Part VI. Theory of competition policy

Chapter 14. Cartels and tacit collusion
**So far**
- Followed mostly a *positive* approach
- Describe, explain workings of imperfectly competitive markets

**In this part**
- Follow mostly a *normative* approach
- Guidance for competitive policy
  - **Basic postulate**: competition is desirable as it promotes economic efficiency
  - **Problem**: firms might be tempted to reduce competition
  - **Consequence**: set of rules aiming at maintaining competition → *competition (antitrust) policy*
Organization of Part VI

• Chapter 14. Collusive practices
  • Price-fixing, market-sharing → firms eliminate competition between them
  • How does collusion emerge? How is it sustained?

• Chapter 15. Horizontal mergers
  • Examine potential effects on welfare
    • Negative: fewer independent decision makers
    • Positive: increased efficiency (synergies)

• Chapter 16. Strategic incumbent firms
  • Incumbent may try to make entry more difficult on their market.
  • How? To what effect
Organization of Part VI (cont’d)

• Chapter 17. Vertically related markets
  • Market for intermediate products; successive steps in the value chain
  • Effects of vertical mergers?
    • Positive: elimination of successive margins
    • Negative: potential foreclosure
  • Effects of vertical restraints
    • Resale-price maintenance, exclusive dealing, …
Chapter 14 - Objectives

Chapter 14. Learning objectives

- Identify the incentives for a firm to collude.
  - Cartel formation
- Understand how cartels and other forms of collusion can be sustained.
  - Sustainability of tacit collusion
  - Repeated competition
- Understand how authorities can fight against collusion.
  - Detecting and fighting collusion
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%
- Concentration on the production side
  - Slow and costly plant construction
  - Economies of scale in the production technology
- Buyer side is more fragmented.
- November 2001: European Commission imposes a fine of 855.22 m € to 8 companies for participating to secret market-sharing and price-fixing cartels.
Formation and stability of cartels

• Simple market structure
  • $n$ symmetric firms produce a homogeneous good
  • Constant marginal cost $c$
  • Competition à la Cournot
  • Firms face an inverse demand given by $P(q) = a - q$, where $q$ is the total quantity produced

• 3 alternative procedures
  • Firms decide simultaneously whether or not to participate in a single industry-wide cartel.
  • Endogenous formation of cartels in a sequential way
  • Bilateral market-sharing agreements (“I stay out of your market if you stay out of mine”)

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Simultaneous cartel formation

• A cartel of $k$ firms is formed, with $1 < k \leq n$.
• The Cournot game is thus played among the other $(n - k)$ independent firms and the cartel.
• All $(n - k + 1)$ players are symmetric.
  • Assumption: inside the cartel the division of profits is equitable.
• For a given cartel size, profits for firms inside and outside the cartel are

$$\pi^{\text{in}}(k) = \frac{(a - c)^2}{k(n - k + 2)^2}$$  \text{ and }  $$\pi^{\text{out}}(k) = \frac{(a - c)^2}{(n - k + 2)^2}$$
• **Cartel stability**: No cartel member has an incentive to unilaterally leave the cartel,

\[
\pi^\text{in}(k) \geq \pi^\text{out}(k - 1) \iff \frac{(a - c)^2}{k(n - k + 2)^2} \geq \frac{(a - c)^2}{(n - k + 3)^2}
\]

• **Lesson**: 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.
• Intuition for this result:
  • 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.

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

• See next example
Example: Stable partial cartels

• Recall:
  • Cournot market with homogeneous good, constant marginal cost
  • Simultaneous formation of a single cartel
  • All firms remain independent if at least 3 firms.

• However, if firms produce horizontally differentiated goods competition and free-riding incentive are relaxed.

• Consider the following inverse demand functions

\[ p_i = a - q_i - \gamma \sum_{j \neq i} q_j, \text{ where } \gamma \in [0,1] \]

measures the strength of product substitutability
Example: Stable partial cartels

• Suppose \( n = 3 \), \( \gamma = 1/2 \) and \( a - c = 1 \).

• Nash equilibrium in which 2 firms form a cartel while the 3\(^{rd} \) remains independent

  • Cartel firms choose \( q_1 \) and \( q_2 \) to maximize their joint profits

\[
\Pi_{12} = \left( (1 - q_1 - \frac{1}{2}(q_2 + q_3))q_1 + (1 - q_2 - \frac{1}{2}(q_1 + q_3))q_2 \right)
\]

• Symmetry leads to \( q_1 = q_2 = q_{12} \) and joint profits

\[
\Pi_{12} = 2 \left( 1 - \frac{3}{2}q_{12} - \frac{1}{2}q_3 \right)q_{12}
\]

• FOC: Derive the cartel’s reaction function

\[
q_{12}(q_3) = \frac{1}{6}(2 - q_3)
\]
Chapter 14 – Formation and stability of cartels

• Independent firm chooses $q_3$ to maximize

$$\pi_3 = \left(1 - q_3 - \frac{1}{2}(q_{12} + q_{12})\right)q_3$$

• Reaction function (from FOC)

$$q_3(q_{12}) = \frac{1}{2}(1 - q_{12})$$

• Equilibrium quantities $q_{12} = 3/11$ and $q_3 = 4/11$

• Equilibrium profits $\pi_1 = \pi_2 = \pi^{in}(2) = 27/242$
  and $\pi_3 = \pi^{out}(2) = 32/242$

• Free-riding effect is still present as $\pi^{out}(2) > \pi^{in}(2)$
• Two requirements for the cartel to be stable
  • Internal stability (no leaving)
    • If firms leave the cartel, 3 firms would be independent.
    • Stability as long as \( \pi^{in}(2) \geq \pi^{out}(1) \) which is true as 
      \[ \frac{27}{242} \approx 0.1116 > \frac{1}{9} \approx 0.1111 \]
  • External stability (no entry into the cartel)
    • Compute the profits firm 3 would obtain by joining firms 1 and 2 in the cartel.
    • No incentive to join as long as \( \pi^{out}(2) \geq \pi^{in}(3) \) which is true as 
      \[ \frac{32}{242} \approx 0.132 > \frac{1}{8} \approx 0.125 \]

• End of example
Sequential cartel formation

• Game where multiple cartels can be formed
  • Exogenous specification of the ordering of the firms; 1st firm proposes a cartel; if all prospective members accept, cartel is formed; otherwise, 1st firm in the ordering that refuses proposes another cartel; etc.

Source: Bloch, 1995
Sequential cartel formation (cont’d)

- Sequentiality entails important differences
  - Firms can commit to stay out of the cartel.
  - At equilibrium, first firms remain independent and free-ride on cartel that last firms will eventually form.
  - Firms prefer to form a cartel of size $k$ than to remain independent if

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

$$\iff (k - 1)(-k^2 + (2n - 3)k - (n + 1)^2) \geq 0$$

$$\iff k > \frac{1}{2} \left(2n + 3 - \sqrt{4n + 5}\right) > 0.8n$$
Sequential cartel formation (cont’d)

• **Lesson**: Consider a Cournot market with homogenous goods. The first \((n - k^*)\) firms remain independent while the last \(k^*\) firms form a cartel, with \(k^*\) being larger than 80% of the firms in the industry.

• **Intuition**
  - **Simultaneous** cartel formation: each firm has an incentive to leave the cartel.
  - **Sequential** cartel formation: first firms can commit to stay out and cartel can then form
Network of market-sharing agreements

• **Bilateral** collusive agreements

• Market-sharing agreements
  • 2 firms are active on different geographical markets or serve distinct consumer segments
  • Refraining from competing on the other firm’s territory
  • Constitute a collusive structure, a collusive network

• Network stability if
  • No pair of firms has an incentive to form a new link.
  • No firm has an incentive to unilaterally destroy an existing link.

• **Lesson**: If collusive network are negotiated bilaterally, they may lead to full collusion, with every firm a monopoly on its own market.
Tacit collusion

- ‘Meeting of the minds’ between colluding firms
- Analysis of ‘tacit agreements’ is also highly relevant for explicit agreements
  - Sustainability necessary for cartels as long as punishments cannot be legally binding
- Considering 2 firms
  - Offer perfect substitutes at constant marginal costs \( c \)
  - Compete over time (each period \( t = 1, 2, \ldots, T \), firms repeat the ‘static’ game)

**Lesson:** If competition is repeated over a **finite** number of periods, firms play according to the (unique) Nash equilibrium of the static game in each period. Tacit collusion cannot emerge.
Tacit collusion: Infinite horizon

• Infinite time horizon (no known end to the game)
• Tacit collusion may emerge.
• Consider the **grim trigger strategy**
  • Firm $i$ starts by choosing the action that maximizes total profits.
  • Firm $i$ keeps on choosing this action as long as both firms have done so in all previous periods.
    $\rightarrow$ *cooperation phase*
  • If one firm deviates, deviation ‘triggers’ the start of the *punishment phase*.
    • Firms choose the action that corresponds to the Nash equilibrium of the static game.
Grim trigger Strategy

• Cooperative action: both obtain $\pi^c = \pi^m/2$

• If one plays the cooperative action and the other optimally deviates, the deviating firm obtains $\pi^d$

• At the Nash equilibrium of the static game, both firms obtain $\pi^n$, with $\pi^d > \pi^c > \pi^n$.

• Trade-off between
  • immediate gain from deviation
  • future losses resulting from the other firm’s punishment

• Trade-off depends on
  • magnitude of the deviation and the punishment profits with respect to the collusive profits
  • the firms’ discount factor
Grim trigger Strategy (cont’d)

- Cooperative phase: present discounted value

\[
V^C = \pi^c + \delta \pi^c + \delta^2 \pi^c + ... = \frac{1}{1 - \delta} \pi^c
\]

- If firm 1 deviates, it will obtain \(\pi^d\) in the current period and \(\pi^n\) in all subsequent periods

\[
V^D = \pi^d + \delta \pi^n + \delta^2 \pi^n + ... = \pi^d + \frac{\delta}{(1 - \delta)} \pi^n
\]

- Follow the grim trigger strategy if and if only

\[
\frac{1}{1 - \delta} \pi^c \geq \pi^d + \frac{\delta}{1 - \delta} \pi^n
\]

\[
\frac{\delta}{1 - \delta} (\pi^c - \pi^n) \geq \pi^d - \pi^c
\]

\[
\delta \geq \frac{\pi^d - \pi^c}{\pi^d - \pi^n} \equiv \delta_{\text{min}}
\]
Application to price competition

- Bertrand competition model with constant and identical marginal costs
  - If both firms collude, they make a profit of $\pi^c = \pi^m/2$
  - Undercutting the rival’s price leads to deviation profits of $\pi^d = \pi^m - \varepsilon$
  - After deviation has occurred, $\pi^n = 0$
  - Minimum discount factor

\[
\delta_{\text{Bert}}^{\text{min}} \geq \frac{\pi^d - \pi^c}{\pi^d - \pi^n} = \frac{\pi^m - (\pi^m / 2)}{\pi^m - 0} = \frac{1}{2}
\]

- **Lesson**: In the infinitely repeated Bertrand duopoly game, any profit level between zero and the monopoly profit can be supported in a subgame perfect equilibrium if the discount factor is sufficiently large, $\delta \geq 1/2$. 

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Application to price competition (cont’d)

• Suppose \( n \) firms operate in the market
  
  • Total collusive profits have to be shared among \( n \) firms: \( \pi^c = \pi^m/n \)

\[
V^C \geq V^D \iff \frac{1}{1 - \delta} \frac{\pi^m}{n} \geq \pi^m \iff \delta \geq 1 - \frac{1}{n} \equiv \delta_{\text{min}}^{\text{Bert}}(n)
\]

• Critical discount factor \( \delta_{\text{min}}^{\text{Bert}}(n) \) is increasing in \( n \)

• **Lesson**: In the infinitely repeated Bertrand price-setting game, the set of discount factors that can support collusion is larger the smaller the number of firms in the market.
Application to quantity competition

- $n$-firm Cournot model with constant and identical marginal costs
  - Inverse demand $P(q) = a - q$
  - Resulting collusive profits:
    \[
    \pi^c = \frac{\pi^m}{n} = \frac{1}{4n} (a - c)^2
    \]
  - Recalling Cournot Nash equilibrium profits:
    \[
    \pi^n = \frac{1}{(n + 1)^2} (a - c)^2
    \]
  - If other firms play the collusive quantity $q^m/n$, then
    \[
    \pi^d = \frac{(n + 1)^2}{16n^2} (a - c)^2
    \]
Application to quantity competition (cont’d)

• Minimum discount factor to allow firms to sustain the monopoly outcome:

\[ \delta_{\text{min}}(n) \equiv \frac{\pi^d - \pi^c}{\pi^d - \pi^n} = \frac{(n+1)^2(a-c)^2}{16n^2} - \frac{(a-c)^2}{4n} = \frac{(n+1)^2}{(n+1)^2} \]

\[ = \frac{(n+1)^2}{n^2 + 6n + 1} \]

• \( \delta_{\text{min}}(n) \) increases with \( n \)
• as \( n \to \infty \), the critical discount factor converges to 1
Optimal punishment of deviating firms

- Under **price competition**, reversion to the Nash equilibrium generates zero profits for all firms.
  - Most severe credible punishment

- Under **quantity competition**, reversion to the Nash equilibrium gives rise to positive profits.
  - Possible to design more severe punishment schemes

- **But, punishment must be credible**
  - Reversion to the Nash equilibrium forever ensures this credibility.
  - With more severe punishments, credibility can be restored by shortening the punishment phase, eventually coming back to the collusive outcome.
Optimal punishment of deviating firms (cont’d) 

• Stick-and-carrot strategies 

1. Start the game by playing the collusive output $q^*$, as prescribed by the collusive agreement.

2. Cooperate as long as the collusive output has been observed in all preceding periods.

3. If one of the players deviates from the collusive agreement at period $t$, play $\hat{q}$ at period $t + 1$ (punishment phase) and return to the collusive agreement at period $t + 2$.

4. If one of the players chooses a quantity $q \neq \hat{q}$ during the punishment phase, start the punishment phase again at the following period.
• **Lesson**: In the infinitely repeated Cournot quantity setting game, the set of discount factors that can support full collusion is larger when firms use the optimal punishment of the stick-and-carrot strategy rather than the reversion to the Nash equilibrium of the grim trigger strategy.
Collusion and frequency of interaction

• Suppose
  • \(n\) firms, Bertrand competition, grim-trigger strategy
  • **Scenario 1**: firms compete only every \(k\) periods

\[
V_1^C = \frac{\pi^m}{n} + \delta^k \frac{\pi^m}{n} + \delta^{2k} \frac{\pi^m}{n} + \ldots = \frac{1}{1 - \delta^k} \frac{\pi^m}{n} \quad \text{and} \quad V_1^D = \pi^m
\]

• **Scenario 2**: price are set for \(k\) periods

\[
V_2^C = \frac{1}{1 - \delta} \frac{\pi^m}{n} \quad \text{and} \quad V_2^D = \pi^m (1 + \delta + \delta^{k} + \delta^{k-1}) + \delta^k \times 0 = \frac{1 - \delta^k}{1 - \delta} \pi^m
\]

• In both cases, cooperation is preferable if \(\delta \geq \left(1 - \frac{1}{n}\right)^{1/k}\)
  • Threshold \(\uparrow\) with \(k\)

• **Lesson**: Firms find it harder to sustain collusion when they interact less frequently or when price adjustments are less frequent.
Collusion and multimarket contact

• What if firms face same competitors on several markets? Does this facilitate tacit collusion?
• 2 effects
  • Deviation more profitable ⟷ it can take place on all markets at the same time
  • Deviation more costly ⟷ deviators can be punished on all markets
• The 2 effects cancel out if identical markets, identical firms and constant return to scale.
• Otherwise, 2nd effect dominates
  • Collusion easier to sustain with multimarket contacts
• Applications
  • Differing markets
  • Differing firms
Application: differing markets

- Different frequency of interaction
  - Suppose that firms can change prices more frequently in market 1 than in market 2
  - Multimarket contact opens up the possibility that a deviation in market 2 can be (immediately) punished in market 1
  - Pooling of incentive constraints across the two markets facilitates collusion

- Different number of firms
  - Suppose that firms A and B are both present in markets 1 and 2, firms C is only present on market 2
  - Idea: to induce firm C to collude by
    - leaving it a larger market share on market 2
    - Using the interaction on market 1 as a disciplining device
Application: differing markets (cont’d)

• Firms $A$ and $B$ are able to sustain collusion in both markets although they would not be able to collude on market 2 were they only active on that market.

• Lesson: With multimarket contact on different markets, collusion may become sustainable in several markets, even though deviations would be profitable if firms were active only in one of the markets.
Application: Differing firms

• 2 markets (1 and 2)
• 2 firms (A and B)
  • firm A is installed in market 1
  • firm B is installed in market 2
• Each firm
  • produces a homogenous good at constant marginal cost c
  • faces a transportation costs of $\tau$ to move one unit of output from its 'home' to the 'foreign' market
• Demand on both markets is given by $Q(p) = a - p$
• Monopoly price for home firm is $p^m(c) = (a - c) / 2$
• To ensure competition, we assure marginal cost of the foreign firm is smaller than the monopoly price
  $$c + \tau < (a + c) / 2 \text{ or } 2\tau < a - c$$
Benchmark: Market-sharing agreements in one market

• As a benchmark, we first examine the optimal collusive outcome that would prevail if firms were only competing in one market.

• Assuming Bertrand competition, the optimal punishment consists for both firms in setting their price equal to $c$ in every future period following a deviation.

• Let $s_h + s_f$ denote the respective market shares of the home and the foreign firm.

(by definition, $s_h + s_f = 1$)
• If the collusive price is \( p \geq c + \tau \)

• A deviating firm with cost \( c_i \) will slightly undercut and achieve immediate profit equal to

\[
\pi^d(p, c_i) = (p - c_i)(a - p)
\]

with \( c_i = c \) for the home firm and \( c_i = c + \tau \)

• Hence both firms abide by the collusive agreement as long as

\[
\begin{cases}
\frac{1}{1-\delta} s_h (p-c)(a-p) \geq (p-c)(a-p) \iff s_h \geq 1 - \delta \\
\frac{1}{1-\delta} s_f (p-c-\tau)(a-p) \geq (p-c-\tau)(a-p) \iff s_f \geq 1 - \delta
\end{cases}
\]
• We can sum the two conditions and conclude that only if \( \delta \geq 1/2 \) the firms can sustain collusive prices above \( c + \tau \).

• But a large enough market share must be allocated to the inefficient foreign firm to keep it from deviating.

• It must be that \( s_f \geq 1 - \delta \).
Market-sharing agreements in two markets

- Focus on symmetric collusive outcomes
  - Both firms set the same price $p$ on both markets
  - The home firm receives a share $s_h$

- For a given $p \geq c + \tau$, the best collusive outcome involves $s_h = 1$ which implies that each firm completely withdraws from the foreign market.

- Best collusive price is $p^m(c) = (a + c)/2$

- Present value of abiding by the market-sharing agreement

$$V^c = \frac{1}{1-\delta} \frac{(a-c)^2}{4}$$
• The best deviation consists in entering the foreign market and undercutting the home firm.
  • immediate profit of \((p^m(c) - c - \tau)(a - p^m(c))\)
  • Meanwhile, in this period, the firm is keeping the monopoly profit on its home market.
• As before the punishment that follows the deviation yields a continuation profit of zero.
• So the present discounted value of deviation is
  \[
  V^D = \frac{(a-c)^2}{4} + \frac{(a-c)(a-c-2\tau)}{4}
  \]
• Therefore a market-sharing agreement can be sustained if \(V^c \geq V^d\) or
  \[
  \delta \frac{(a-c)^2}{1 - \delta} \geq \frac{(a-c)(a-c-2\tau)}{4} \iff \delta \geq \frac{1}{2} \frac{a-c-2\tau}{a-c-\tau}
  \]
Market-sharing agreements with differing firms

**Lesson**: The optimal market-sharing agreement can be sustained over a larger set of discount factors than the most profitable collusive outcome that firms can achieve when they are present on one market only.
Case. Multimarket contact in the U.S. airline industry

- Markets: different city-pair routes
- Multimarket contact may facilitate collusion when
  - Firms differ in their production costs across markets
  - Markets themselves differ
- Both conditions are relevant in this industry.
- Hub and spoke model
  - Significant cost advantage to the carrier operating the hub
- Significant cross-route differences
- Experts claimed: airlines refrain from pricing aggressively in a given route for fear of retaliation in another jointly contested route.
- Fares are (on average) higher on routes where the competing carriers have extensive interroute contacts.
Tacit collusion and cyclical demand

• Many markets are characterized by demand fluctuations
• Extension of the single-market analysis
  • 2 demand states: demand is either good $Q_G(p)$ or bad $Q_B(p)$ with $Q_G(p) > Q_B(p)$, for all $p$
  • Firms observe state of demand before setting their price.

• **Lesson**: Under demand uncertainty, the critical discount factor above which the fully collusive outcome can be sustained is larger than under demand certainty.

• Intuition
  • Punishment entails loss of an average of high and low profits $\rightarrow$ it is less severe than if the good demand state persisted
  • Hence, fully collusive outcome is more difficult to sustain than under demand certainty.
Tacit collusion and cyclical demand (cont’d)

• Partial collusion for lower discount factors
  • Full collusion sustained in the bad demand state but not in the good demand state
    • Bad demand: firms charge the monopoly price.
    • Good demand: firms set prices more aggressively than under monopoly.
  • Possible result: firms price lower in the good than in the bad demand state
  • Model can generate lower prices after a positive demand shock and countercyclical prices and markups.
Tacit collusion and cyclical demand (cont’d)

• **Lesson**: When full collusion cannot be sustained, firms may partially collude by setting the respective monopoly price in the bad demand state and setting a price lower than the respective monopoly price in the good demand state. This result is compatible with counter-cyclical prices and markups.

• **Illustration**: market for antibiotic tetracycline
  • Firms were confronted with a positive demand shock when the Armed Service Medical Medical Procurement Agency placed a large order in October 1956.
  • Thereafter, pure discipline among firms broke down.
Tacit collusion with unobservable actions

• Here, firms do not observe deviations
  • As before, demand uncertainty. But, no observation of state of demand, nor of rivals’ prices → no way to infer deviations from market outcomes.

• Model
  • 2 firms, homogeneous product, constant marginal cost \( c \), Bertrand competition
  • Bad demand state (probability \( \alpha \)): no demand
  • Good demand state (probability \( 1-\alpha \)): \( Q(p) > 0 \) for all \( p \geq c \).
  • If firm faces zero demand, signal extraction problem:
    • Is it because rival deviated or because of bad demand?
 Tacit collusion with unobservable actions (cont’d)

• Structure of punishment?
  • Punishment forever after zero demand? Too harsh as zero demand may result from bad state.
  • But milder punishment → lower discipline...

• Proposed strategies for both firms:
  1. Start with the collusive phase and charge price \( p^m \) until one firm makes zero profit (which along the equilibrium path, occurs in the low demand state)
  2. If one firm makes zero profits, this triggers a punishment phase for \( T \) periods in which each firm charges \( c \). After \( T \) periods firms return to step 1.
Tacit collusion with unobservable actions (cont’d)

• Proposed strategies (cont’d)
• Clearly leads to higher profits than repeated static Bertrand equilibrium.
• Objective: find $T$ that maximizes expected present discounted value under constraint that strategies constitute an equilibrium. (see details in book)

• Lesson: Even if firms cannot observe deviations of other firms from equilibrium play, collusion can still be supported to some extent. However, the conditions for collusion to be sustainable are stricter than in a world in which deviations can be immediately observed and punished. In addition, profits are lower.
Detecting and fighting collusion

• Why do competition authorities mainly try to uncover explicit agreements such as price-fixing cartels if firms have other means to sustain collusion?

• **Answer (Lesson):** Without the information sharing within a cartel, collusion is more likely to be infeasible. Even if it is feasible, collusion may not be supported over the whole time-horizon but firms may alternate between collusive and punishment phases (over varying length) in which they switch between a high and a low price.
Detecting and fighting collusion

- Communication is central to collusion; thus it can be used to detect collusion.
  - Collusion might leave significant pieces of evidence.
    - Permanent records of meetings or agreements
    - Telephone conversations may have been tapped.
- Competition authorities have designed policies to encourage cartel members to bring evidence to the authorities by themselves.
- Simply looking at possible high price-cost margins is not sensible.
  - as we have seen in Chapter 3 about market power
The difficulty in detecting collusion

• Four methods to detect collusion

1. Is the firm’s behaviour consistent or not with properties or behaviour that are supposed to hold under a wide class of competitive models?
2. Are there structural breaks in the firm’s behaviour?
3. Does the behaviour of suspected colluding firms differ from competitive firm’s behaviour?
   • If only a subset of firms in the industry colludes and they can be identified a comparison can be directly carried out.
   • Otherwise one can resort to comparison across markets and across periods.
4. Which model (competitive or collusive) better fits the data?
The difficulty in detecting collusion (cont’d)

• All 4 methods suffer from 2 general problems:
  1. Necessary data to identify firm’s behaviour often not available (cost is often unobservable).
  2. Firms have incentive to misreport private information.
     • Authorities are likely to suffer from the so-called indistinguishability theorem
     • → firms misreport cost information to make prices appear as resulting from competitive – and not collusive – behaviour

• Even if needed data are available, estimation of firm’s behaviour may be extremely sensitive to model specifications.
Leniency and whistleblowing programmes

• To obtain evidence for the existence of cartels and collusion, competition authorities introduced
  • Corporate leniency programmes
    • Reduced sentences for firms that cooperate with the authorities and provide evidence for the existence of a cartel
  • Whistleblowing programmes
    • Shielding individual informants from criminal sanctions
• Results of law enforcement
  • Make cartels less stable
  • Break-up existing cartels
  • Prevent the formation of cartels
Case. The vitamin cartels (cont’d)

- For violation of article 81 of the Community Treaty and article 53 of the European Economic Area Agreement, 8 companies were fined for forming a cartel.
- 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.
Case. The beer cartel in the Netherlands

• 4 Dutch beer brewers formed a cartel on the beer market (a branded consumer good market) in the Netherlands.
  • Coordinated prices and price changes (at the wholesale level)
  • Operated in 2 market segments
    • Consumption on the premises (bars, restaurants, hotels) → Coordinated rebate policies, market-sharing agreements
    • Retail (mostly supermarkets) → Market-sharing agreements
• In 2007 the European Commission fined the 3 leading Dutch brewers Heineken, Grolsch and Bavaria a total amount of 274m EUR for operating this cartel between at least 1996 and 1999.
• InBev (also part of the cartel) provided essential information that led to surprise inspections and hard evidence (handwritten notes, proof of secret meeting dates)
• Under the Commissions leniency programme, InBev did not have to pay fines.
Leniency programme

• Considering a corporate leniency programme whereby a cooperating firm is granted a reward (or, at least, a reduced fine).

• The condition for the sustainability of collusion becomes more stringent.

• **Lesson**: Reducing fines for firms which report incriminating evidence may deter collusion. However, for some cartels, competition authorities have to grant sufficiently large positive rewards to deter collusion.
Whistleblowing programme

• Complementation of the corporate leniency programme by granting a positive reward to employees reporting incriminating evidence.
• Firms will have to bribe informed employees to prevent them from disclosing information.
• Collusion becomes less profitable and thus harder to sustain.

• **Lesson**: Corporate leniency and individual whistleblowing programmes are complementary in the fight against collusion.
Review questions

• Contrast the conditions for cartels to be stable when they form in a simultaneous versus sequential way.

• Explain how a collusive outcome may emerge noncooperatively as the equilibrium of a repeated game. Discuss how the horizon of the game, the number of firms, the frequency of interaction and multimarket contact affect the sustainability of collusion.

• Explain why tacit collusion is harder to sustain when demand fluctuates and the rival’s actions cannot be observed.

• Explain why competition authorities encourage colluding firms and their employees to report incriminating evidence through leniency and whistleblowing programmes.