overcome a larger one may be reluctant to respect output restrictions.
3. Similar market shares : larger firms with spare capacity could be tempted to defect from a price-fixing agreement, with smaller firms having limited capacity to issue credible threats to punish defectors.
4. Similar products: with differentiated products it is more difficult to reach agreements on prices.
5. Vertical integration : members being vertically integrated downstream may be able to undercut the cartel price by reducing its transfer price to its own retailers.
6. Transaction costs: the capacity to collude depends on the ability to specify contractual relations correctly, to agree on several factors (joint profit maximisation, how do adapt to changes in the economic environment), to monitor the fellow conspirators' behaviour and to punish those not complying with the agreement.

Different collusion forms
Factors influencing on cartel stability

1. Seller concentration and number of firms.
2. Different goals of members, that could have conflicting objectives.
3. Non-price competition (ex. advertising campaigns or brand proliferation) .
4. Monitoring and detection of cheating.
5. Sanctions.
6. Buyer concentration: buyers with market power may threaten the agreed price by switching to alternative suppliers or by suggesting different agreements with individual producers.
7. Fluctuations in demand.
8. Entry of new competitors.
9. Competition law(antitrust).
10. Other non-economic factors (lack of leadership, trust).

Different collusion forms
Trade associations

- The cartel reaches its aims (maximisation of joint profit, self-protection) by means of market power, i.e. the capacity to set the price above the marginal cost.
- Trade associations improve their members' position not necessarily through a reduction in competition: they provide firms with industry data (on sales, clients' solvency, product quality, innovation), they favour the relations with customers, labour unions and government.
- To achieve these goals they publish sectorial journals, stimulate joint research programmes, instigate market research surveys, define trade terms, and recruit lobbyist.
- The line between legal and collusive cooperative is often very fine and open to interpretation: moves to standardize output are legal or not?
- A trade association does not itself help foster collusion, but it might represent an intermediate step towards collusion.

Different collusion forms
Joint Ventures

- It is an association between two or more otherwise competing firms. The common form is the consortium (or syndicate in banking and insurance).
- They are usually established for activities that are too risky for an individual firm.
- JV could prevent or distort competition by merging the interests of different firms, but they are also a powerful tool to stimulate innovation, by enabling R&D projects that would not otherwise be feasible (in this regard they have been also sponsored by government and international institutions). Furthermore, by banding together, a group of firm could be able to overcome entry barriers.
- In some, rare, cases there have been state-sponsored collusion, where the government has imposed cartelization on reluctant firms in order to promote the rationalization of a too-fragmented industry.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Leadership with trust
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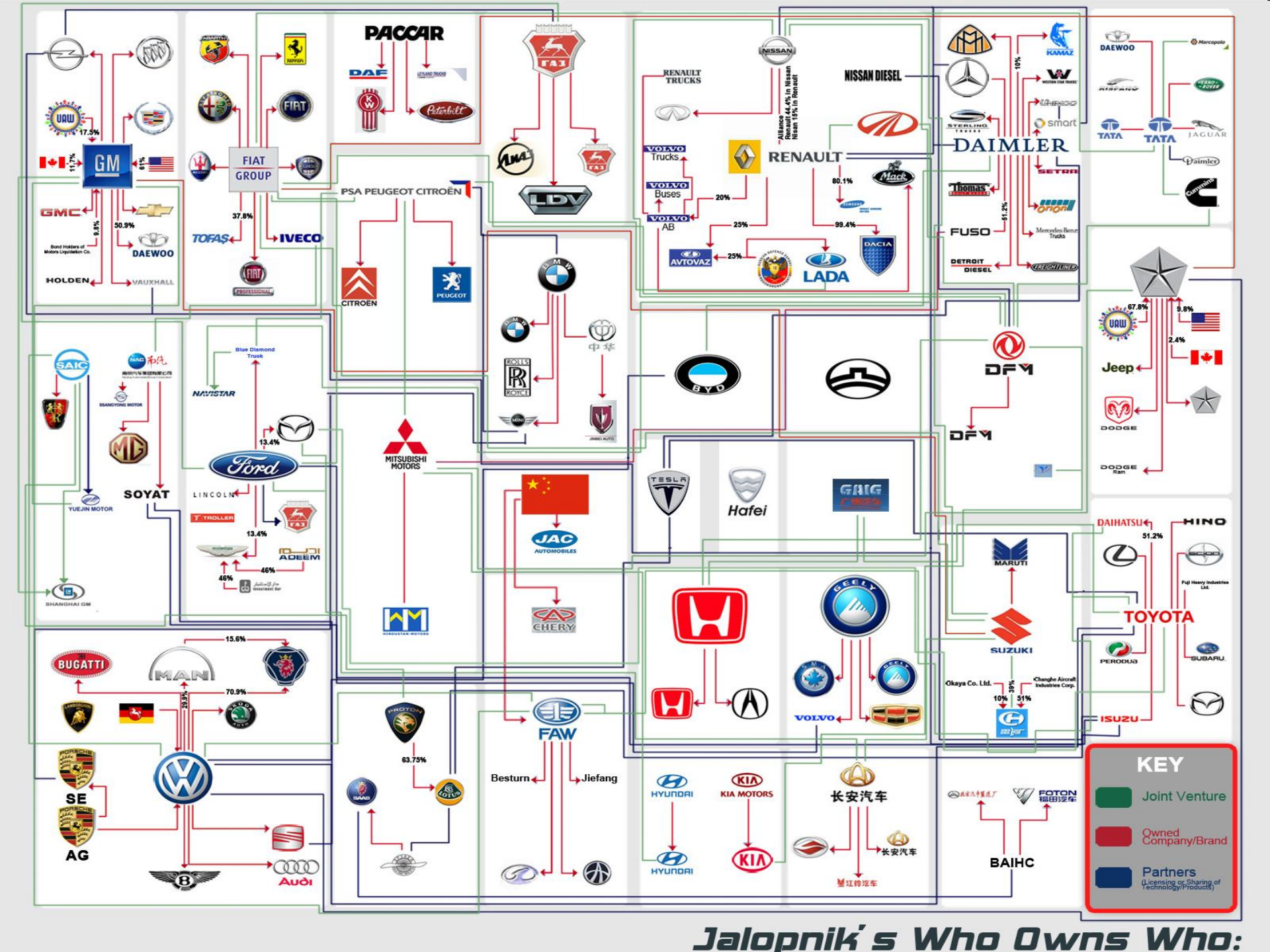

Jalopnik's Who Owns Who:

Summary

- Non collusive models
  - Cournot
  - Stackelberg
  - Bertrand
- Collusive models
  - Game theory
  - Prisoner's dilemma
  - Collusion
    - Cartels
    - Trade associations
    - JVs

Reading list

- Chapter 7-8, Lipczynski et al., 2013