

Gliederung der Vorlesung

Teil 1: Markt- und Preistheorie

- A Perfect Competition vs. Monopoly
- B Market Power, Competition, and Welfare
- C Market Structure and Market Power

D Collusion and Cartels

- 1) Collusion and Cartels
- 2) Incentives to Collusion and Cheating
- 3) Cartel Stability
- 4) Facilitating Factors
- 5) How to Detect and Fight Collusion
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Teil 2: Wettbewerbstheorie und –politik

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- H Vertikale Vereinbarungen und Zusammenschlüsse
- I Behinderungsstrategien – Kampfpreise, Monopolisierung und Preisdiskriminierung

D1: Collusion and Cartels

- What is a cartel?
 - attempt to enforce market discipline and reduce competition between a group of suppliers
 - cartel members agree to coordinate their actions
 - prices
 - market shares
 - exclusive territories
 - prevent excessive competition between the cartel members

Vereinbarungen und abgestimmte Verhaltensweisen

Collusion (Merriam-Webster): secret agreement or cooperation especially for an illegal or deceitful purpose

D1: Collusion and Cartels

- Cartels have always been with us
 - electrical conspiracy of the 1950s
 - garbage disposal in New York
 - Archer, Daniels, Midland
 - the vitamin conspiracy
- Some are *explicit* and difficult to prevent
 - OPEC
 - De Beers
 - shipping conferences

Beispiele s. Homepage von Stephen Martin, insb. DOJ Videos zu Lysine-Kartell
<http://www.mgmt.purdue.edu/faculty/smartin/courses/cm.asp>

D1: Collusion and Cartels

- Other less explicit attempts to control competition
 - formation of producer associations
 - publication of price sheets
 - peer pressure (NASDAQ?)
 - **violence**
- Cartel laws make cartels illegal in the US and Europe (and from 1.1.2006 even in Austria!)
- Authorities continually search for cartels
- Have been successful in recent years
 - Nearly \$1 billion in fines in 1999

Österreich: Materialien zum Regierungsvorlage betreffend das Bundesgesetz gegen Kartelle und andere Wettbewerbsbeschränkungen (Kartellgesetz 2005 - KartG 2005) Zum Titel

Während das geltende Kartellgesetz den Titel Bundesgesetz **über** Kartelle und andere Wettbewerbsbeschränkungen trägt, soll das neue Gesetz ein Bundesgesetz **gegen** Kartelle und andere Wettbewerbsbeschränkungen sein; damit soll schon im Titel deutlicher als bisher der Zweck des Gesetzes zum Ausdruck kommen.

Die nach dem zweiten Weltkrieg einsetzende Kartellgesetzgebung ist von der Vorstellung ausgegangen, dass das Kartellwesen – oder besser das Kartellunwesen – eine nicht nur weit verbreitete, sondern auch unvermeidliche Erscheinung des Geschäftslebens ist und nach (großzügiger) Genehmigung von Kartellen durch das Kartellgericht zum Ausgleich begleitender Maßnahmen bedarf: Dabei handelt es sich zunächst um die „Verwaltung“ genehmigter Kartelle unter kartellgerichtlicher Aufsicht (wofür die Institution des Kartellbevollmächtigten vorgesehen wurde). Die einschlägigen Bestimmungen werden durch die vorgesehene Reform gegenstandslos.

Daneben erhält das geltende Kartellgesetz 1988 noch weitere Bestimmungen, die den oben angeführten Zweck verfolgen: Es sind dies die in den §§ 28 bis 30 KartG 1988 enthaltenen kartellvertragsrechtlichen Bestimmungen (Kündigung und Austritt, Mäßigung von Vertragsstrafen, Vertragshilfe gegen Sperren) und die in den §§ 122 bis 124 KartG 1988 enthaltenen zivilprozessualen Bestimmungen (Zivilprozesse über Kartellverträge, Klage wegen Sperren, Beschränkung von Schiedsverträgen). Die angeführten Bestimmungen sind schon derzeit unzeitgemäß und weitgehend totes Recht. In das neue System, das eine Genehmigung von Kartellen nicht mehr kennt und von einem allgemeinen Kartellverbot ausgeht, passen sie überhaupt nicht mehr; sie sollen deshalb in ein neues Kartellgesetz nicht übernommen werden.

Die Regelung über unverbindliche Verbandsempfehlungen wird nicht übernommen, da sie nicht in das neue System passt.

Auch die Einrichtung des Kartellregisters ist im neuen System entbehrlich und wird daher nicht weitergeführt.

D1: Cartels: Examples: The vitamin cartel

- The European Commission has found that 13 European and non-European companies participated in cartels aimed at eliminating competition in the vitamin A, E, B1, B2, B5, B6, C, D3, Biotin (H), Folic Acid (M), Beta Carotene and carotinoids markets.
- A striking feature of this complex of infringements was the central role played by Hoffmann-La Roche and BASF, the two main vitamin producers, in virtually each and every cartel, whilst other players were involved in only a limited number of vitamin products.
- Fines were imposed on the following eight companies as follows:
 - - F. Hoffmann-La Roche AG (Switzerland): € 462 million
 - - BASF AG (Germany): € 296 million
 - - Aventis SA (France): € 5.04 million
 - - Solvay Pharmaceuticals BV (Netherlands): € 9.1 million
 - - Merck KgaA (Germany): € 9.24 million
 - - Daiichi Pharmaceutical Co Ltd (Japan): € 23.4 million
 - - Eisai Co Ltd (Japan): € 13.23 million
 - - Takeda Chemical Industries Ltd (Japan): € 37.05 million

D1: Cartels: Largest cartel fines imposed by EU commission: By Company

Total amount per case (Euros)

Hoffmann-La Roche AG	462,000,000	2001
Lafarge SA ₁	249,600,000	2002
BASF AG ₂	236,845,000	2001
Arkema	219,131,250	2006
Arjo Wiggins Appleton PLC ₁	184,270,000	2001
Solvay	167,062,000	2006
BPB PLC ₁	138,600,000	2002
Shell	108,000,000	2006
Aalberts	100,800,000	2006
Hoechst AG ₁	99,000,000	2003

1 Appeal lodged before the CFI.

2 Following judgment by the CFI.

Link DG Comp Statistics 

Link-Adresse: <http://ec.europa.eu/competition/cartels/statistics/statistics.pdf>

D1: Cartels: Largest cartel fines imposed by EU commission: By Sector

Total amount per case (Euros)

Vitamins	2001	790,505,000
Plasterboards	2002	478,320,000
Hydrogen peroxide	2006	388,128,000
Acrylic glass	2006	344,562,500
Copper fittings	2006	314,781,000
Carbonless paper	2001	313,690,000
Industrial bags	2005	290,710,000
Bitumen Netherlands	2006	266,717,000
Copper plumbing tubes	2004	222,291,100
MCAA	2005	216,910,000

Table 2. Eleven Global Cartels with Corporate Fines Imposed by U.S., EC, and Canada, 1996-2003.

Cartel	U.S.	EC	Canada
	<i>Million U.S. dollars</i>		
Lysine	92.5	97.9	11.5
Citric Acid	110.4	120.4	7.9
Vitamins	906.5	756.9	64.0
Sodium gluconate	32.5	51.2	1.6
Graphite electrodes	436.0E	172.0	15.5
Sorbates	132.0	-- ⁺	5.1
Nucleotides	9.0	21.1	--
Vitamin B3	29.7	--	2.5
Isostatic graphite	15.4	51.0	0.4 ⁺
Fine art auctions	52.9	20.1	--
Methyl glucamine	--	2.83	0.34
Total	1,816.9	1,308.3	108.8

Sources: Connor (2003: Tables A.1-A.12).

+ = more fines likely pending

-- = as of 2003, zero fines by this jurisdiction

E = Estimated

Note: These are the only global cases for which two or more jurisdictions had imposed fines by mid-2003.

Connor, JICT 2004

D1: Collusion and Cartels

- Antitrust laws prohibit agreements aimed at fixing prices, sharing markets etc.
- Rationale: such agreements allow firms to exercise market power they would not have otherwise
- Collusion may take different forms, and laws may differ as to what is collusion and what is evidence required to prove it
- Plan: what is collusion, what helps firms to sustain it, what actions can be taken to fight it

⇒ Tacit vs. explicit collusion

D1: Collusion

- Definition: Collusion refers to a situation where firms set prices which are higher than some competitive benchmark (or prices close enough to monopoly situation)
 - ⇒ For economists, collusion is an outcome
- Different kinds of collusions:
 - ⇒ Tacit vs. explicit collusion

D2: The Incentive to Collude

⇒ Cartel formation and collusion constrained because

- they are generally illegal
 - Art 101 TFEU (ex Art 81 (1) EG) und §1 GWB
 - *per se* violation of anti-trust law in US
 - substantial penalties if prosecuted
- cannot be enforced by legally binding contracts
- the cartel has to be *covert*
 - enforced by non-legally binding threats or self-interest

⇒ Collusive agreements need to be self-enforcing

Problem: there is an incentive to cheat on cartel agreement:

- $MR > MC$ for each member $\Rightarrow$ Cartel members have the incentive to increase output

⇒ cartels tend to be *unstable* (OPEC!)

Exceptions of illegality of cartels: De Beers is tacitly supported by the South African government; export cartels are legal in US and also in Germany (? , Schmidt, p. 279)

Self-enforcing: es muss individuell rational, also profitmaximiert sein, sich an Kartellabmachungen zu halten!

Konsolidierte Fassung des Vertrags über die Arbeitsweise der Europäischen Union - DRITTER TEIL: DIE INTERNEN POLITIKEN UND MASSNAHMEN DER UNION - TITEL VII: GEMEINSAME REGELN BETREFFEND WETTBEWERB, STEUERFRAGEN UND ANGLEICHUNG DER RECHTSVORSCHRIFTEN - Kapitel 1: Wettbewerbsregeln - Abschnitt 1: Vorschriften für Unternehmen - Artikel 101 (ex-Artikel 81 EGV)

Artikel 101

(ex-Artikel 81 EGV)

(1) Mit dem Binnenmarkt unvereinbar und verboten sind alle Vereinbarungen zwischen Unternehmen, Beschlüsse von Unternehmensvereinigungen und aufeinander abgestimmte Verhaltensweisen, welche den Handel zwischen Mitgliedstaaten zu beeinträchtigen geeignet sind und eine Verhinderung, Einschränkung oder Verfälschung des Wettbewerbs innerhalb des Binnenmarkts bezwecken oder bewirken, insbesondere

a) die unmittelbare oder mittelbare Festsetzung der An- oder Verkaufspreise oder sonstiger Geschäftsbedingungen;

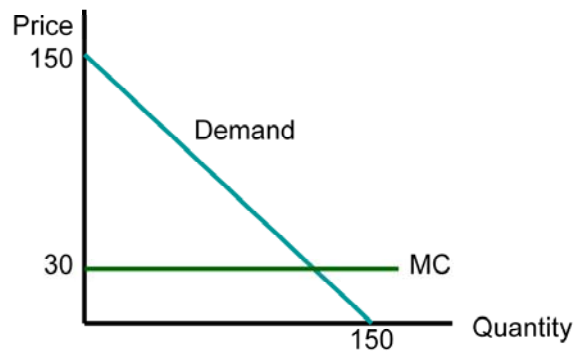
b) die Einschränkung oder Kontrolle der Erzeugung, des Absatzes, der technischen Entwicklung oder der Investitionen;

c) die Aufteilung der Märkte oder Versorgungsquellen;

d) die Anwendung unterschiedlicher Bedingungen bei gleichwertigen Leistungen gegenüber Handelspartnern, wodurch diese im Wettbewerb benachteiligt werden;

D2: The Incentive to Cheat

- Take a simple example
 - two identical Cournot firms making identical products
 - for each firm $MC = \$30$
 - market demand is $P = 150 - Q$ where Q is in thousands
 - $Q = q_1 + q_2$



D2: The Incentive to Cheat

$$\begin{aligned}\text{Profit for firm 1 is: } \pi_1 &= q_1(P - c) \\ &= q_1(150 - q_1 - q_2 - 30) \\ &= q_1(120 - q_1 - q_2)\end{aligned}$$

To maximize, differentiate with respect to q_1 :

Solve this for q_1

$$\partial \pi_1 / \partial q_1 = 120 - 2q_1 - q_2 = 0$$

$$q_1^* = 60 - q_2/2$$

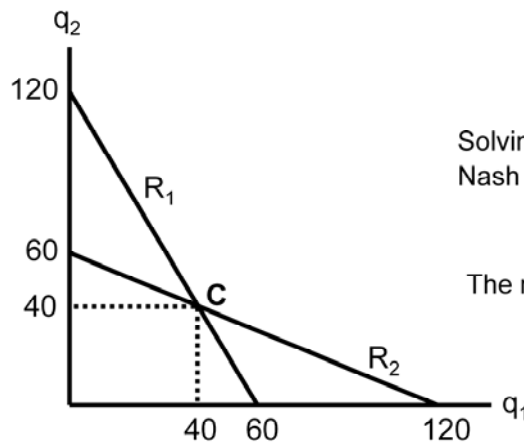
This is the *best response function* for firm 1

The best response function for firm 2 is then:

$$q_2^* = 60 - q_1/2$$

D2: The Incentive to Cheat

These best response functions are easily illustrated



$$q_1^* = 60 - q_2/2$$

$$q_2^* = 60 - q_1/2$$

Solving these gives the Cournot-Nash outputs:

$$q_1^C = q_2^C = 40 \text{ (thousand)}$$

The market price is:

$$P^C = 150 - 80 = \$70$$

Profit to each firm is:

$$\pi_1 = \pi_2 = (70 - 30) \times 40 = \$1.6 \text{ million}$$

D2: The Incentive to Cheat (cont.)

What if the two firms agree to collude?

They will agree on the monopoly output

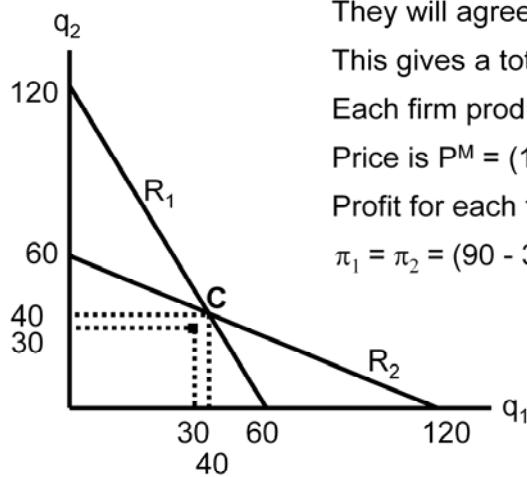
This gives a total output of 60 thousand

Each firm produces 30 thousand

Price is $P^M = (150 - 60) = \$90$

Profit for each firm is:

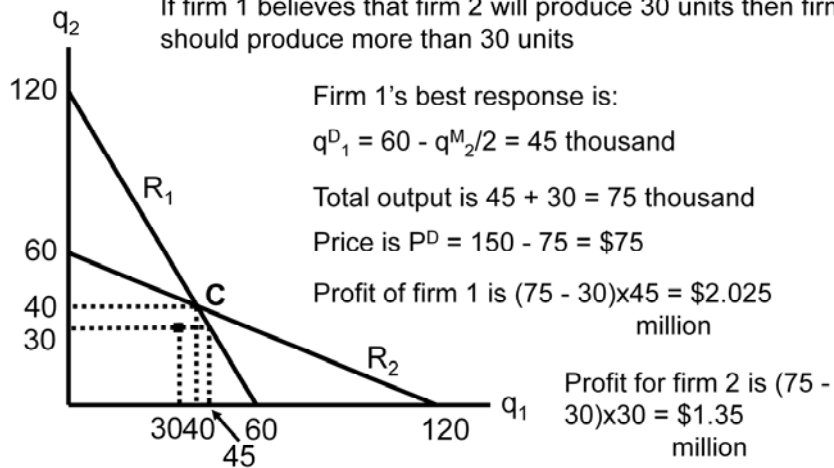
$$\pi_1 = \pi_2 = (90 - 30) \times 30 = \$1.8 \text{ million}$$



D2: The Incentive to Cheat (cont.)

Both firms have an incentive to cheat on their agreement

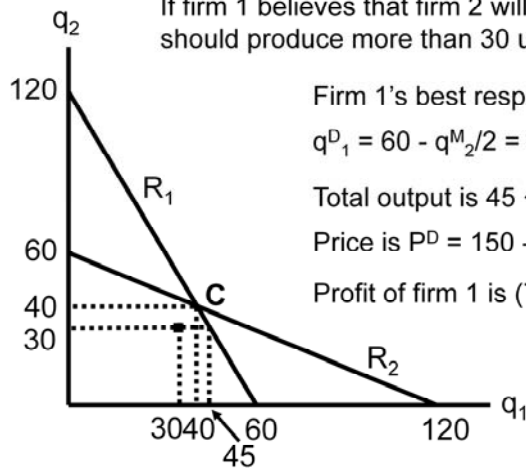
If firm 1 believes that firm 2 will produce 30 units then firm 1 should produce more than 30 units



D2: The Incentive to Cheat (cont.)

Both firms have an incentive to cheat on their agreement

If firm 1 believes that firm 2 will produce 30 units then firm 1 should produce more than 30 units



Firm 1's best response is:

$$q_1^D = 60 - q_2^M/2 = 45 \text{ thousand}$$

Total output is $45 + 30 = 75$ thousand

Price is $P^D = 150 - 75 = \$75$

Profit of firm 1 is $(75 - 30) \times 45 = \$2.025$ million

Profit for firm 2 is $(75 - 30) \times 30 = \$1.35$ million

Cheating pays!!

D2: The Incentive to Cheat (cont.)

Firm 2 can make the same calculations!

This gives the following pay-off matrix:

		Firm 1	
		Cooperate (M)	Deviate (D)
Firm 2	Cooperate (M)	(1.8, 1.8)	(1.35, 2.025)
	Deviate (D)	(2.025, 1.35)	(1.6, 1.6)

Prisoners' dilemma

D2: The Incentive to Cheat (cont.)

Firm 2 can make the same calculations!

This is the payoff matrix:

Both firms have the incentive to cheat on their agreement

		Firm 1	
		Cooperate (M)	Deviate (D)
Firm 2	Cooperate (M)	(1.35, 2.025)	(1.6, 1.6)
	Deviate (D)	(2.025, 1.35)	(1.6, 1.6)

This is the Nash equilibrium

Prisoners' dilemma

D3: Cartel Stability

- The cartel in our example is unstable
- This instability is quite general
- Can we find mechanisms that give stable cartels?
 - violence is one possibility!
- Suppose that the firms interact over time
 - Make cheating unprofitable:
Reward “good” behavior, punish “bad” behavior
- Ingredients necessary to enforce collusion
 - Timely detection of deviations from collusive actions
 - Credible mechanism for the punishment of deviations
 - Threat of punishment prevents firms from deviating

D3: Repeated Games

- Formalizing these ideas leads to **repeated games**
 - a firm's strategy is *conditional* on previous strategies played by the firm and its rivals
 - In the example: cheating gives \$2.025 million once
 - But then the cartel fails, giving profits of \$1.6 million per period
 - Without cheating profits would have been \$1.8 million per period
 - So cheating might not actually pay
- Repeated games can become very complex
 - strategies are needed for every possible history
- But some "rules of the game" reduce this complexity
 - Nash equilibrium reduces the strategy space considerably

D3: Example: Cournot duopoly

The pay-off matrix from the simple Cournot game

		<i>Firm 1</i>	
		Cooperate (M)	Deviate (D)
<i>Firm 2</i>	Cooperate (M)	(1.8, 1.8)	(1.35, 2.025)
	Deviate (D)	(2.025, 1.35)	(1.6, 1.6)

D3: Repeated Games (cont.)

- Time “matters” in a repeated game
 - is the game finite? T is known in advance
 - Exhaustible resource
 - Patent
 - Managerial context
 - or infinite?
 - this is an analog for T not being known: each time the game is played there is a chance that it will be played again

D3: Repeated Games (cont.)

- Take a finite game: Example played twice
- A potential strategy is:
 - I will cooperate in period 1
 - In period 2 I will cooperate so long as you cooperated in period 1
 - Otherwise I will defect from our agreement
- This strategy lacks **credibility**
 - neither firm can **credibly commit** to cooperation in period 2
 - so the promise is worthless
 - The only equilibrium is to deviate in both periods

D3: Repeated Games (cont.)

- What if T is “large” but finite and known?
 - suppose that the game has a unique Nash equilibrium
 - the only credible outcome in the final period is this equilibrium
 - but then the second last period is effectively the last period
 - the Nash equilibrium will be played then
 - but then the third last period is effectively the last period
 - the Nash equilibrium will be played then
 - and so on
- The possibility of cooperation disappears
 - **The Selten Theorem:** If a game with a unique Nash equilibrium is played finitely many times, its solution is that Nash equilibrium played every time.
 - The example is such a case

D3: Repeated Games (cont.)

- How to resolve this? Two restrictions
 - Uniqueness of the Nash equilibrium
 - Finite play
 - Cartel stability is possible even if cooperation is over a finite period of time
 - if there is a credible reward system
 - which requires that the Nash equilibrium is not unique
- ⇒ There is a possibility of rewarding “good” behavior
- If you cooperate in the early periods then I shall ensure that we break to the Nash equilibrium that you like
 - If you break our agreement then I shall ensure that we break to the Nash equilibrium that you do not like
- This is a limited scenario

D3: Cartel Stability (cont.)

- What happens if we remove the “finiteness” property?
- Suppose the cartel expects to last indefinitely
 - equivalent to assuming that the last period is unknown
 - in every period there is a finite probability that competition will continue
 - now there is no definite end period
 - so it is possible that the cartel can be sustained indefinitely

D3: A Digression: The Discount Factor

- How do we evaluate a profit stream over an indefinite time?
 - Suppose that profits are expected to be π_0 today, π_1 in period 1, π_2 in period 2 ... π_t in period t
 - Suppose that in each period there is a probability ρ that the market will last into the next period
 - probability of reaching period 1 is ρ , period 2 is ρ^2 , period 3 is ρ^3 , ..., period t is ρ^t
 - Then expected profit from period t is $\rho^t \pi_t$
 - Assume that the discount factor is R . Then expected profit is
 - $PV(\pi_t) = \pi_0 + R\rho\pi_1 + R^2\rho^2\pi_2 + R^3\rho^3\pi_3 + \dots + R^t\rho^t\pi_t + \dots$
 - The effective discount factor is the “probability-adjusted” discount factor $\Gamma = \rho R$.

Discount factor $R=1/(1+r)$; r : interest rate

Alternative interpretation of discount factor (allowing for different period lengths)

Kaplow, Shapiro, p. 1105: If one period takes time T , and if the interest rate per unit time is r , then the discount factor is $\delta = e^{-rT}$. T can be interpreted as the detection lag (see later).

D3: Cartel Stability (cont.)

- Analysis of infinitely or indefinitely repeated games is less complex than it seems
- Cartel can be sustained by a ***trigger strategy***
 - “I will stick by our agreement in the current period so long as you have always stuck by our agreement”
 - “If you have ever deviated from our agreement I will play a Nash equilibrium strategy forever”

D3: Cartel Stability (cont.)

- Take example 1 but suppose that there is a probability ρ in each period that the market will continue:
 - Cooperation has each firm producing 30 thousand
 - Nash equilibrium has each firm producing 40 thousand
- So the trigger strategy is:
 - I will produce 30 thousand in the current period if you have produced 30 thousand in every previous period
 - if you have ever produced more than 30 thousand then I will produce 40 thousand in every period after your deviation
- This is a “trigger” strategy because punishment is *triggered* by deviation of the partner
- Does it work?

D3: Cartel Stability (cont.)

- Profit from sticking to the agreement is:
 - $PV^C = 1.8 + 1.8 \Gamma + 1.8 \Gamma^2 + \dots$
 $= 1.8/(1 - \Gamma)$
- Profit from deviating from the agreement is:
 - $PV^D = 2.025 + 1.6 \Gamma + 1.6 \Gamma^2 + \dots$
 $= 2.025 + 1.6 \Gamma/(1 - \Gamma)$
- Sticking to the agreement is better if:
 - $PV^C > PV^D$

this requires: $\frac{1.8}{1 - \Gamma} > 2.025 + \frac{1.6 \Gamma}{1 - \Gamma}$, which requires $\Gamma = \rho R > 0.592$

if $\rho = 1$ we need $r < 86\%$; if $\rho = 0.6$ we need $r < 13.4\%$

With higher probability that world does not go on, cheating is more profitable c.p.
 => Discount factor needs to be higher to guarantee cooperation.
 Rho is probability that world goes on!

D3: Cartel Stability (cont.)

- Profit from sticking to the agreement is:

$$\begin{aligned}
 PV^C &= 1.8 + 1.8 \Gamma + 1.8 \Gamma^2 + \dots \\
 &= 1.8 / (1 - \Gamma)
 \end{aligned}$$

- Profit from deviating

$$\begin{aligned}
 PV^D &= 2.025 + 1.6 \Gamma + 1.6 \Gamma^2 + \dots \\
 &= 2.025 + 1.6 \Gamma / (1 - \Gamma)
 \end{aligned}$$

- Sticking to the agreement is more profitable than

$$PV^C > PV^D$$

this requires: $\frac{1.8}{1 - \Gamma} > 2.025 + \frac{1.6 \Gamma}{1 - \Gamma}$, which requires $\Gamma = \rho R > 0.592$

if $\rho = 1$ we need $r < 86\%$; if $\rho = 0.6$ we need $r < 13.4\%$

A cartel is more likely to be stable the greater the probability that the market will continue and the lower is the interest rate

D3: Cartel Stability (cont.)

- This is an example of a more general result
- Suppose that in each period
 - profits to a firm from a collusive agreement are π^C
 - profits from deviating from the agreement are π^D
 - profits in the Nash equilibrium are π^N
 - we expect that $\pi^D > \pi^C > \pi^N$
- Cheating on the cartel does not pay so long as:

$$\pi^D - \pi^C < \frac{\Gamma}{1 - \Gamma} (\pi^C - \pi^N)$$

This is the short-run gain from cheating on the cartel

This is the long-run loss from cheating on the cartel

⇒ The cartel is stable if short-term gains from cheating are low relative to long-run losses

In the preceding example $\pi^D = 2.025 > \pi^M = 1.8 > \pi^N = 1.6$

D3: Cartel Stability (cont.)

- Condition on discount factor: Cheating on the cartel does not pay so long as:

$$\Gamma > \frac{\pi^D - \pi^C}{\pi^D - \pi^N}$$

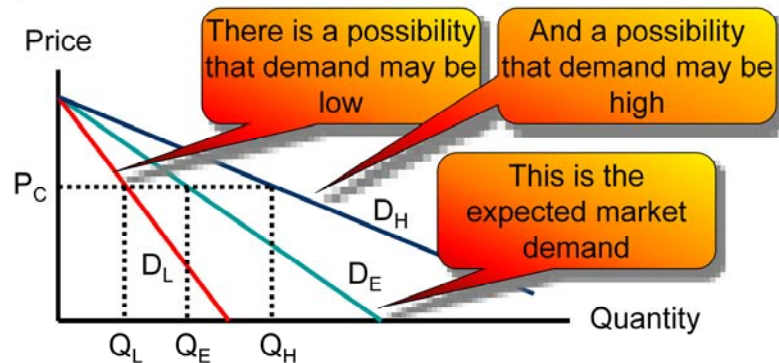
- There is always a value of $\Gamma < 1$ for which this equation is satisfied
 - Bertrand duopoly (homogeneous product): π^D approx. monopoly profit; π^M : $\frac{1}{2}$ monopoly profit; π^N : 0.
 $\Rightarrow \Gamma > \frac{1}{2}$
- $\Rightarrow$ The cartel is stable if cartel members value future profits (high probability-adjusted discount factor)

D3: Trigger strategies

- Any cartel can be sustained by means of a trigger strategy
 - prevents 'destructive' competition
- But there are some limitations
 - assumes that punishment can be implemented quickly
 - deviation noticed quickly
 - non-deviators agree on punishment
 - sometimes deviation is difficult to detect
 - punishment may take time
 - but then rewards to deviation are increased
- The main principle remains
 - if the discount rate is low enough then a cartel will be stable provided that punishment occurs within some "reasonable" time

D3: Trigger strategies (cont.)

- Another objection: a trigger strategy is
 - harsh
 - unforgiving
- Important if there is any *uncertainty* in the market
 - suppose that demand is uncertain

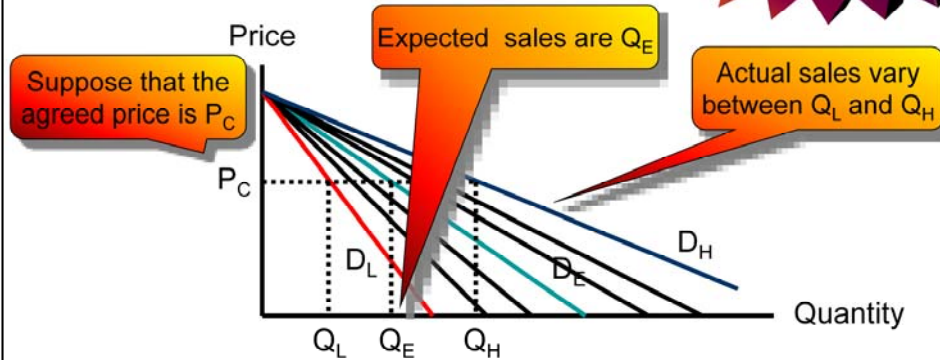


Green-Porter Modell

D3: Trigger strategies (cont.)

- Another objection: a trigger strategy is
 - harsh
 - unforgiving
- Important if there is any *uncertainty* in the market
 - suppose that demand is uncertain

A firm in this cartel does not know if a decline in sales is "natural" or caused by cheating



D3: Trigger strategies (cont.)

- These objections can be overcome
 - limit punishment phase to a finite period
 - take action only if sales fall outside an agreed range
- Makes agreement more complex but still feasible
- Further limitation
 - approach is *too* effective
 - result of the **Folk Theorem**

Suppose that an infinitely repeated game has a set of pay-offs that exceed the one-shot Nash equilibrium pay-offs for each and every firm. Then any set of feasible pay-offs that are preferred by all firms to the Nash equilibrium pay-offs can be supported as subgame perfect equilibria for the repeated game for some discount factor sufficiently close to unity.

Elements of successful collusion

- *reaching consensus:*
 - Understanding what conduct is permitted (prices)
- *detection:*
 - reliable means to detect departures
- *punishment:*
 - credible mechanism to punish such departures
- *Inclusion*
 - inducing participation by a sufficiently large number of incumbent suppliers
- *entry barriers*
 - No arriving new entrants so as to undermine the effectiveness of collusion.

Kaplow, Shapiro, p. 1103,

Economists have long recognized that there exist certain prerequisites to successful collusion. The classic modern reference is Stigler (1964). Green and Porter (1984) embed these issues in a supergame context. The key elements are (1) *reaching consensus: some understanding must be reached* among the otherwise-competing firms regarding what conduct is permitted under the terms of the collusive agreement, such as the prices that the firms will charge; (2) *detection: some reliable means must exist by which departures from the agreement can be detected*; and (3) *punishment: some credible mechanism must be established by which such departures are punished if and when they are detected*. Specifically, the prospect of detection and punishment must be sufficient to deter individual firms' proclivity to cheat on the agreement, typically by cutting prices in the short-term, hoping to reap greater profits through a higher market share, at the expense of the other firms, before they can respond. Related to the need to reach an agreement is the problem of (4) *inclusion: a means of inducing participation by a sufficiently large number of incumbent suppliers so that competition from non-participants does not undermine the profitability of the collusive agreement*. Lastly and relatedly, the incumbent firms must be protected by (5) *entry barriers: there must not be so much competition from quickly arriving new entrants so as to undermine the effectiveness of collusion*.

D3: Collusion: Coordination

- Which collusive price? The problem of coordination
 - ⇒ Tacit collusion: costly experimentation to coordinate on a collusive outcome, risk of triggering price wars
 - ⇒ Explicit collusion: firms coordinate on collusive outcome and avoid problems due to shock adjustments
 - ⇒ (Market sharing schemes: possible to adjust to cost and demand shocks without triggering price wars)
 - ⇒ Firms will try to talk in order to coordinate!

Role of Communications

One of the specific shortcomings of standard models of oligopolistic supergames is that they do not help us understand how the firms initially determine which of the plethora of equilibria to play. One interpretation of these games is that the firms engage in extensive communications and perhaps negotiations *before the game begins, in order to agree upon the equilibrium that they will play*. Under this interpretation, the equilibria in oligopolistic supergames represent self-enforcing outcomes that can arise once an agreement is reached. The alternative explanation of the observed conduct is that the firms somehow find their way to a relatively collusive outcome without engaging in any communications, other than through their actions in the market, such as their setting of prices.

The critical role of communications in sustaining collusion is revealed in the fascinating study by Genesove and Mullin (2001) of the Sugar Institute, a trade association that operated from 1927 to 1936. They examine in detail how sugar refiners established a set of rules to facilitate collusion. The Sugar Institute experience shows how weekly meetings among sugar refiners were used to establish and interpret rules that enforced business practices making price-cutting more transparent. In contrast to the theories described above, which involve no cheating in equilibrium, cheating did occur, but retaliation was carefully limited. This example illustrates a number of functions served by regular communications, functions that could not be served simply by initial communications.

D4: Cartel Formation: Facilitating Factors

- What factors are most conducive to cartel formation and to collusion?
 - sufficient profit motive
 - means by which agreement can be reached and enforced
- **The potential for monopoly profit**
 - collusion must deliver an increase in profits: this implies
 - demand is relatively inelastic
 - restricting output increases prices and profits
 - entry is restricted
 - high profits encourage new entry
 - but new entry dissipates profits (OPEC)
 - new entry undermines the collusive agreement

New entry: Vitamin cartel

Cartel formation vs. Collusion: Zwei unterschiedliche Sachen: Kartellbildung ist Abschluss eines Abkommens, kollusives Verhalten kann „nur“ nicht-kooperatives Gleichgewicht sein.

Wichtig hier: Grundsätzlich erleichtern Faktoren, die Kartellbildung erleichtern auch kollusives Verhalten und umgekehrt.

Faktoren, die kollusives Verhalten erleichtern sind in der Fusionskontrolle besonders wichtig!

Zu den Faktoren, die Kartellbildung erleichtern bzw. Kartelle stabiler machen s. a. den Anhang.

D4: Factors that facilitate collusion

I. Structural factors

$$\frac{\pi^m [1 + \delta + \delta^2 + \dots]}{n} = \frac{\pi^m}{n[1 - \delta]} \geq \pi^m$$

Concentration

$$\delta \geq 1 - \frac{1}{n}$$

Entry

Cross-ownership and other links with competitors

Regularity and frequency of orders

Buyers' power

Evolution of demand

Symmetry

Multi-market contacts

Hinweis: Die Gleichungen beziehen sich auf den Bertrand-Fall mit n Unternehmen.

s. zu diesen Ausführungen auch die ausführliche Diskussion in Kapitel 3.3., S. 1108 ff. (bzw. C, S. 31ff.) in Kaplow und Shapiro

- Konzentration (+): Einträglicher abzuweichen, wenn sehr viele Firmen am Markt sind
- Koordination ist leichter, wenn weniger Firmen am Markt
- Markteintritt (-): Je höher Eintrittsbarrieren, desto wahrscheinlicher ist Kollusion
- Kreuzbeteiligungen oder andere Verbindungen unter Konkurrenten (+) (Google-Apple)
- Regelmäßigkeit und Häufigkeit von Aufträgen (+): Je regelmäßiger und häufiger Aufträge, desto leichter Aufdeckung von Abweichungsverhalten und Bestrafung; sehr großer Auftrag erhöht Abweichungsprofit (Boeing/McDonnell Douglas)
- Käufermacht (-): Je höher Käufermacht, desto weniger wahrscheinlich Kollusion unter Anbietern (z.B. kann großer Käufer Nachfrage bündeln)
- Nachfrageelastizität (? , -): Unklar, weil Preisreduzierung sowohl in der Abweichungs- als auch Bestrafungsperiode große Effekte hat
- Aber: niedrige Elastizität impliziert hohen kollusiven Preis und Profit
- Art der Nachfrage: Zukünftige Nachfrage sinkend (-) (zukünftige Profite kleiner → Bestrafung weniger stark)
- Unsicherheit (-): (geringe Nachfrage entweder aufgrund Abweichung des Konkurrenten aber auch aufgrund geringerer Marktnachfrage)
- Innovationen (-) : (nicht klar, wer zukünftige Gewinne lukriert)
- Produkthomogenität (? , +): bei differenzierten Gütern ist einerseits Bestrafung nicht so wirkungsvoll aber auch Abweichungsprofit kleiner
- Aber: "Sichtbarkeit" von Abweichungen größer bei homogenen Produkten
- Asymmetrie (-): Kleinere Firma hat größeren Anreiz abzuweichen
- Multi-market Kontakt (+): nivelliert Marktasymmetrien; häufigerer Kontakt; Bestrafung potentiell in allen Märkten (aber Abweichungsgewinn auch); aber: Kaplow, Shapiro: „Thus, in more realistic models in which defections and/or punishments actually occur, multi-market contact may have no effect on the ability of the firms to collude.“ 1116
- Überschusskapazität (? , +): einerseits Abweichungsprofit höher, andererseits Möglichkeit der Bestrafung

D4: Facilitating factors, II

II. Price transparency and exchange of information

Observability of firms' actions facilitate enforcement

- Green and Porter's model
- Exchange of information on *past/current* data

Coordination and the role of communication

- Focal points
- Exchange of information on *future* prices and outputs (private v. public announcements)

Examples: ATP and collusion in auctions

II) Preistransparenz und Informationsaustausch (Transportbetonkartell in D)

Beobachtbarkeit (+)

Erhöht Aufdeckbarkeit von Abweichungsverhalten

Preiskriege nicht hinreichend, dass keine Kollusion (Bestrafungsperiode)

Informationsaustausch (+)

Hilft Firmen zu kooperieren; Effizienzargumente nur glaubhaft bei aggregierten Informationen, nicht bei individuellen (z.B. für bessere, relative Anreizsysteme)

„Private“ Ankündigungen (nur für die Konkurrenten bestimmt) "schlechter" als öff. Ankündigungen (auch für Konsumenten, z.B. Werbung)

Beispiele für private Ankündigungen: ATP: Airline tarif publisher: Unternehmen haben bekannt gegeben, wann sie die Ticketpreise um wie viel ändern werden.

Vorankündigung für Preiserhöhung

Auktionen (Deutsche Auktion für Spektrumlizenzen 1999: Mannesmann bot 18,18 Mio DM für Spektren 1-5 und 20 Mio DM für Spektren 6-10; Mindestserhöhung 10%; T-Mobil bekam 1-5 für 20 Mio DM und Mannesmann 6-10 auch für 20 Mio DM, d.h. Mannesmann signalisierte eine Marktaufteilung und T-Mobil nahm an!)

Koordination (+)

"focal point", z.B. status quo erhalten (im Zuge von Marktöffnung nicht zu exportieren; in den Markt einzutreten etc.)

D4: Facilitating factors, III

III. Pricing rules and contracts

- Most-Favoured Nation clause (ambiguous effect)
 - Meeting-Competition clauses (helps collusion, by eliciting information on rivals and discouraging deviations in the first place)
 - Resale price maintenance (enhances cartel stability by eliminating variation in retail prices)
 - Uniform delivered pricing; basing point pricing
- ⇒ Important problem/consideration with facilitating factors:
Redeeming virtues: Might be efficiency enhancing!

(III) Preisregeln und Kontrakte

Most-Favoured Nation – Meistbegünstigungsklausel: Geringerer Anreiz abzuweichen, da selektive Preissenkungen nicht möglich sind. Gleichzeitig geringere Bestrafungsmöglichkeiten, da Bestrafung teurer wird. Es fehlt die Möglichkeit selektiv zu bestrafen. Rückwirkende Klauseln können effizienzsteigernd sein, da sie Investitionsschutz darstellen können.

Kaplow, Shapiro: a firm's use of a most-favored customer clause—under which it agrees to give all customers under contract the benefits of any price cut extended to a subsequent customer—may greatly reduce its incentive to defect from a collusive price since it must sacrifice profits on its existing customer base that was otherwise locked in for a period of time at a higher price.

Meeting competition clause (Niedrigstpreisgarantie) (+)

Verringert Anreize abzuweichen, weil eine Preisreduktion nur neue, nicht aber existierende Kunden von anderen Verkäufern abwerben würde

Resale Price Maintenance (Preisbindungen, +)

Retail-Preisvariationen werden eingeschränkt und stabileres Umfeld fördert die Kollusion

Andere Preispraktiken (+)

Uniform delivered prices (gleiche Preise trotz Transportkosten), basing point pricing (Basispreis plus TK) erhöhen Beobachtbarkeit

Redeeming virtues of facilitating factors: see below: black list!

Definition: Basing point pricing (also known as delivered pricing) refers to a system in which a buyer must pay a price for a product inclusive of freight costs that does not depend on the location of the seller.

Context: The freight costs may be calculated from a specific location or "basing point" from standard published freight rate schedules. Under this system, customers located near or far from the basing point pay the same price. Thus nearby customers are discriminated against or are charged "phantom" freight that they would not incur if they had a choice of paying separately for the product and for the freight charges. Conversely, the freight costs of distant customers are absorbed by the sellers. This practice has been extensively used in industries such as steel and cement and has been viewed as a method to facilitate collusion among firms.

In competition, prices are expected to reflect costs. Economists therefore expect FOB (free on board) plus actual freight costs to emerge in competition. However, firms even in competition may adopt a system of delivered pricing because it is simple and saves administrative costs. This is particularly the case when firms establish price zones within which transportation distances and costs do not vary very much. Moreover FOB pricing plus actual freight costs may be a better means of collusion because it facilitates allocation of customers geographically. In addition the practice may be adopted in order to deter locational entry by otherwise competing firms.

Source Publication: Glossary of Industrial Organisation Economics and Competition Law, compiled by R. S. Khemani and D. M. Shapiro, commissioned by the Directorate for Financial, Fiscal and Enterprise Affairs, OECD, 1993.

Hyperlink: <http://www.oecd.org/dataoecd/8/61/2376087.pdf>

D5: PRACTICE: How to detect and fight collusion?

For economists, collusion is an outcome

Both tacit and explicit agreements may sustain collusion

So, why not inferring collusion from market data?

Inferring collusion from data. Problems, I: price levels

Price data availability (list v. effective prices)

Difficult to estimate 'monopoly price' and marginal costs

Where to set the threshold level?

*A dangerous principle: firms guilty because able to set a high price... (market power not a problem *per se*)*

See Kaplow, Shapiro, Sect. 3.4

how should the factors listed above, which make it more or less difficult to sustain collusive outcomes, be incorporated into a price-fixing case in which the existence of an agreement is proved through circumstantial evidence (Indizienbeweis!).

D5: Standards of proof, II: data

Inferring collusion from data. Problems, II: evolution of prices

Price parallelism: not a proof of collusion (common shocks)

Which legal certainty if firms are found guilty for independent business practices?

'*Parallelism plus*' not convincing either, unless there is proof of coordination on facilitating factors (eg., RPM, info exchange)

Periods of 'price wars' not sufficient condition for collusion either (new capacity, new competitors, demand shocks...)

Conclusion

Econometric tests as complementary evidence, not proof of collusion (results sensitive to different techniques used)

Woodpulp (Holzzellstoff), Dyestuffs (Teerfarben) -Fälle

Woodpulp: Explicit collusion between KEA and Fides, but no agreements with other firms in the industry. European Commission nevertheless concluded from parallel behavior (quarterly price announcements, quasi-simultaneity of announcements, and identical prices) that other firms also infringed Art. 81.

ECJ rejected the Commission's conclusions, as „concertation is not the only plausible explanation for the parallel conduct.

Difference to Dyestuff-case, where also parallel conduct was found: Companies sent faxes to their subsidiaries at the same hour and day!

D5: Standards of proof, III: hard evidence

Hard evidence only (of communication on prices and/or coordination on facilitating practices) as proof

(focus on observable elements verifiable in courts, to preserve legal certainty: fax, e-mail, phone calls, video etc.)

Too lenient with the firms?

(Since collusion can be reached tacitly, focusing on 'hard evidence' amounts to permitting collusion?)

Not necessarily: firms will try to coordinate to avoid costly market experimentation and will leave 'traces'

More active policies can be used, ex ante and ex post

s. a. Videotapes-Fall 2007, Sony etc. WuW April 2008

Kaplow/Shapiro, p. 1126

a paradox of proof. Suppose available evidence indicates that, in the situation under scrutiny, collusion is especially easy and the danger of supra-competitive pricing is accordingly very high. Moreover, evidence conclusively demonstrates that we have experienced a collusive outcome—at roughly the monopoly price—for years. Who wins? Arguably, the defendants. They could argue that, precisely because collusion is so easy, they were able to achieve monopolistic results—and, they gleefully concede, will be able to continue to do so for the foreseeable future—without any meetings in smoked-filled rooms, elaborate negotiations, and so forth. Just a few public pricing signals and they were off. Moreover, since all have taken courses in strategy at business school and all are advised by the leading consulting firms and their affiliated game theory experts, coordinating punishment with only minimal, indirect communications is a snap. Hence, the very strength of the evidence of the ease and success of collusion makes it implausible to infer that the defendant firms actually met and had long discussions about price-fixing.

D5: Ex ante policies to fight collusion

Black list of facilitating practices might deter collusion and free resources for cartel detection

- Private announcements of future prices/outputs
- Exchange of disaggregate current/past information
- Meeting competition, RPM and other clauses, if adopted by coordination
- Cross-ownership among competitors not to be allowed
- Merger control (joint dominance)

Deterrence of collusion: criminal sanctions?

Kaplow Shapiro, p.1132: Discussion of facilitating factors

There remains another important consideration with many facilitating practices: they may have redeeming virtues. Some information exchange enhances planning. Forcing trading into formal markets (which was permitted in *Chicago Board of Trade*⁸⁰) produces benefits that flow from public prices. Contractual arrangements with buyers regarding the sellers' and competitors' prices reduce search costs. Exchange of cost information may enhance productive efficiency by shifting output to more efficient firms; see Shapiro (1986). Even what may seem literally to be price-fixing will often be efficient, such as when productive partnerships or joint ventures are formed and the resultant entity fixes a single price for its common product. Likewise, many other arrangements that may seem beneficial may also have effects on the feasibility of collusion. Accordingly, it is necessary to formulate a means of balancing the costs and benefits

⇒ **Rule of Reason**

D5: Ex post policies to fight collusion

- Surprise inspections
- *Leniency programmes*
 - The US and EU experience:
 - Leniency must be clear and certain (not discretionary)
 - Leniency should be extended to firms that report *after* an investigation has started
- Leniency in the EU
 - total **immunity** ⇔ first one to inform Commission of an undetected cartel
 - **reduction** of fines ⇔ evidence that represents "significant added value" (evidence to prove the infringement).
 - first company: 30 to 50% reduction, the second 20 to 30% and subsequent companies up to 20%.

Leniency: Kronzeugenregelung

Cartels - Leniency

The penalties for companies that breach the competition rules can be very severe. For cartel infringements, the largest fine imposed on a single company is over €479 million; the largest fine imposed on all members of a single cartel is €992 million. In June 2006 the Commission revised its [guidelines for setting fines in competition cases](#). These revised guidelines will often lead to fines for cartels being significantly higher than previously.

However, companies that have participated in illegal cartels have a limited opportunity to avoid or reduce a fine. The Commission operates a leniency policy whereby companies that provide information about a cartel in which they participated might receive full or partial immunity from fines.

About the leniency policy

Along with the other detection and investigation tools at the Commission's disposal, the leniency policy proves very successful in [fighting cartels](#).

In essence, the leniency policy offers companies involved in a cartel - which self-report and hand over evidence - either total immunity from [fines](#) or a reduction of fines which the Commission would have otherwise imposed on them. It also benefits the Commission, allowing it not only to pierce the cloak of secrecy in which cartels operate but also to obtain insider evidence of the cartel infringement. The leniency policy also has a very deterrent effect on cartel formation and it destabilizes the operation of existing cartels as it seeds distrust and suspicion among cartel members.

In order to obtain total **immunity** under the leniency policy, a company which participated in a cartel 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 at the premises of the companies allegedly involved in the cartel. If the Commission is already in possession of enough information to launch an inspection or has already undertaken one, the company must provide evidence that enables the Commission to prove the cartel infringement. In all cases, the company must also fully cooperate with the Commission throughout its procedure, provide it with all evidence in its possession

D6: Other horizontal agreements: JVs

Joint-Ventures: as for mergers, trade-off between market power and efficiency

A special case: Research Joint-Ventures

Because of spillovers and non-rivalry, R&D unlikely to attain socially optimal levels

RJV may promote R&D by sharing costs and avoiding duplications, but:

R&D may fall absent competition, and...

collusion may extend to marketing and production

Only RJV on basic research should be allowed

Competition rules applying to undertakings in the EC and ECSC Treaties
(http://ec.europa.eu/competition/antitrust/legislation/entente3_en.html)

...

3. Horizontal co-operation agreements

[Council Regulation No 2821/71](#) on application of Article 85 (3) [now 81 (3)] of the Treaty to categories of agreements, decisions and concerted practices
Official Journal L 285, 29.12.1971 p. 46-48

Commission reforms competition rules for co-operation between companies

[Press Release IP/00/1376 - 29.11.2000](#)

[Commission Regulation \(EC\) No 2658/2000 of 29 November 2000 on the application of Article 81\(3\) of the Treaty to categories of specialisation agreements](#)
Official Journal L 304, 05.12.2000, p. 3

[Commission Regulation \(EC\) No 2659/2000 of 29 November 2000 on the application of Article 81\(3\) of the Treaty to categories of research and development agreements](#)
Official Journal L 304, 05.12.2000, p. 7 (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000R2659:EN:HTML>)

[Commission Notice - Guidelines on the applicability of Article 81 to horizontal co-operation agreements](#)
Published in the *Official Journal C 3* of 06.01.2001, p. 2. ([http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001Y0106\(01\):EN:HTML](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001Y0106(01):EN:HTML))

Beispiel EU-Praxis: Ford/Volkswagen Joint Venture 1992, 93/49/EEC: Commission Decision of 23 December 1992 relating to a proceeding pursuant to Article 85 of the EEC Treaty (IV/33.814 - Ford Volkswagen)

(<http://eur-lex.europa.eu/Notice.do?val=293829:cs&lang=en&list=293829:cs,&pos=1&page=1&nbl=1&pgs=10&hwords=ford%20volkswagen~&checktexte=checkbox&visu=#texte>)

D6: Research Joint Ventures (RJVs)

- *The Economist*: number of alliances between firms in the US: less than 800 in the 70s - 20.000 in the late 80s.
- Policy response favourable: Cooperative Research Act of 1984 in the U.S.A. or exemptions for RJVs from Art. 85 of the Treaty of Rome, extended considerably in 1985.

Advantages:

- (i) Coordination of projects avoids unnecessary duplications.
- (ii) Spillovers can be internalised.
- (iii) Socially useful information is disseminated efficiently.
- (iv) Financial constraints can be overcome.

Kaiser, IJIO 2002: Sematech: Cooperation among American semiconductor firms.
Germany: 1971: 10 % of all manufacturing firms involved in R&D cooperation. 20 years later: 50%

Commission Regulation (EC) No 2659/2000 of 29 November 2000 on the application of Article 81(3) of the Treaty to categories of research and development agreements (Text with EEA relevance)

Article 1

Exemption

1. Pursuant to Article 81(3) of the Treaty and subject to the provisions of this Regulation, it is hereby declared that Article 81(1) shall not apply to agreements entered into between two or more undertakings (hereinafter referred to as "the parties") which relate to the conditions under which those undertakings pursue:

(a) joint research and development of products or processes and joint exploitation of the results of that research and development;

(b) joint exploitation of the results of research and development of products or processes jointly carried out pursuant to a prior agreement between the same parties; or

(c) joint research and development of products or processes excluding joint exploitation of the results.

This exemption shall apply to the extent that such agreements (hereinafter referred to as "research and development agreements") contain restrictions of competition falling within the scope of Article 81(1).

2. The exemption provided for in paragraph 1 shall also apply to provisions contained in research and development agreements which do not constitute the primary object of such agreements, but are directly related to and necessary for

D6: The effect of spillovers: a formal analysis

- Duopoly with quantity competition
- Linear demand function: $p = a - bq$, $q = q_1 + q_2$
- R&D technology: $c_i = \underline{c} - f(X_i)$,
 - R&D expenditure of firm i : x_i
 - Effective R&D expenditure of firm i : $X_i = x_i + \theta x_j$
 - (Input) Spillover parameter: $0 \leq \theta \leq 1$
 - Cost reduction technology: $f(X_i) = \beta X_i^{1/2}$

- Profit of firm i :

$$\pi_i = (a - b(q_i + q_j))q_i - (\underline{c} - \beta\sqrt{x_i + \theta x_j})q_i - x_i, \quad i \neq j, i = 1, 2$$

The following section on RJVs is technically advanced! So you should know the ideas but not the details of the formal derivation!

Literature: D'Aspremont C., Jacquemin, A. (1988), "Cooperative and Noncooperative R&D in

Duopoly with Spillovers," American Economic Review, 78, 1133-1137. Here we employ Kamien, Muller, Zang, AER 1992 framework. See also Leahy, Neary, AER 1997

D6: The effect of spillovers:

Sequential choice of R&D and output

No R&D cooperation

- Two stage game:
- First stage: firms choose R&D expenditures simultaneously
- Second stage: After observing the rivals R&D expenditures, both firm choose simultaneously their output
- Solution of the model: Backwards:
 - Derivation of optimal output given R&D expenditures, then
 - Derivation of optimal R&D expenditures taking into account the effect on the second stage of the game

Commitment possible: by investing a lot in R&D, firms become „strong“ in the output game.

D6: The effect of spillovers: Sequential choice of R&D and output No R&D cooperation cont.

- Equilibrium of the second stage, given x_1 and x_2

$$q_1 = \frac{a - \underline{c} + 2\beta\sqrt{x_1 + \theta x_2} - \beta\sqrt{x_2 + \theta x_1}}{3b} \quad \text{and}$$

$$q_2 = \frac{a - \underline{c} + 2\beta\sqrt{x_2 + \theta x_1} - \beta\sqrt{x_1 + \theta x_2}}{3b}$$

- Reduced profit function of firm 1: Substitute for q_1 and q_2 , profits as a function of R&D expenditure

$$\pi_1 = \frac{\left(a - \underline{c} + 2\beta\sqrt{x_1 + \theta x_2} - \beta\sqrt{x_2 + \theta x_1}\right)^2}{9b} - x_1$$

Equilibrium in the output game: Standard Cournot equilibrium with linear demand and const marginal costs.

q as a function of x_1 and x_2 : Two effects of an increase in my R&D expenditure on my rival's output:

-Increase due to increased spillover (effect with θx_1)

=> Competitive advantage externality; reduces incentive to invest in R&D

=> decrease due to the fact that I am tougher and have lower costs.

=> Strategic investment effect

D6: The effect of spillovers: Sequential choice of R&D and output No R&D cooperation cont.

- Equilibrium of the first stage:
 - Deriving first order conditions w.r.t. x_i $\frac{\partial \pi_i}{\partial x_i} = 0$
 - Solving for symmetric equilibrium for firms $i = 1, 2$.
- Symmetric equilibrium:
(No R&D coop. (NC))
$$x^{NC} = \frac{(a - c)^2 \beta^2 (2 - \theta)^2}{(9b - \beta^2 (2 - \theta))^2 (1 + \theta)}$$
- Results:
 - Increase in spillovers reduces firm R&D expenditures x^*
 - Firms invest more in R&D in the two stage game (commitment) than in the one stage (no commitment) game if $\theta < 1/2$!

Possibility of commitment makes firms more aggressive.

The effect of spillovers: Higher spillovers imply that - given my own R&D expenditures - effective R&D expenditures increase. Due to the convexity of the cost reduction technology, the marginal return of R&D investments decreases leading to a lower level of R&D expenditures.

Additionally competitive advantage externality: A given R&D investment makes the rival stronger if the spillover is higher.

D6: The effect of spillovers: Sequential choice of R&D and output No R&D cooperation cont.

- Equilibrium output:
$$q^{NC} = \frac{3(a - \underline{c})}{9b - \beta^2(2 - \theta)}$$
- Effective R&D expenditures:
$$X^{NC} = \frac{(a - \underline{c})^2 \beta^2 (2 - \theta)^2}{(9b - \beta^2(2 - \theta))^2}$$
- Results:
 - Increase in spillovers decreases effective R&D expenditures X^*
 - Increase in spillovers decreases output per firm

D6: R&D cooperation in the two stage model

- R&D cooperation: Firms choose R&D expenditures such that industry profits are maximized
- Second stage: Competition in the quantity game
- Solution:
 - Maximize $\pi_1 + \pi_2$ w.r.t x_1 and x_2 $\frac{\partial(\pi_1 + \pi_2)}{\partial x_i} = 0, i = 1, 2.$
 - Solve for symmetric equilibrium (CO)
$$x^{CO} = \frac{(a - c)^2 \beta^2 (1 + \theta)}{(9b - \beta^2 (1 + \theta))^2}$$
 - For $\theta = 1/2$: $x^{CO} = x^{NC}$
 - For low values of the spillover parameter ($< 1/2$), R&D cooperation leads to lower R&D expenditures than non-cooperation, for high values the opposite holds!

What about profits: Clearly increase! Cooperating firms could choose the R&D expenditure from the non-cooperative solution, implying the same profit than in that case. If they deviate they only do that in order to realize higher profits. Of course, profits coincide for $\theta = 1/2$.

For high values of θ the positive externality of spillovers dominates the choice of the firms, for low values the negative effect of increased competition dominates (Prisoners dilemma in the game with commitment). In the first case an increase in x increases the profit of the rival due to the spillover (*combined profits externality*), in the second the rival's profit falls due to the resulting fall in my costs and therefore the fact that I am now a tougher competitor.

D6: RJVs in the two stage model

- RJVs: Firms choose R&D expenditures such that industry profits are maximized and internalize all spillovers, i.e. set $\theta = 1$
- Second stage: Competition in the quantity game
- Solution:
 - Maximize $\pi_1 + \pi_2$ w.r.t x_1 and x_2
 - Solve for symmetric equilibrium (RJV)

$$x^{RJV} = \frac{2(a - \underline{c})^2 \beta^2}{(9b - 2\beta^2)^2}$$
- For all θ : $x^{RJV} > x^{NC}$
- RJVs lead to higher R&D expenditures than R&D competition. They are beneficial for society since output and profits are greater and prices are lower.

The statement w.r.t. to profits follows immediately from the fact that profits are greater under RJVs compared to R&D cooperation and spillover $= 1$. In the latter case profits are greater than under R&D competition.

Pepall et al. Conclude from the welfare result that RJVs should be encouraged as long as they do not lead to cooperation in outputs or prices, i.e. to price-fixing cartels.

D6: R&D cooperation: A caveat

- The above results were derived for a special case, namely linear demand. The result also extends to more general cases (see Kamien, Muller, Zang, AER 1992 and Leahy, Neary, AER 1997).
- However, results do not hold for simple iso-elastic demand (see Dasgupta, Stiglitz, 1980) if elasticity of demand is smaller or equal to 1.
- In this case, R&D cooperation and RJVs enable the firms to implement the collusive solution in the quantity game! (Götz, Hammerschmidt, BoER 2009)

D6: Other horizontal agreements:

Cross-Licensing, Patent Pooling, Standard-Setting

- Cross-licensing: Firms reciprocally allow each other to use technology protected by patents
 - Anti-competitive potential: per-unit-royalties (vs. fixed payments)
 - Efficiencies: technological progress (no “blocking” patents)
- Patent pools: firm or organization holds portfolio of patents and licenses it to third parties as package
 - Effects similar to cross-licensing + reduction of transaction costs.
- Cooperative standard setting: competing firms decide on common standard
 - Pro: Single network, no stranded customers, ex post competition
 - Con: no ex-ante competition, no choice between standards

As a reference for the competitive concerns which arise in the area of intellectual competition see the DOJ and FTC Report ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: Promoting Innovation and Competition, April 2007 <http://www.usdoj.gov/atr/public/hearings/ip/222655.pdf>

Beispiel: Breitbandausbau Deutschland: s. **DStGB legt Rechtsgutachten zur Breitband-Offensive vor.**

http://www.dstgb.de/homepage/pressemeldungen/dstgb_legt_rechtsgutachten_zu_r_breitband_offensive_vor/index.html, Mai 2009

Der jetzige Regulierungsrahmen behindert den schnellen Ausbau und muss deshalb geändert werden. Dies ist das Ergebnis des heute vom DStGB vorgelegten Rechtsgutachtens von Prof. Dr. Dr. Christian Kirchner, Humboldt-Universität zu Berlin.

Die Regelungen konzentrieren sich derzeit zu sehr auf die sog. „letzte Meile“, um die sich die Wettbewerber in den Metropolregionen streiten. Im Gebiet der „weißen Flecken“ muss zunächst einmal die Netzstruktur aufgebaut werden, um Wettbewerb zu ermöglichen. Dazu gehört zunächst, dass für Unternehmen, die den Ausbau vorantreiben, die Rechts- und Planungssicherheit erhöht wird indem die **Fristen der Regulierungsentscheidungen auf fünf Jahre verlängert werden.** Zusätzlich muss das Wettbewerbsrecht verändert werden, so dass **Kooperationsmodelle** ermöglicht werden. Damit könnten dann gemeinsame Investitionen zur Erstellung der Infrastruktur durch Unternehmen ermöglicht werden, die sonst als Anbieter von Telekommunikationsdienstleistungen miteinander im Wettbewerb stehen. Dabei geht es nur um projektbezogene Kooperationen auf der Infrastrukturebene. Die jetzige Rechtslage lässt dies nicht ohne weiteres zu, da die Unternehmen Gefahr

D7: Appendix: Cartel formation (cont.)

- **Costs of reaching a cooperative agreement**
 - even if the potential for additional profits exists, forming a cartel is time-consuming and costly
 - has to be negotiated
 - has to be hidden
 - has to be monitored
- **There are factors that reduce the costs of cartel formation**
 - small number of firms (recall Selten)
 - high industry concentration
 - makes negotiation, monitoring and punishment (if necessary) easier
 - similarity in production costs
 - lack of significant product differentiation

Anhang: nicht in der Vorlesung

D7: Appendix: Cartel formation (cont.)

- Lack of product differentiation
 - if products are very different then negotiations are complex
 - need agreed price/output/market share for each product
 - monitoring is more complex
- Most cartels are found in relatively homogeneous product markets
- Or firms have to adopt mechanisms that ease monitoring
 - basing point pricing

Anhang: nicht in der Vorlesung

Look at the cartel cases detected by the commission!

D7: Appendix: Cartel formation (cont.)

- **Stable market conditions**
 - accurate information is essential to maintaining a cartel
 - makes monitoring easier
 - unstable markets lead to confused signals
 - makes collusion “near” to monopoly difficult
 - uncertainty can be mitigated
 - trade association
 - common marketing agency
 - controls distribution and improves market information
- **Other conditions make cartel formation easier**
 - detection and punishment should be simple and timely
 - geographic separation through market sharing is one popular mechanism

Anhang: nicht in der Vorlesung

D7: Appendix: Cartel Detection

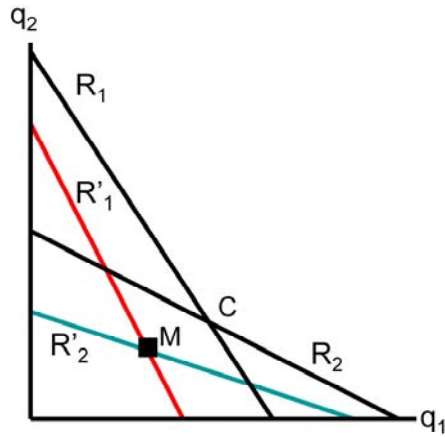
- Cartel detection is far from simple
 - most have been discovered by “finking”
 - even with NASDAQ telephone tapping was necessary
- If members of a cartel are sophisticated they can hide the cartel: make it appear competitive
 - **“the indistinguishability theorem”**
 - ICI/Solvay soda ash case
 - accused of market sharing in Europe
 - no market interpenetration despite price differentials
 - defense: price differentials survive because of high transport costs
 - soda ash has rarely been transported so no data on transport costs are available
- The Cournot model illustrates this “theorem”

Anhang: nicht in der Vorlesung

Exapmles of cartels and cartel detection at work:

<http://www.usdoj.gov/atr/public/speeches/212266.htm>

D7: Appendix: The Indistinguishability Theorem



- ♦ start with a standard Cournot model: C is the non-cooperative equilibrium
- ♦ assume that the firms are colluding at M : restricting output
- ♦ M can be presented as non-collusive if the firms exaggerate their costs or underestimate demand
- ♦ this gives the apparent best response functions R'_1 and R'_2
- ♦ M now “looks like” the non-cooperative equilibrium

Anhang: nicht in der Vorlesung

D7: Appendix: An Example

- ♦ Suppose market demand is $P = 100 - Q$, that there are 3 firms and that each firm has true marginal costs of \$20
- ♦ The Cournot equilibrium market price and the outputs for each firm are given by the equations:
 $q_i = (A - c)/(N + 1)$; $P_C = (A + cN)/(N + 1)$ where we have that $A = 100$, $c = 20$, $N = 3$
- ♦ So we have: $q_i = 20$ and $P_C = \$40$
- ♦ Suppose the firms are colluding on the monopoly price, which is $(A + c)/2 = \$60$
- ♦ What production cost $20 + f$ would make this look like a Cournot price?
We need $(100 + 3(20 + f))/4 = 60$; so $160 + 3f = 240$
which gives $f = \$80/3 = \26.67
- ♦ The same result can be obtained by overestimating the reservation price

Anhang: nicht in der Vorlesung