

Industrial Economics

Chrysovalantou Milliou

AUEB – Erasmus Program



Slides

Industrial Organization: Markets and Strategies
Paul Belleflamme and Martin Peitz, 2d Edition

Couse Outline

1. Basic Concepts ✓
2. Monopoly ✓
3. Static Oligopoly ✓
4. Dynamic Oligopoly ✓
5. Product Differentiaton ✓
6. Cartels & Tacit Collusion
7. Horizontal Mergers
8. Vertically Related Markets
9. R&D

6. COLLUSION



Slides

Industrial Organization: Markets and Strategies
Paul Belleflamme and Martin Peitz, 2d Edition

Case: The vitamin cartels



- Worldwide market for bulk vitamins
- In Europe, sales of bulk vitamins were 800m € in 1998
- Production of vitamins is highly concentrated
 - Largest firm is Hoffmann-La Roche: market share of 40-50%
 - BASF: 20-30%
 - Aventis: 5-15%
- November 2001: European Commission imposes a fine of 855.22m € to 8 firms for participating to secret market-sharing and price-fixing cartels.
- Hoffmann-La Roche (462m €) and BASF (296,16m €) were considered the joint leaders and instigators of the cartels.
- Aventis received significantly lower fines as the first company to cooperate both with the US Department of Justice and the European Commission.

6. Collusion

Collusion is the situation in which firms' prices are higher than a competitive benchmark (the equilibrium prices that we would expect in the market if competition was functioning properly).

Another definition:

Collusion is the situation in which prices are very close to the monopoly price although there is no monopoly in the market.

In Economics, collusion coincides with the result and not with the way in which we reach the result.

6. Collusion

Two different types of collusion:

1. Explicit Collusion = Cartel

Collusion due to an explicit (but secret) **agreement** between firms.

It is the outcome of **communication** between firms.

Cartel members agree to coordinate their actions:

- Prices
- Market shares
- Exclusive territories
- Bids in auctions

2. Tacit Collusion

Collusion not due to an agreement between firms but due to independent strategies followed by each firm - 'Meeting of the minds'.

Note: Only explicit collusion (cartel) is illegal according to Competition Law.

Contents

6.1 Explicit Collusion (Cartel)

6.2 Tacit Collusion

6.3 Collusion & Competition Policy

6.1 Explicit Collusion (Cartel)

Cartel Formation & Stability model

- **Model Assumptions:**

- n firms ($i = 1, 2, \dots, n$)

- Homogeneous products with the following market demand function:

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

where total quantity $q = q_1 + q_2 + \dots + q_n$

- Cost function of firm i : $C_i(q_i) = cq_i$ with $a > c \rightarrow$ symmetric $MC: c$

- Dynamic game:

Stage 1: Each firm decides whether or not will participate in a (unique) cartel.

Stage 2: The cartel (operating as one firm) and each of the firms that do not participate in the cartel choose simultaneously and separately their quantities.

- No capacity constraints.

6.1 Explicit Collusion (Cartel)

Cartel Formation & Stability model

- **Model Solution – Equilibrium:**

Solution by Backward Induction:

- Stage 2

Assume that a cartel of k firms is formed, with $1 < k \leq n$.

We have a Cournot game with $(n - k + 1)$ players are symmetric: The $(n - k)$ independent firms (out of the cartel) and the cartel (as one player).

Solving this game (in the same way as we have solved the “Cournot model with n firms” in subsection 3.2), we find the profits of each firm which is **in** the cartel and of each firm which is **out** of the cartel:

$$\pi^{in}(k) = \frac{(a-c)^2}{k(n-k+2)^2}$$

$$\pi^{out}(k) = \frac{(a-c)^2}{(n-k+2)^2}$$

Cartel Formation & Stability model

- **Model Solution – Equilibrium (cont.):**

- Stage 1

For the cartel to be stable, it must be that none of its members has an incentive to unilaterally leave the cartel, i.e., that the following condition holds:

$$\pi^{in}(k) \geq \pi^{out}(k-1) \Leftrightarrow \frac{(a-c)^2}{k(n-k+2)^2} \geq \frac{(a-c)^2}{(n-k+3)^2}$$

We observe that:

- If $k \geq 3$ (which requires that $n \geq 3$), the above condition is not satisfied.
- If $k = 2$ and $n \geq 3$, the above condition is not satisfied.
- If $k = 2 = n$, only then the above condition is satisfied and a cartel which includes all the firms in the market is formed.

Why? Formation of the cartel induces positive externalities on the firms outside the cartel (higher market price); All firms prefer to *free-ride* on the public good provided by cartel members.

6.1 Explicit Collusion (Cartel)

Cartel Formation & Stability model

Consider the formation of a single cartel on a Cournot market with homogeneous goods and constant marginal costs. If there are at least three firms in the industry, all firms remain independent. If there are just 2 firms in the industry, the 2 firms form a cartel.

- The result changes if firms produce *horizontally differentiated goods*. Competition and free-riding incentive are relaxed then
→
It is possible to find stable cartels comprising not all firms but a strict subset of them (if goods are sufficiently differentiated).

6.2 Tacit Collusion

Tacit Collusion model

- **Model Assumptions:**

- $n = 2$ firms ($i = 1, 2$)
- Homogeneous products with market demand function: $Q(p) = (a - p)/b$, [It is the reverse of $P(Q) = a - bQ$]
where Q is the total quantity.

- Cost function of firm i : $C_i(q_i) = cq_i$ with $a > c \rightarrow$ symmetric $MC: c$

- Each firm i faces

$$q_i = \begin{cases} 0 & \text{if } p_i > p_j \text{ or } p_i > a \\ \frac{a-p}{2b} & \text{if } p_i = p_j = p < a \\ \frac{a-p}{b} & \text{if } p_i < \min(a, p_j) \end{cases} \quad i, j = 1, 2 \text{ and } i \neq j$$

- Firms choose their prices simultaneously and separately in each period t , where $t = 1, 2, \dots, T$.
- Firms discount future profits and the discount rate is δ , with $0 \leq \delta \leq 1$.

Tacit Collusion model

- **Model Solution – Equilibrium:**

Which prices firms choose in each period t in equilibrium?

1. If $T = 1$

We have the standard Bertrand model:

There is a unique Nash equilibrium in which:

$$p_1^B = p_2^B = c$$

“Bertrand paradox”

→ No Tacit collusion in equilibrium.

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

2. If $T > 1$ periods with T being a finite number

We have a repeated standard Bertrand game:

We have a unique Subgame Perfect Nash Equilibrium in which in each period t :

$$p_{1t}^* = p_{2t}^* = c$$

“Bertrand paradox in each period”

→ No Tacit collusion in equilibrium.

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

3. If $T \rightarrow \infty$ (infinite horizon)

We have a repeated standard Bertrand game without an end.

This game has multiple Subgame Perfect Nash Equilibria, one of which is:

$$p_{1t}^* = p_{2t}^* = c$$

“Bertrand paradox in each period”

There are though also equilibria in which there is tacit collusion when particular conditions are satisfied. In one of these equilibria, firms play the following **trigger strategy** (see next page).

→ Tacit collusion may emerge in equilibrium.

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

Trigger strategy:

- Firm i starts ($t = 1$) by choosing the action that maximizes total profits:

Sets the *collusive price* p^c , where $c < p^c = p^m$

- Firm i keeps on choosing (in each subsequent period t) the collusive price as long as both firms have done so in all previous periods → *collusion phase*
- If the other firm deviates ($p^d = p^c - \varepsilon$), then deviation ‘triggers’ the start of the *punishment phase*.

In particular, from then on firms choose the action that corresponds to the Nash equilibrium of the static game:

Sets the *punishment price* $p^p = c$

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

It follows that under the trigger strategy:

- The profits of a firm in a collusive period:

$$\pi^c = \pi^m/2$$

- The profits of a firm when it deviates in the period in which it deviates:

$$\pi^d = \pi^m$$

- The profits of a firm in a punishment period:

$$\pi^p = 0$$

The following holds: $\pi^d > \pi^c > \pi^p$

Important observation: There is a trade-off between:

- Immediate gain from deviation
- Future losses resulting from the other firm's punishment

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

In order to have collusion in equilibrium, a firm's profits be higher when it colludes than when it deviates:

$$\pi^c + \delta \pi^c + \delta^2 \pi^c + \dots \geq \pi^d + \delta \pi^p + \delta^2 \pi^p + \dots$$

→

$$\pi^c / (1 - \delta) \geq \pi^d + \delta \pi^p / (1 - \delta)$$

→

$$\delta \geq (\pi^d - \pi^c) / (\pi^d - \pi^p)$$

$$\delta \geq 1/2$$

In the infinitely repeated Bertrand duopoly game, tacit collusion can arise in a Subgame Perfect Nash equilibrium if the discount factor is sufficiently large, $\delta \geq 1/2$.

Tacit Collusion model

- **Model Solution – Equilibrium (cont.):**

The condition for the emergence of tacit collusion, $\delta \geq (\pi^d - \pi^c)/(\pi^d - \pi^p)$, means that a necessary condition for the existence of tacit collusion is that firms care enough about their future profits.

Moreover, it means that:

- The lower are π^p (i.e., the stricter is the punishment), the more likely is collusion.
- The higher are π^d , the less likely is collusion.
- The higher are π^c , the more likely is collusion.

6.2 Tacit Collusion

Tacit Collusion model with Quantity choices

See Problem Set IV

Tacit Collusion & Market Features

- Market features/characteristics affect the likelihood of tacit collusion.

For example:

- **Number of firms in the market**

If all firms choose the collusive action, then each makes profit $\pi^c = \pi^m/n$

Thus, the smaller is n , the higher are the collusion profits.

→ The smaller is n , the more likely is collusion.

- **Symmetry of costs**

Assume that the marginal costs of firms differ, e.g., $MC_1 = c_1 < MC_2 = c_2$

Firms preferences might differ – no clear focal point for explicit collusion.

For tacit collusion: If firm 1 (the more efficient firm) deviates, it extracts more π^d and the punishment cannot be so severe, i.e., π^p is not too low for firm 1.

→ The lower is cost asymmetry, the more likely is collusion.

(a similar argument applies for symmetry in market shares)

6.3 Collusion & Competition Policy

6.2 Collusion & Competition Policy

- By raising prices above competitive levels, cartels reduce consumer surplus and welfare (total surplus).

How do the competition policy authorities in EU try to fight cartels?

Watch the following video of the EC on the fight against cartels:

<https://audiovisual.ec.europa.eu/en/video/I-072385?lg=OR>

6.2 Collusion & Competition Policy

Article 101 of the EU Treaty

The following shall be prohibited as incompatible with the internal market: all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between member states and which have as their object or effect the prevention, restriction or distortion of competition within the internal market, and in particular those which:

- (a) directly or indirectly fix purchase or selling prices or any other trading conditions;*
- (b) limit or control production, markets, technical development, or investment;*
- (c) share markets or sources of supply;*
- (d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;*

6.2 Collusion & Competition Policy

Ex-ante measures:

- **Announcement of high fines**

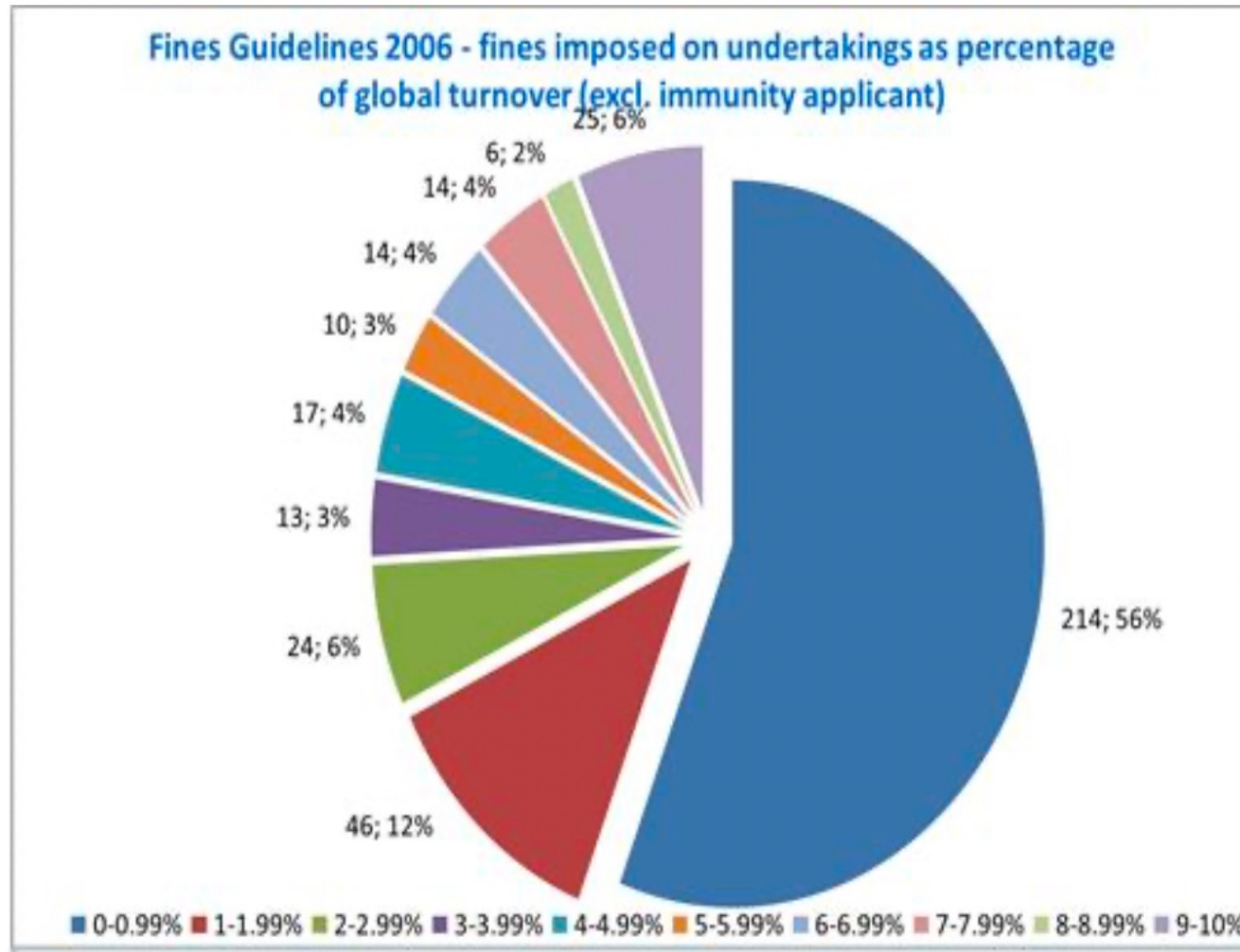
The fines may include, first, the payment of high amounts to the competition policy authorities, and second, the payment of damages.

The first category of fine can be up to 30% of the annual (last year of violation) turnover of the firm in the relevant market.

The fine is limited to 10% of the overall annual turnover of the firm.

The amount of the fine depends on the duration of the violation and its severity.

6.2 Collusion & Competition Policy

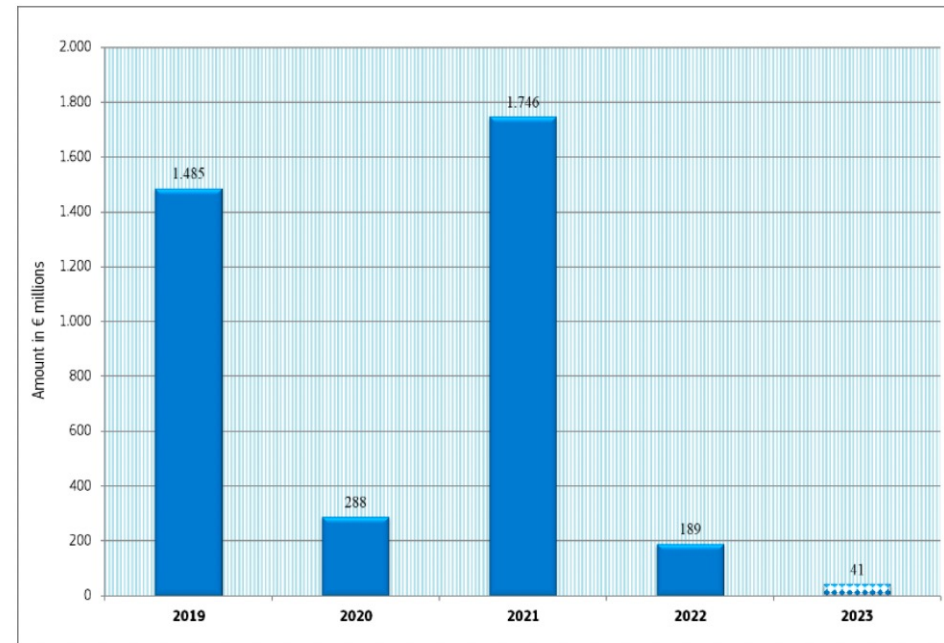


6.3 Collusion & Competition Policy

1.1. Fines imposed (not adjusted for Court judgments) - period 2019 - 2023

Last change: ++22 November 2023++

Year	Amount in €*)
2019	1 484 877 000
2020	288 080 000
2021	1 746 254 000
2022	188 594 000
++2023++	41 233 000
Total	3 749 038 000



*) Amounts of fines imposed by the Commission (incl. corrections following amendment decisions) and not corrected for changes following judgments of the Courts (General Court and Court of Justice) and only considering cartel infringements under Article 101 TFEU.

6.3 Collusion & Competition Policy

1.5. Ten highest cartel fines per case (since 1969)

Last change: ++30 March 2022++

Year	Case name	Amount in €*)
2016/2017	Trucks	3 807 022 000
2019/2021	Forex	1 413 274 000
2012	TV and computer monitor tubes	1 409 588 000
2013/2016/2021	Euro interest rates derivatives (EIRD)	1 308 172 000
2008	Carglass	1 185 500 000
2014	Automotive bearings	953 306 000
2021	Car emissions	875 189 000
2007	Elevators and escalators	832 422 250
2001	Vitamins	790 515 000
++2010/2017++	Airfreight (incl. re-adoption)	739 642 616

*) Amounts adjusted for changes following judgments of the Courts (General Court and Court of Justice) and / or amendment decisions.

6.3 Collusion & Competition Policy

1.6. Ten highest cartel fines per undertaking (since 1969)

Last change: ++08 July 2021++

Year	Undertaking	Case	Amount in €*)
2016	Daimler	Trucks	1 008 766 000
2017	Scania	Trucks	880 523 000
2016	DAF	Trucks	752 679 000
2008	Saint Gobain	Carglass	715 000 000
2012	Philips	TV and computer monitor tubes	705 296 000 of which 391 940 000 jointly and severally with LG Electronics
2012	LG Electronics	TV and computer monitor tubes	687 537 000 of which 391 940 000 jointly and severally with Philips
2016	Volvo/Renault Trucks	Trucks	670 448 000
++2021++	VW Group	Car emissions	502 362 000
2016	Iveco	Trucks	494 606 000
2013	Deutsche Bank	Euro interest rate derivatives (EIRD)	465 861 000

*) Amounts adjusted for changes following judgments of the Courts (General Court and Court of Justice) and / or amendment decisions.

6.2 Collusion & Competition Policy

Ex-ante measures (cont.):

- **Treatment of mergers**

The authorities, when they evaluate a potential merger, they take into account whether it will facilitate collusion in the market.

- **Treatment of facilitating practices**

Practices such as Retail Price Maintenance, Price-Matching/Best Price Guarantees, Exchange of Information within trade associations, etc...

6.2 Collusion & Competition Policy

Case: WoodPulp

In 1984, the EC decided that 40 wood pulp producers and 3 trade associations infringed article 85 of the EC Treaty (now article 101).

The main accusations made by the EC was the parallel pricing behavior of the producers.

Parallel behavior consisted of:

- (i) a system of quarterly price announcements
- (ii) (quasi-) simultaneity of price announcements
- (iii) the fact that announced prices were identical

Fines of between ECU 50.000 and 500.000 were imposed on the addressees of the decision.

6.3 Collusion & Competition Policy

In 1993, the Court of Justice annulled the EC decision. It stated that:

“parallel conduct cannot be regarded as furnishing proof of concentration unless concentration constitutes the only plausible explanation for such conduct”

This ruling created precedent for future decisions regarding cartels:

Hard evidence that prove the communication and the existance of agreement among the firms should be found in order to conclude that there is a cartel among them

6.3 Collusion & Competition Policy

How can the Competition Authorities find hard evidence for the existence of cartels?

Ex – post measures:

- **Dawn raids**

Detailed investigations by the competition policy authorities in the offices of the firms for the collection of hard evidence.

The investigations might result into the collection of useful evidence (e-mails, minutes of meetings, etc.).

6.3 Collusion & Competition Policy

Coca-Cola bottler fined in Greece for obstructing dawn raid

Ciaran Willis

06 March 2020



Buy PDF



6.3 Collusion & Competition Policy

- **Leniency programs**

These are programs that offer full or partial immunity of the fines to the firms that participate in a cartel and provide hard evidence to the Competition Authorities.

They are very successful both in the US and in the EU.

In order to obtain full immunity, a firm must be the first one to inform the Commission of an undetected cartel by providing sufficient information to allow the Commission to launch an inspection.

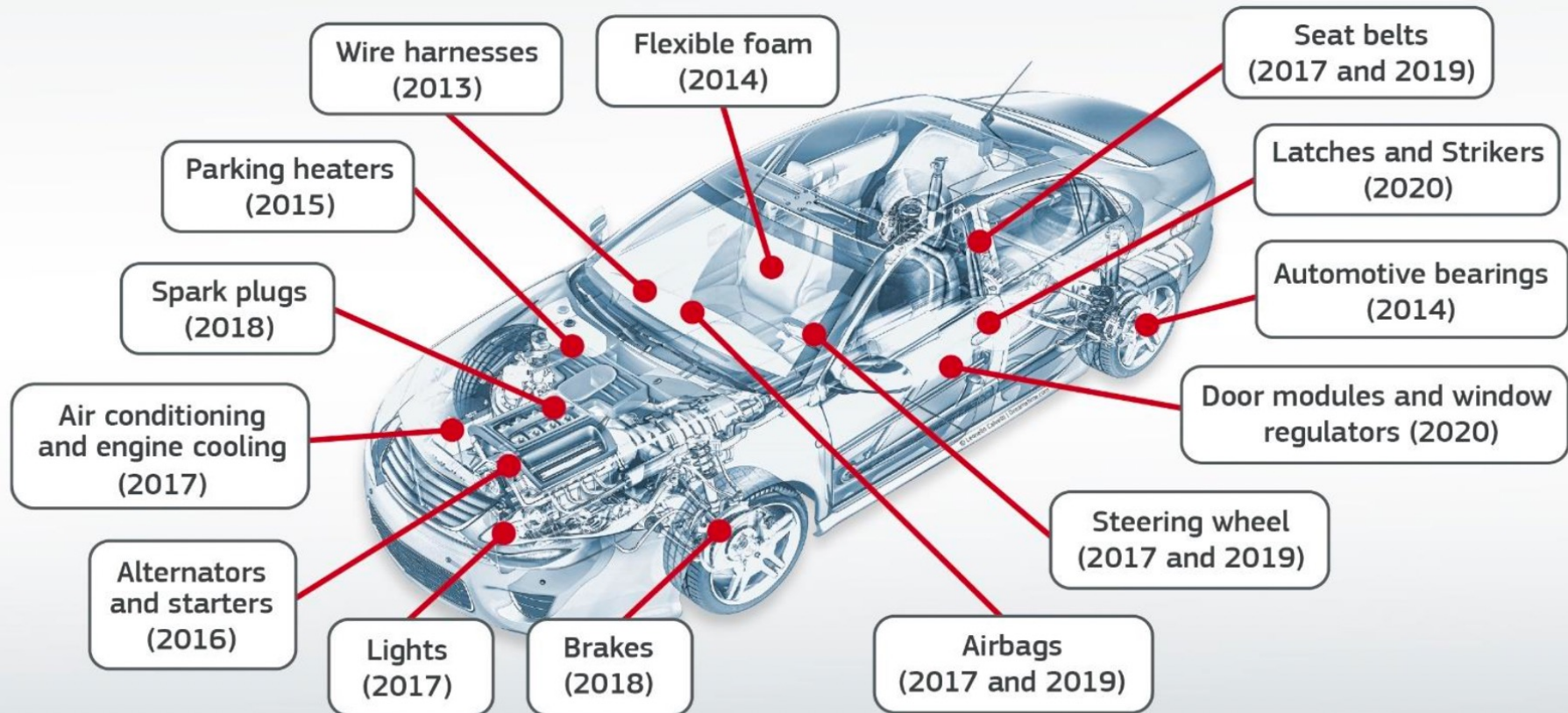
If the Commission has already started an inspection, the firm must provide evidence that enables the Commission to prove the cartel infringement.

6.3 Collusion & Competition Policy

1.12. Car part cases decided since 2013

Last change: ++09 September 2021++

Commission has fined **car parts cartels**
almost €2.2 billion since 2013



6.3 Collusion & Competition Policy

Case: Car glass

In 2008, The EC imposed a fine of a total 1.354.896,000 euros on Asahi, Pilkington, Saint-Gobain and Soliver for illegal market sharing, and exchange of commercially sensitive information regarding deliveries of car glass in the EEA.

Asahi, Pilkington and Saint-Gobain were the three major players in the car glass market of Europe.

Between 1998 and 2003 these firms discussed target prices, market sharing and customer allocation in a series of meetings and other illicit contacts.

The Belgian company Soliver also took part in some of these discussions.

6.3 Collusion & Competition Policy

The fine imposed was the highest cartel fines the EC had ever imposed, both for an individual firm (880.000.000 euros on Saint Gobain) and for a cartel as a whole.

Competition Commissioner Neelie Kroes said:

"These companies cheated the car industry and car buyers for 5 years in a market worth w billion euros in the last year of the cartel.

The overall fines are high because of the large market, the seriousness of the case, and Saint-Gobain's earlier offences.

The Commission has imposed such high fines because it cannot and will not tolerate such illegal behavior.

Management and shareholders of companies that damage consumers and European industry by running cartels must learn their lessons the hard way – if you cheat, you will get a heavy fine."

6.3 Collusion & Competition Policy

Case: Beer Market of the Netherlands

Four beer manufacturers, Heineken, Grolsch, Bavaria, InBev, participated in a cartel in the Dutch beer market.

Between 1996 and 1999, the four firms held many unofficial meetings. At these meetings, they coordinated their prices and price increases of beer in the Netherlands, both in the on-trade segment of the market (where consumption is on the premises) and the off-trade market segment (consumption off the premises - mainly sold through supermarkets), including private label beer.

Moreover, they occasionally coordinated other commercial conditions offered to individual customers in the on-trade segment and engaged in customer allocation, both in the on- trade and the off-trade segment.

6.3 Collusion & Competition Policy

The EC imposed the following fines: Heineken 219.275.000 euros, Grolsch 31.658.000 euros, Bavaria 22.850.000 euros, InBev 0 euros (due to the participation in the Leniency program).

How was the cartel found?

InBev informed the Commission of the existence of the infringement through the application of the Leniency program.

The EC launched then an investigation. InBev provided documentation to the Commission that was crucially important to confirming the existence of a cartel.

The evidence uncovered was hand-written notes taken at unofficial meetings. The evidence found showed that that in all four brewery groups high-ranking management participated in the cartel meetings. There was also evidence that the companies were aware that their behavior was illegal and took measures to avoid detection, such as using code names and abbreviations to refer to their unofficial meetings and holding these meetings in hotels and restaurants.

6.3 Collusion & Competition Policy

Case: Greek milk cartel

In 2007, the Hellenic Competition Authority concluded that there was horizontal price fixing among the largest dairy product firms in Greece. It imposed a fine of almost 50 million euros to these firms as well as to some Greek supermarket chains that participated in some of the agreements.

In particular, before the decision, there were complaints in the press by milk producers regarding the pressure that they were facing by dairy product firms.

The Hellenic Competition Authority started an investigation. Based on the results of its investigation, the Commission concluded that the firms had committed three violations:

They had entered into an agreement regarding the price at which they bought milk from cow breeders and shared the sources of milk.

6.3 Collusion & Competition Policy

Through the Hellenic Milk Organization, the firms had obtained information regarding the average monthly market prices and quantities for every cow breeder and used the information to fix the prices at which they purchased milk from them.

The dairy product companies made a number of agreements regarding their trade policy, exchanging their price lists so as to harmonize their wholesale pricing practices and align their discount policies. They offered resale price maintenance to supermarket chains. The commission found that supermarkets agreed to maintain the retail prices of dairy products as required by the dairy companies.

6.3 Collusion & Competition Policy



European Commission - Press release



Antitrust: Commission fines Barclays, RBS, Citigroup, JPMorgan and MUFG €1.07 billion for participating in foreign exchange spot trading cartel

Brussels, 16 May 2019

In two settlement decisions, the European Commission has fined five banks for taking part in two cartels in the Spot Foreign Exchange market for 11 currencies - Euro, British Pound, Japanese Yen, Swiss Franc, US, Canadian, New Zealand and Australian Dollars, and Danish, Swedish and Norwegian crowns.

6.3 Collusion & Competition Policy



TOP STORIES
NEWS

Germany fines BMW, Daimler, VW over steel cartel

German carmakers Daimler, BMW and Volkswagen have been ordered to pay €100 million for forming a cartel to fix steel prices. Germany's competition watchdog has zeroed in on the steel industry in recent years.



Germany's competition watchdog, the Bundeskartellamt, imposed the fine, accusing the three companies of engaging in "anticompetitive practices" to buy steel.

In a statement, the Bonn-based authority said Volkswagen, Daimler and BMW met regularly with steel producers "between 2004 and the end of 2013" to discuss uniform surcharges for purchasing the raw material.