

# Treatment of Whistleblowers in Minimizing Cartel Damage

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### **Objectives of the study**

The objective of the thesis was to investigate how the social damage that is caused by cartels could be minimized. An important question is that should cartels be viewed as an administrative felony by the company, as a personal felony by the cartel's managers or both. Different systems of cartel penalties, confession rewards and detection systems are evaluated in order to understand how the legislation could be modified so that cartel activity is most effectively discouraged.

### **Methodology**

The study was mostly conducted as a literature review. Academic literature, legislation and authority reports were analyzed in estimating the effect of different anticartel procedures. The effects of different policies were evaluated using data from past cartel trials. Cartel punishments in the European Union were analyzed using an Ordinary Least Squares regression.

### **Results of the Study**

The main findings are that offering reduced punishments (leniency) to confessors or the cartel (whistleblowers) has a destabilizing effect which can also be verified empirically. Without a confession, the evidence of collusion is rarely sufficient for a conviction. Offering positive rewards to whistleblowers is found theoretically useful, but empirical evidence is still scarce. Both theoretical and empirical evidence suggests that personal punishments should be imposed on cartel managers in order to reduce collusive damage. Such punishments are still missing in several OECD countries, including Finland.

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# 1. Introduction

## 1.1 First words

A cartel is an agreement among firms in a given industry, in which the participating organizations agree to fix pricing, production, bidding or other aspects of competition in hope of increased profits.

Since competition is vital for a healthy economy in the form of economic efficiency, competition-reducing activity – collusion – is deemed illegal in most countries. A minor scholar debate about the harmfulness or collusion and the utility of antitrust regulation still consists. Many legal authors and economists affiliated with the so-called Chicago school state that regulating cartels might be a worse burden than the cartels themselves and is a mistake. A common claim in the Chicago school is that when trying to protect competition, one is actually protecting inefficient competitors and causes a market distortion.

On the contrary a vast majority of competition researchers agree that cartels are to be avoided. Firms have an incentive to form a cartel, fix prices and increase their profits with a social cost. This was pointed out by Adam Smith already in 1776 in "*Wealth of Nations*". Lately several analyses on cartel regulation have showed that the lack of it caused substantial social losses in the past. A traditional view – for example used by the Sentencing Commission of United States – is that cartels typically overcharge approximately 10% compared to competitive prices. However, a recent research [Connor et al. 2004] provides statistical evidence that a typical overcharge might be closer to 25%.

In this thesis, I employ the mainstream assumption that cartels are adverse and should be prohibited and fought against in society.

In industrialized countries a government agency is typically assigned to reveal cartels. Reliably identifying and breaching cartels is however remarkably difficult. Concrete evidence is seldom found and participants rarely have incentives to confess the existence of a profitable cartel.

This thesis discusses the challenge of identifying cartels reliably enough to break and convict them, so that social welfare could be optimized. The main emphasis is on how cartel participants should be persuaded to confess the cartel, and how such subjects should be legally treated.

## 1.2 Terminology

Antitrust law – synonymous with competition law, an anachronistic term used mainly in the United States

Bid-rigging – firms fix the outcome of a public bidding in order to increase the price of a project, regarded as one form of cartel

Collusion (de facto cartel) – firms illegally fix prices, quantities or other market terms to receive higher profits

Conscious parallelism – a legitimate market practice where firms choose equal pricing without the existence of a cartel pact, also known as tacit collusion

Courageous leniency program – a legal measure where whistleblowers are allowed positive rewards for their actions, see moderate leniency program

First-best cartel program – a legal measure which enables breaching all cartels without a cost to society, see second-best cartel program

Immunity – complete protection against cartel prosecution, both personal and corporate

Legal cartel (de juro cartel) – a cartel which is allowed by the government, or even created by it

Leniency program – a legal measure which enables lower punishments to cartel-reporting members, see moderate leniency program and courageous leniency program

Moderate leniency program – whistleblowers are allowed a reduced or void cartel punishment, but no positive rewards

Price leadership – one company posts its future prices and other firms follow, similarly to conscious parallelism

Second-best cartel program – legislation which enables breaching all cartels but only with a public cost

Whistleblower – a participant of a cartel who reports the illegal demeanor to antitrust authorities, both individual people and firms can be considered as whistleblowers

### 1.3 Historical background

Since the times of Roman Empire there have been insights about the positive effects of competition, and thus regulations to decrease pricing power. Around 50BC, a law was enacted to impose heavy fines on anyone directly, deliberately, or “insidiously” hindering the passage of supply ships. The legislation eventually got harsher, since anno domini 301 emperor Diocletian ordered a death penalty for anyone concealing supplies or contriving the scarcity of goods. [Wilberforce 1966]

Medieval kings and queens are known to have given competition-related orders, since guilds of craftsmen and traders were known to commit price collusion. Henry III of England passed an act in 1266 to fix bread and ale prices so that they would correspond with the price of grains. The punishments included fines, pillory and tumbrel. Later the competition laws were extended to labor wages. In 1349, Edward III fixed the wages of certain craftsmen since guilds were suspected to fix their wage demands. The history of competition legislation has been thoroughly studied by Lord Richard Wilberforce.

The formal study of competition and its effects initiated much later, in the 18<sup>th</sup> century. Adam Smith claimed in “*Wealth of Nations*” 1776 that complete freedom of trade is a utopia since private interests of individuals would result in unwanted outcomes if trade was not restrained in any way.

Modern competition legislation began in the United States in 1890 in the form of *Sherman Antitrust Act*. The meaning of the act was to breach many well-known cartels in the era, the most notable ones being oil, railroad, tobacco and salt cartels controlling the prices throughout the country.

In the United States, competition legislation is known as *antitrust*. Here “trust” refers to an illegal setup by firms where a common central board or symposium decides over prices, production quantities, market areas or other relevant aspects of competition. In U.S. terminology, antitrust law is synonymous with competition law. The term has become anachronistic since “trust” is not used to denote cartels anymore.

The Sherman act was given as follows:

*“Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal, shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine*

*not exceeding \$10,000,000 if a corporation, or, if any other person, \$350,000, or by imprisonment not exceeding three years, or by both said punishments, in the discretion of the court.”*

Notably, the *Sherman act* does not mention the whistleblowers. The whole question of how to treat the whistleblowers had not arisen at the moment. According to the act, each participant of a cartel should be punished not regarding whether they took part in confessing the cartel or not. Under the act, the incentives to confess the existence of cartel was thus low.

The maximum imprisonment has been later changed to ten years and the maximum fine to \$100,000,000. However, fines much larger than that have been administered in international cartels cases, for example *Roche Vitamins Inc. vs. United States Court of International Trade* in 1999.

In Europe, a similar system was founded in the *Treaty of Rome*, 1958. What is nowadays known as article 101 of the *Treaty on the functioning of the European Union* was given:

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

- (a) directly or indirectly fix purchase or selling prices or any other trading conditions;*
- (b) limit or control production, markets, technical development, or investment;*
- (c) share markets or sources of supply;*
- (d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;*
- (e) make the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts”*

Notably, the article does not mention any punishments, since the European Economic Community did not have authority to enforce any. The punishments were to be imposed by member states.

The so-called “leniency programs”, trying to invoke whistle-blowing, did not emerge until 1978 when United States established “*Amnesty program*”. Until this, all antitrust laws in the world were concentrated on *detering* cartels by penalty threats. Modern antitrust policies rely on invoking

whistle-blowing instead, with the leniency in a central role. A central reason for this is the difficulty of ruling cartel convictions without a confession, and thus an inadequate deterrence effect.

As times passed, economists received more tools in studying collusion and cartels. Game theory and computational statistics theory give great possibilities to evaluate oligopolistic situations. The formation of an oligopoly was understood better as were the rationalities which lead to collusive behavior. Thus it has become possible to construct theoretical models to study the behavior of firms in a cartel under different legislation adjustments. The search for a socially optimal cartel legislation could begin.



## 2. Theories and models of cartels

Gary Becker claimed in this seminal 1968 work “*Crime and Punishment: an Economic View*” that criminals maximize their utility just like any other agents in society. They seek a quantifiable benefit via committing crimes. Thus the legislation system - its punishments and detection probabilities - could be set such that there are no longer incentives to commit crimes. The main idea can be simplified so that the *expected value* of the sanction – the probability of detection multiplied by the fine – should be heavier than the expected gain by committing the crime.

Becker initiated a research program where optimal legislation emerges from the maximization of social benefit. The economic literature on cartel damage minimization has its roots strongly on Becker’s thinking.

Since then, several game theoretic models have been developed to investigate cartel sustainability in an oligopoly. Besides the ones thoroughly reviewed here, among others, Kaplow and Shavell [1994], Rey [2003] and Harrington [2008] have contributed to the field. The evaluation here is confined to three different models due to significant differences in their policy conclusions. It should be noticed that minor-looking assumption differences in the outlines of the models result in notable differences in the conclusions.

All the models follow Becker’s assumption that criminal activities are initiated in order to produce larger profits, and in case legislation is formed so that cartels no longer increase profits, cartels would diminish. Further, cartels are assumed to be formed for the benefit of the *companies* and not the personal benefits of cartel managers. A cartel model involving personal executive benefits [Aubert 2009] is introduced later. The notations and Greek symbols used by the authors are converged at some points to avoid misconceptions.

### 2.1 Motta and Polo’s model

Motta and Polo [2003] have examined cartel situations as infinitely repeated single-stage games. They assume that a participant can break the cartel if an individual either deviates from the cartel strategy or reports it to the antitrust authorities. The antitrust authorities are also given a certain chance to detect the activity. The cartel can also be established again, even in the very next period following the conviction. The model is chosen because of the assumptions of constant punishments

and detection probabilities over time. The consequences of these assumptions might be rather surprising.

The authors show that leniency programs might actually *enhance* the stability of the cartel. If one participant has sufficient incentives to reveal the collusion, then everyone else should reveal it also. Motta and Polo assume that in such a collaborative and simultaneous whistleblowing, the authorities grant each member some leniency. Thus no one would receive full punishment for the conspiracy. The members might be tempted to commit in a new cartel immediately in the next period of time, as the costs of conspiracy have been proven small. Thus the leniency might increase cartel activity.

In reality, no simultaneous whistle-blows have ever been recorded. Sometimes the difference has been a case of hours or minutes, a phenomenon known as a rush to the courthouse.

Motta and Polo build their model with the following assumptions:

- The task of the antitrust authorities is to maximize a utilitarian social welfare function.
- Full fines  $\bar{F}$  are set on firms who are found guilty and have not co-operated with authorities
- Reduced fines  $R < F$  are set on guilty firms who co-operate with the authorities
- If any participant confesses the cartel, all participants are found guilty
- There is a probability  $\alpha \in [0, 1]$  that the authorities suspect a firm for cartel participation
- There is a probability  $p \in [0, 1]$  that a suspected firm is found guilty by the authorities
- Authorities do not make type I judicial errors, meaning innocent firms are never convicted
- The budget of the antitrust authority and the maximum fine  $\bar{F}$  are exogenously given

The assumptions give place to two different collusive strategies. In the first one, firms collude from the first period on until the authorities begin an investigation. In case the authorities express their suspicions, all participating firms blow the whistle and pay the reduced fine. In the next period the firms go back to the collusive strategy, since nothing has changed in the market and collusion is still more profitable than a competitive strategy. If someone deviates, all firms continue with competitive production to eternity. This strategy is called “Collude and reveal” (CR). Notably the application of this strategy requires two rather heavy assumptions. Firstly, the authorities are assumed grant leniency to each and every firm if they confess simultaneously. Secondly, the suspicion probability  $\alpha$  is supposed to stay constant if a once breached cartel re-establishes itself.

In the other strategy, firms collude until a deviation occurs. A possible monitoring or investigation by the authorities does not change the firms' practices. If the firms are proven guilty, they pay the unreduced fine of  $\bar{F}$ . In the next period they revert back to collusion and continue it until someone deviates or the cartel is detected again. If someone should deviate, other firms punish with competitive production to eternity. This strategy is called "Collude and Do Not Reveal" (CNR).

Motta and Polo find and express parameter limits for the different corporate strategies given the assumptions. The limits where the competition strategy decisions change can be expressed with equations or graphs.

- i) Firm colludes and reveals if monitored (CR strategy) has the expected value of:

$$V_{CR} = \alpha(\pi^N - R) + (1 - \alpha)\pi^C + \delta V_{CR}$$

$\pi^N$  stands for the profit of a competing firm during a period when collusions is absent.  $\pi^C$  refers to the profit of a colluding firm during a period of collusion. Alpha is the monitoring probability and sigma is the discount factor. R refers to the reduced fine which is imposed on confessing cartelists. The first two terms of the right hand side refer to the expected profit of the firm during the first period and the last one to the value from there on.

If the firm would deviate, it would receive an expected value:

$$V_D = \pi^D + \frac{\delta\pi^N}{1 - \delta}$$

$\pi^D$  stands for the profit of the deviating firm during the period when the deviation occurs. The second term of the equation refers to the profits received under the Nash punishment which is assumed to continue forever.

Requiring  $V_{CR} > V_D$  directly gives us the strategy limit:

$$\alpha < \frac{\pi^C - (1 - \delta)\pi^D - \delta\pi^N}{\pi^C - \pi^N + R}$$

If the above equality holds, the firms choose the “collude and reveal” strategy over deviation from cartel. As collusion was assumed to be more profitable than fair competition, the constraint alone is sufficient to sustain collusion in the market.

It must be noted that since R is in the denominator, the right hand side is increasing in R. This means that the larger the leniency (smaller R) the harder it is to fulfill the inequality. This implies that leniency programs might make the “collude and reveal” strategy less profitable, thus *decreasing* the number of whistle-blows.

ii) Firm colludes and will not reveal if monitored (CNR strategy) has the expected value of:

$$V_{CNR} = \alpha(\pi^C + \delta[p(\pi^N - F) + (1 - p)\pi^M]) + (1 - \alpha)(1 + \delta)\pi^C + \delta^2 V_{CNR}$$

Here F refers to the full fine imposed on convicted firms who did not confess. The equation might seem a little complicated and maybe needs some explanation. Since the firm can only be found guilty (probability p) after being monitored (probability  $\alpha$ ), the conviction process is assumed to take two periods of time. Thus not being monitored in the first period brings safe cartel profits for two periods (worth  $\pi^C + \delta\pi^C$  since the second period’s profit is discounted). The last term  $\delta^2 V_{CNR}$  is the strategy’s value from that period onwards.

If we require in a similar way than before,  $V_{CNR} > V_D$ , meaning that the CNR strategy is more profitable than collusion, we find the sustainability constraint:

$$\alpha < \frac{(1 + \delta)(\pi^C - (1 - \delta)\pi^D - \delta\pi^N)}{\delta p(\pi^C - \pi^N + F)}$$

The above equation ensures that firms prefer to maintain collusion over deviating.

However, this is not a sufficient condition for the CNR strategy to hold, since we have to also require that it is more profitable than the CR (collude and reveal) strategy. For this

to hold, we have to require that firms choose not to reveal even under the possible monitoring. Thus we demand that  $CNR > CR$  in the subgame starting when the authorities choose to monitor the industry. We get the following equations:

Value of revealing:

$$V_R = \frac{\pi^N}{1 - \delta} - R$$

Value of not revealing:

$$V_{NR} = \pi^C + \delta[p(\pi^N - F) + (1 - p)\pi^C] + \delta^2 V_{CNR}$$

The value consists of sure collusion profits in the first period, discounted expected profits of the next period including a possible conviction, and the value from the second period onwards.

By substituting the earlier equation for  $V_{CNR}$  and utilizing some extensive algebraic manipulation we obtain the expression for the limit where non-revealing becomes more profitable:

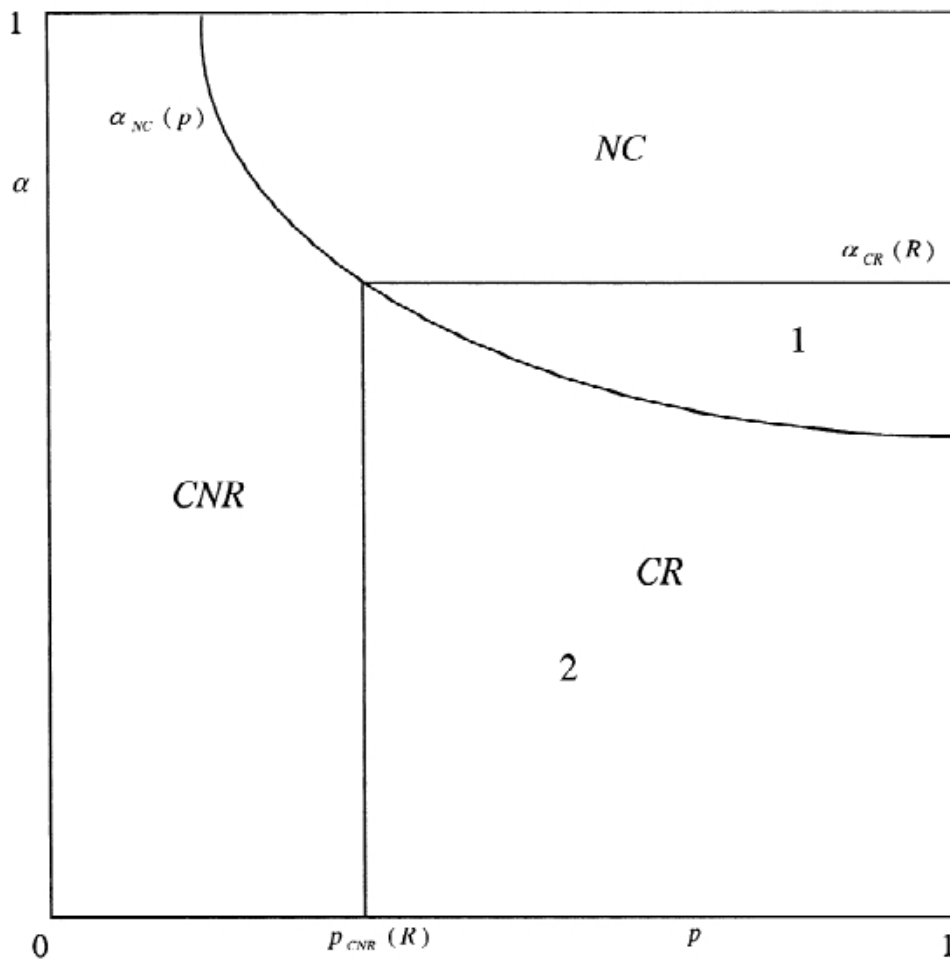
$$\alpha < \frac{(1 + \delta)[\pi^C - \pi^N + R(1 - \delta) - \delta p(1 - \delta)(\pi^C - \pi^N + F)]}{\delta^3 p(\pi^C - \pi^N + F)}$$

The equation gives the values of the monitoring probability  $\alpha$  where the “collude and not reveal” –strategy is chosen over the “collude and reveal when monitored” –strategy. This also makes it a subgame perfect corporate strategy. Motta and Polo claim that if the given policy parameters ( $\alpha$ ,  $p$ ,  $F$ ,  $R$ ) fulfill the requirements of the “do not reveal” and “do not deviate” constraints, there exists a subgame perfect equilibrium for the CNR strategy, which would imply strongly sustainable collusion.

The superiority of non-revealing is of course the exact opposite of what the antitrust authorities want. Thus they strive to increase the monitoring probability  $\alpha$  which is on

the left hand side, increase the detection probability  $p$ , increase the maximum fines  $F$  and decrease the whistleblower fines  $R$ . These actions bend the strategic decisions to the favor of the “collude and reveal” or even to the “do not collude” strategy which brings profits of  $\pi^N$  every year. Importantly Motta and Polo’s conclusion is that under some parameter circumstances, the leniency programs might *increase* the sustainability of cartels!

The different strategies considering the monitoring and conviction probabilities can be described by the following graph. The curves and limits are based on the equations expressed earlier. The vertical axis represents the probability of being monitored and the horizontal axis shows the probability of conviction when monitored:



The authorities of course wish that firms would lie in the NC “no collusion” set, but it would require a very high monitoring and conviction rate, which are expensive to maintain. The second-most-wanted set is the CR “collude and reveal”. If the enforcers have an insufficient budget, they cannot deter firms from choosing the “collude and do not reveal” CNR strategy. Area 1 refers to a set of circumstances where leniency programs are adverse. If  $R < F$ , firms choose to collude and reveal due to reduced punishments. If instead  $R = F$ , meaning no leniency is in place, the firms choose not to collude at all. Area 2 refers to situations where a firm does collude, but the existence of leniency programs attracts the firms to confess. The  $\alpha_{NC}(p)$  curve follows from indifference between deviating and the CNR strategy, formally the relation  $V_{CNR} = V_D$ . The respective equations are expressed on pages 11 and 12.

Thus the graph depicts that the main statement of the authors: acceptability of leniency programs depends on the policy parameters. The utilitarian antitrust authorities optimize social utility by adjusting the values of  $\alpha$  and  $p$ , and by enabling or disabling leniency programs. The constraint is their exogenously given budget. Increasing the monitoring and convicting rates is of course costly.

The Motta and Polo model is relatively well-known and often referred to. However, its assumptions are strong and lead to conclusions which are usually objected. If we assume that a cartel’s chance of being monitored and found guilty is increased every time it is detected, the conclusions change. They change also if we assume that the authorities would not accept a simultaneous confession by all cartel participants. Under such alternated circumstances, the model would always promote for the existence of leniency programs ( $R < F$ ). However, using Motta and Polo’s assumptions leniency programs might be sometimes adverse.

The intuition of Motta and Polo is that if the antitrust authorities can give a sufficient deterrence with their investigations and the maximum fine  $F$ , any leniency programs will be unnecessary and socially non-optimal. However, if the detection deterrence is not harsh enough, leniency programs should be employed to breach the remaining cartels.

Another conclusion is that the firms who are already under investigation should be granted leniency after confession. The social benefit from falling cartels exceeds the losses from reduced fines. Thus a utilitarian authority should extend the leniency to cartels already under investigation.

Hinlopen [2003] is one of many who oppose Motta and Polo’s assumptions. He claims that antitrust authorities would hardly grant leniency to each member in an all-around simultaneous

confession. Further, Hinloopen assumes that the fines for repeated offenders should exceed those of first time colluders. Following these changes, Hinloopen's model presents different conclusions.

## 2.2 Hinloopen's model

Hinloopen [2003] presents another kind of a repeated-stage game model to analyze cartel detections with. He assumes that the factors that affect the detection probability are the number of periods the cartel exists, the number of firms in the cartel, the resources of the antitrust authorities and the level of transparency in the relevant market. Thus ex ante detection probabilities might differ between time periods. The probabilities might be either random or accumulating, both ways are analyzed.

The model assumes that the possibility of a cartel bust in a given year is  $p_t$  ( $0 < p_t < 1$ ) and that any cartel shall continue until it is revealed by authorities or someone deviates. The model is therefore based on calculating probabilities for cartel sustainability for a given time span. The chance of cartel detection between years  $t$  and  $t+k$  is:

$$P_t(k) = 1 - \prod_{j=0}^k (1 - p_{t+j})$$

In the equation,  $(1 - p_{t+j})$  refers to the probability of *not* getting caught in year  $t+j$ , where  $t+j$  is between  $t$  and  $t+k$ . Thus the sum equation gives the chance of not getting caught during any of the periods. Therefore one minus the sum equation thus gives the chance that the cartel is detected on some given period between periods  $t$  and  $t+k$ .

Further, we notice that since the  $p(k)$  is strictly increasing in time, a detection always occurs sooner or later. Formally expressed:  $\lim_{k \rightarrow \infty} p_t(k) = 1$ . For clarity,  $t$  expresses a period of time and  $k$  is the *concurrent* period of time. The detection and "monitoring" probabilities are not separated as in Motta and Polo's model.

When a cartel is detected by authorities, a fine  $F \in [0, \bar{F}]$  is set to be paid once by each cartel member. The maximum fine  $\bar{F}$  is exogenously given. Hinloopen points that in the U.S. and the EU the fine sum is typically evaluated in context with the firm's gross annual revenue. In the EU the maximum fine amount is 10% of the firm's annual turnover, as is shown in chapter 4 of the thesis.



Let us assume some probabilities for the cartel detection in given periods. The following table illustrates the sustainability of a cartel on two different detection probability paths. On the left side path, the per-period detection probabilities are assumed randomly changing. On the right side path, the probabilities are increasing in time, implying that the cartel evidence is accumulating. The per-period probabilities are not assumed constant like Motta and Polo did. The cartel fine  $F$  is set at 10 units of money.  $\Gamma_{(t,k)}$  refers to the accumulated expected fine from year  $t$  (starting period) to the concurrent period  $k$ .

TABLE 1 – PER-PERIOD FINE PAYMENTS AND OVERALL FINE PAYMENTS AS EXPECTED AT THE BEGINNING OF PERIOD 1 FOR TWO DIFFERENT SEQUENCES OF PER-PERIOD DETECTION PROBABILITIES WITH  $F = 10$ .

Period	$p_t$	$F_t(k)$	$\Gamma_{t,k}$	$p_t$	$F_t(k)$	$\Gamma_{t,k}$
1	0.20	2.00	2.00	0.10	1.00	1.00
2	0.10	0.80	2.80	0.15	1.35	2.35
3	0.10	0.72	3.52	0.20	1.53	3.88
4	0.20	1.30	4.82	0.25	1.53	5.41
5	0.30	1.56	6.37	0.30	1.38	6.79
6	0.80	2.90	9.27	0.45	1.45	8.23
7	0.20	0.15	9.42	0.60	1.06	9.29
8	0.50	0.29	9.71	0.80	0.57	9.86
9	0.70	0.20	9.91	0.90	0.13	9.99
10	0.10	0.01	9.92	0.95	0.01	10.00

Let us follow the left path at first. There is a 0,20 probability of conviction in the first period, which gives the expected fine of 2 units. After the first period, there is a probability of 0,80 that the cartel has not been detected and still remains. As the detection probability is 0,10 in the second period, there is actually a  $0,8 \cdot 0,1 = 0,08$  probability of detection in the second period, which gives the expected fine of 0,80 units.

Note that on the left side path, an abnormally high probability of detection - like period 6 - decreases the probability that the cartel is detected next period. This is because there is a smaller probability that the cartel even exists anymore, so the probability of detection is small as well. Generally, increasing the detection probability in any given period increases the expected fine payment in that period and lowers it for the following periods.

Hinlopen claims that an infinitely repeated game can only sustain a collusive agreement if the expected discounted value by collusion compliance ( $C$ ) is larger than by deviating or reporting ( $a$ ). In other words,  $a$  refers to doing anything else except colluding.

Formally:  $V^c \geq V^a$  must hold at all times. This does not mean that the profit by colluding should be higher than by deviating on every individual period. Instead it means that the all-future discounted value for colluding should always be higher than the discounted value by non-colluding.

In the model, a cartel firm's profit is in a given period  $t$  is:

$$v_t^c = [1 - p_t]\pi^c + p_t(\pi^N - F_t)$$

Thus the notifications that Hinlopen uses in his article are a bit different from Motta and Polo's and I have converged them for easier followability. The equations are thus easy to follow. The expected total payoff for cartel compliance, discounted by rate  $r > 0$ , starting from period  $t$  is as follows:

$$V_t^c = \sum_{k=t}^{\infty} \frac{v_t^c(k-t)}{(1+r)^{k-t}}$$

The equation implies that the total discounted value of the collusion strategy is the discounted sum of the values on each individual period. Accordingly, if some other strategy should lead to a higher discounted income, the collusion would cease. Thus the interest of the antitrust authorities is that  $V^a > V^c$  for some alternative strategy  $a$ . Such are namely a deviation to Nash-Cournot production and a whistle-blow.

We can safely suppose that  $\pi^D > \pi^c > \pi^N$ , where  $D$  refers to deviation. The discounted expected profit for deviation is:

$$V_t^D = (1 - p_t)\pi^D + p_t(\pi^N - F) + \sum_{i=t+1}^{\infty} \frac{\pi^c}{(1+r)^{i-t}}$$

The equation shows that the strategy value is the expected profit from the first period of time plus the discounted present value from that period onwards. Let us suppose that a possible whistleblower only receives a fine of  $\Omega F$ , where  $0 < \Omega < 1$ . Thus the expected discounted profit for the whistleblower is:

$$V_t^{WB} = \pi^{WB} - \Omega F + \sum_{i=t+1}^{\infty} \frac{\pi^c}{(1+r)^{i-t}}$$

Now we can start to evaluate the conspirator's incentives. Let us compare the profits of whistle-blowing and deviating to those of collusion compliance. The cartel sustains if  $V_t^c \geq \max[V_t^{WB}, V_t^D]$  for all periods  $t$ , which gives two equations:

$$\sum_{i=t}^{\infty} \frac{v_t^c(i-t)}{(1+r)^{i-t}} \geq \pi^{WB} - \Omega F + \sum_{i=t+1}^{\infty} \frac{\pi^C}{(1+r)^{i-t}}$$

$$\sum_{i=t}^{\infty} \frac{v_t^c(i-t)}{(1+r)^{i-t}} \geq (1 - p_t)\pi^D + p_t(\pi^N - F) + \sum_{i=t+1}^{\infty} \frac{\pi^C}{(1+r)^{i-t}}$$

These equations are called the cartel sustainability conditions, quite much like in the Motta and Polo model. One should note that antitrust authorities are extremely interested in this equation, since their main responsibility is to induce cartel reports and enhance competition.

We can make three observations from the sustainability conditions. Firstly, whistle-blowing the cartel is more likely when the leniency is higher (that is, the smaller the  $\Omega$  is). Okada [2005] claims that for a leniency programs to be successful, the value of  $\Omega$  should be sufficiently *predictable* as well. Otherwise even high levels of leniency cannot produce good results, but it is not shown in Hinloopen's model.

Secondly, increasing the penalty ( $F$ ) for violations has two opposing effects. On the other hand, as punishments are increased, the amount of avoided punishment rises which makes whistle-blowing more attractive. However, also the amount that the whistleblower has to pay is now larger than before (assuming that  $\Omega$  remains unchanged). Thus both the amount of avoided punishment and the punishment that still has to be paid are increased as  $F$  is raised. The net effect depends on the levels of  $\Omega$  and the detection probabilities. If we assume full amnesty ( $\Omega = 0$ ), the net effect of increasing the penalties is always cartel-destabilizing. In that special case the amount which the whistleblower has to pay is actually *not* increased even if  $F$  is raised and  $\delta$  remains the same. Otherwise the effect is difficult to estimate or measure.

Thirdly, increasing the per-period detection probabilities ( $P_t$ ) will increase whistle-blowing. As  $P$  gets higher, all participants are more likely to confess than before. This is no different from the Motta and Polo model. Hinloopen does not mention the costs of antitrust enforcement but it can be assumed that the detection probability should be on a cost-effective and sufficiently high level.

Further, Hinloopen notes that what actually matters is the *assumed* level of  $P_t$  instead of the real objective probability. Thus having a tough reputation is beneficial for the authorities. If the detection probability is assumed to be low by the cartelists, the leniency programs will not be successful even if the real detection probability is high.

Besides these notifications from the theoretic model, Hinloopen argues that an increase in the limitation period during which the cartel can be prosecuted, makes reporting more profitable. As the antitrust officials can charge a cartel even after the collusion has ended, whistle-blows can be expected even from cartels that already ceased to exist. Thus increasing the time span when the cartel can be prosecuted bends the strategy profitabilities so that whistle-blowing strategy gains advantage over the deviation strategy. There is no economic reason why there should be any time limitations at all; the optimal allowed prosecution period is forever. However, legislations commonly include a concept which rules perpetrators immune to charges at some point. There are few exceptions to the rule, including responsibility for a murder which never expires.

When it comes to leniency programs, we have now learned that low  $\Omega$  (high leniency) induces cartel reporting. Then what is the optimal level of  $\Omega$ ? According to the cartel sustainability equation,  $\frac{\partial \pi^{WB}}{\partial \Omega} < 0$  for all values of  $\Omega$ . Thus  $\Omega = 0$  (full amnesty) for all whistleblowers would be the optimal policy decision. The higher leniency the program will allow, the more effective the program is supposed to be.

But what if  $\Omega$  could be a negative number? It would imply a positive *reward* for a whistle-blow, and not merely an alleviated punishment. According to Hinloopen's theory, a positive rewarding system would be beneficial. There is no eminent reason why such a reward program could not be introduced. Hinloopen however assumed  $0 < \Omega < 1$  so we will need additional research.

### 2.3 Spagnolo's model

Spagnolo [2004] grasps the question of allowing positive rewards. He names such reward-allowing leniency programs "courageous" while the sanction-reducing or -cancelling programs are "moderate".

Spagnolo begins by stating that all illegal cooperation, including mafia activity, human trafficking, drug dealing, false auditing, bribing, corruption, and even terrorism, is based on trust. Thus the authorities can fight the conspiracies by shaping private incentives such that trust is reduced. In

other words, to make one party play against the other. Thus the alleged felons are made to play a form of the Prisoner's Dilemma game. As the cartel participants have high incentives to deceive each other, they cannot trust each other in the first place. Maximizing the incentives clearly requires that the whistleblowers receive money instead of merely avoid punishments.

Moreover, Spagnolo brings a new aspect of the leniency programs to the table. As a company can avoid punishments to itself and simultaneously cause punishments to its competitors, a leniency program can be used as a strategic tool to damage competitors and gain competitive advantage in the industry. Acknowledging this makes entering a cartel pact even less comfortable.

His model proposes:

Initially the legislator sets the parameters of law enforcement. Then, having observed the parameters, the firms interact in an oligopolistic game. There are assumed to be  $N > 1$  symmetric, risk-neutral firms in the market. The firms have an infinite time span in discrete time  $t = 1, 2, \dots, \infty$ . The firms discount future payoffs with a common factor  $\delta$ ,  $0 < \delta < 1$ .

On each period the antitrust authorities try to detect any cartel activity, and have success with a probability  $p_t$ . It is assumed that cartel detection always results in conviction, similarly with Hinlopen. The firms can also choose to report the cartel to antitrust authorities in any period.

The payoffs are assumed  $\pi^D > \pi^C > \pi^N > \pi^P$ , where d means deviation, c collusion, and n Nash-Cournot production.  $\pi^P$  refers to "punishment" and depicts the payoff if a firm is convicted by the authorities.

In Spagnolo's model, the fine for the convicted firms is  $F \in [0, \bar{F}]$ . The reduced fine for the whistleblower can be *negative* as well, meaning that it can be a reward instead of a punishment. Spagnolo uses notification RF for reduced fine but I continue with the earlier notification  $\Omega F$  for uniformity.

The author points out that using taxpayers' money to finance rewards for the whistleblowers will unlikely be politically accepted. Thus the leniency programs have to be *self-financing*. This means that the sum of the rewards paid to the whistleblowers must be equal or smaller than the sum of the fines paid by other cartel participants. Let us temporarily use the notification RW for positive rewards. Formally:

$$\sum_{\substack{j=1, \\ \text{if } j=WB}}^n RW_j \leq \sum_{\substack{j=1, \\ \text{if } j \neq WB}}^n F_j$$

The left hand side sums the positive rewards allowed to firms when they are whistleblowers and the right hand side sums the fines imposed on convicted firms.

With these assumptions and definitions Spagnolo offers differing conclusions under different limitations to leniency. The three different occasions are:

- i) No leniency whatsoever is allowed ( $\Omega F = F, \Omega = 1$ )
- ii) Moderate leniency is allowed ( $\Omega F \in [0, F], \Omega \in [0, 1]$ )
- iii) Courageous leniency is allowed (negative  $\Omega$  is possible)

If there is *no* leniency whatsoever ( $\Omega F = F$ ), a firm who sticks with the collusion pact can expect a profit stream:

$$p \left( \pi^c - F + \frac{rv^c}{(1-\delta)} \right) + (1-p)\pi^c + (1-p)\delta \left[ p \left( \pi^c - F + \frac{\delta v^c}{(1-\delta)} \right) + (1-p)\pi^c \right] + (1-p)^2 \delta^2 \dots$$

which gives us equation:  $V^c = \frac{\pi^c - pF}{(1-\delta)}$ . Notably, the collusion payoff is decreasing in detection probability ( $p$ ) and the fines ( $F$ ). Thus Spagnolo concludes that increased fines are unquestionably useful, even if there is no leniency program in place. This differs from the claim of Hinlopen.

Assuming value  $\gamma \in [0, 1]$  for the probability that the deviating firm is revealed by authorities itself, the expected income for a deviator is:

$$V^D = \pi^D - \gamma F + \frac{\delta v^P}{1-\delta}$$

Combining the results of i) and ii) we can find Spagnolo's cartel sustainability equation:

$$\frac{\pi^c - pF}{1 - \delta} > \pi^D - \gamma F + \frac{\delta v^P}{1 - \delta}$$

Note that in the absence of leniency programs, no firm has incentives to report the cartel to the authorities. Thus the only hope of antitrust programs is that the participants deviate from the cartel. This is maximized by setting the fines as harsh as is allowed by the legislation, namely  $F = \bar{F}$ . Also, if possible, the cartel detection probability for the deviating participants  $\gamma$  should be minimized as seen from the last equations. It is hard to know what this would imply in reality though. The logic is that the cartel investigators should close their eyes from those participants who deviate from a cartel, since deviating is useful for society. Not investigating the deviators would however actually mean full leniency, and no leniency was supposed to exist in the first part of the model. The model thus “forgives” deviators, and this is considered different from whistleblower leniency.

One might wonder why the deviator detection  $\gamma$  is different from the normal detection probability  $p$  anyway. Spagnolo’s intuition is that the cartel becomes ex-post detectable is a member suddenly deviates from it and changes its oligopoly strategy.

If leniency programs are in place, the conclusions change. A third corporate option rises to the side of collusion and deviation, namely the whistle-blowing. Now we have  $\Omega F \neq F$ , which brings new strategic options to the game. Spagnolo also introduces a new term as well: a leniency program can be *exploitable*. This means a situation where the cartel members can *increase* their utility from joining the cartel. This would be against the authorities’ wishes since the meaning of leniency programs is of course to make cartels less profitable.

Spagnolo states: if *all* reporting firms are eligible to leniency, then the leniency program is exploitable if the reduced fine is so small that  $\Omega F < pF$  holds. In such a case the leniency would allow the reduced fine to be less than the expected amount of cartel fine. If only the *first* reporting firm is eligible to leniency, the expected amount of fine for a whistleblower is  $\frac{(N-1)F + \Omega F}{N}$ . Thus the program is only exploitable if  $\frac{(N-1)F + \Omega F}{N} < pF$ . This can be reformed to  $\Omega F < (pN - (N-1))F$  or alternatively  $\Omega F < pF - (N-1)(1-p)F$  with some algebraic manipulations. This shows that restricting the leniency eligibility to the first whistleblower is optimal. It narrows down the set of exploitable leniency programs.

This is consistent with the U.S. antitrust legislation policy in the moment. The first reporter is granted automatic full amnesty but the following confessors will receive no leniency. The EU leniency system, however, contradicts. In the EU system the following reporters might gain a reduction if they present additional and valuable information to the authorities.

Spagnolo also claims that antitrust investigations and whistleblower rewards are substitutes, since both aim at reducing cartel damage. Investigations cost money whereas self-financing rewards are costless. Thus optimal law enforcement policy should rely as much as possible on self-financing rewards. In this way the antitrust legislation would be so-called “first best”, since cartels could be broken down without any taxpayer money spent.

Now let us evaluate how Spagnolo describes a situation where leniency programs can be in place, but only “moderate” programs are allowed by legislation.

Suppose leniency programs are constrained to be *moderate* ( $\Omega F = 0$ ). In such a case the leniency program should be restricted to the first reporting party just as before, and have the reduced fine  $\Omega F$  set as follows:

$$\Omega F = pF - (N - 1)(1 - p)F$$

with the exception that if  $pF - (N - 1)(1 - p)F < 0$ , then  $\Omega F = 0$  is used instead, since positive rewards are not allowed. The equation directly follows from the non-exploitability equation stated earlier. The reduced fine should namely be such that it gives the maximal motivation to whistleblow, without still being exploitable.

The optimal law enforcement policy under moderate leniency programs can thus be described with the following statements:  $F = \bar{F}$ , meaning that the punishment to detected cartelists is the heaviest possible that is allowed by the legislation.  $\Omega F$  is defined by the above equation, being as effective as possible without being exploitable. The detection probability  $p > 0$  is optimized so that the marginal social benefit of deterrence equals the marginal social cost of cartel investigation. Formally expressed:  $c'_p(p) = u'(c_p(p))$ . This is comparable to the  $MC = MR$  decisions of competitive firms in a market. The previous authors Motta and Hinloopen implicitly stated something like this, but Spagnolo is the first to express it on paper.

It can be noticed that the moderate leniency system determines a “corner solution” at  $\Omega F = 0$ .

Whenever the optimal fine would be below zero, the zero fine is imposed. Spagnolo suggests that



since detection probabilities  $p$  are rather low, the optimal whistleblower fine  $\Omega F = pF - (N - 1)(1 - p)F$  often becomes negative, implying non-allowed positive rewards. Thus these moderate leniency programs generally result in  $\Omega F = 0$ . This means that when moderate leniency is in place, the optimal solution is usually to grant 100% leniency. This already hints that strictly positive rewards might be useful, as shown next.

If  $\Omega F$  is not constrained, meaning that positive rewards are allowed, the conclusions are as following. The leniency program should be restricted to the first reporter only and has:

$$\Omega F = pF - (N - 1)(1 - p)F,$$

not regarding whether or not the outcome is above or below zero. After all, it does not matter anymore since positive rewards are allowed. Now the sustainability of cartels is minimized, since the deter by such rewards is extremely high. How to trust your cartel partners when you know that they might literally sell you out? Can any cartels sustain in such circumstances?

Spagnolo claims: There exists a finite level of fines  $F'$  such that when  $\bar{F} \geq F'$ , the optimal law enforcement policy implements the first best – complete and costless – deterrence with given parameters. These are  $\gamma = p = 0$ ,  $F' \leq F \leq \bar{F}$ , and  $-(N - 1)F \leq RF \leq -(N - 1)F'$ .

This would imply that there exists a first-best cartel program which would completely deter all cartels without any social cost. Namely, no cartel investigation would be required any longer. All cartels would fall apart by whistle-blows, which would be financed by the fines imposed on the other cartel participants. Thus it would have  $\gamma = p = c(p) = 0$ . No company has a fear of being caught by the antitrust officials, but instead *all* cartels are confessed by any of its members. The model thus sees antitrust investigation and leniency as *substitutes*, and claims that in the optimum policy, courageous leniency is sufficient and no investigation costs  $c(p)$  are needed at all.

This contradicts to Becker's [1968] well-known findings which suggested that a strictly positive probability of detection is always necessary for any kind of prohibitive legislation to have any effect.

Thus Spagnolo comes to the conclusion that:

- i) If no leniency is allowed, the fines should be set to maximum and cartel deviators should not be investigated (assuming that being not investigated is different from *leniency*).

- ii) If moderate leniency is allowed, the outcome is generally that the whistleblower will receive the minimum punishment. The leniency should always be restricted to the first reporter and antitrust investigation be financed so that its marginal costs equal its marginal benefit.
- iii) When courageous leniency is allowed on sufficiently high volume, all cartels are automatically whistle-blown. The confessors will always receive strictly positive rewards and the leniency should be restricted to the first reporter. No antitrust investigation is needed any longer under this legislation.

Spagnolo does not discuss the problemacy of punishments when all of the firms simultaneously confess. He suggests that some firm always decides to report first. Further, he points that firms might hurry to confess and the time span between possible confessions can be small. Even in these cases, the leniency should be restricted for the first reporter only.

Additionally, Spagnolo claims that the so-called *restitution* effect in legislation is unambiguously adverse. If the self-reporting firms have to pay back their collusive profits, the attractiveness of reporting is reduced. Thus the restitution requirement should be simply removed from U.S. law, granted that the sole purpose of antitrust legislation is to prevent the existence of cartels. However, the personal restitution of the cartel managers should not be amended. There is no kind of social loss involved when the cartel managers lose their personal benefits they have gained with the cartel, and a personal bankruptcy of a manager would not cause production losses unlike a bankruptcy of a firm.

When considering positive rewards for whistleblowers, a usual opposing argument is that *fraud* information could be presented to the antitrust authorities in order to gain money rewards and punishing competitors at the same time. However, a usual contra-argument to this is that courts ordinarily weigh evidence and it is a normal task of judges to recognize fabricated evidence from truthful ones. Thus Spagnolo claims it is unlikely that such a mischievous oligopoly strategy could be effectively employed.

An important notification is that all of the three models have a different view on the social cost of antitrust enforcement. Motta and Polo assume that the budget of the antitrust authorities is exogenously fixed and its level effects what the authorities can and cannot do. Thus the authorities just try to maximize the effect they can exert with their resources. Hinlopen sees the enforcement

as free of cost. His model does not express any costs of antitrust investigations. In his theory, the authorities solely aim at minimizing the amount of cartels, instead of finding an economic social optimum. Thus his model is not “utilitarian” like the others. Harrington [2011b] argues that breaching a maximal number of cartels is not the same thing as minimizing cartel damage. Spagnolo considers the enforcement in the most credible way, assuming that it has a cost  $c(p)$  with characteristics  $c'(p) > 0$  and  $c''(p) < 0$ . His model aims at maximizing total social benefit, also taking into consideration the cost efficiency of the enforcement. Paradoxically his model suggests that no enforcement is needed at all, granted that the leniency systems are courageous.

Also, it can be notified that all the models of Motta & Polo, Spagnolo and Hinloopen agree that some kind of a leniency program should always be in place. Cartel stability is always stronger in the absence of such a program. However there is partial disagreement on the details of the programs and in which circumstances they should be applied. Furthermore, a “courageous” program which allows positive rewards is seen as more potent than a mere “moderate” program.

Motta and Polo use the assumption that the authorities need some time to convict the cartel. First the authorities start to review the firm(s) and give their solution in the next period. In the other models, the investigation happens in each period  $t$  after the companies have made their decisions and the penalty is immediately set. Motta and Polo come to the (credible) conclusion that leniency programs which work also after the investigation has started are of high importance, since it is that time when the firms start to have strong incentives to confess.

Motta and Polo assume that all cartelists might confess at the same time, and such a unilateral whistle-blow could be accepted by the authorities. Spagnolo disagrees on this strongly, and claims that there is always at least a minutes or seconds difference between the confessions. According to Spagnolo, the leniency should be strictly restricted to the first confessor overall.

Hinloopen’s model assumes that the detection probabilities vary over time, and might be accumulating. The other models assume that the probabilities do not fluctuate but remain constant, granted that everything else remains *ceteris paribus*. Also, Motta and Polo assume that cartels have to be monitored before they can be detected. The other models (implicitly) assume that all industries are monitored all the time, and thereby a conviction can strike to whomever at any time.

Motta and Polo make the assumption that if a cartel should be broken, it can simply be reorganized in the following periods. Hinloopen argues that if a cartel is breached, the firms are forced to continue with competitive production. Spagnolo’s model does not take a stance in this issue. In

reality we can assume that firms once convicted of a cartel remain closely tracked by authorities at least for some time.

Since we know that penalties are hardly given in real life without a confession – as claimed by Gellhorn [2004], Okada [2005] and many others – the importance of leniency during investigation is increased. Thus the extension of leniency to include also under-investigation cases is seen positively by authorities in the US and the EU. The Motta and Polo model depicts the policies of authorities quite accurately in this issue: authorities want to offer leniency even when the cartel is already under investigation (monitoring), since they want to ensure that the cartel is breached and there might not be enough evidence otherwise.

Hammond [2000] argues that the strongest feature of leniency programs is the *individual* immunity they give to the managers who whistle-blow. In United States, the maximum penalty for a cartel manager is ten years of imprisonment (originally three years). Notably none of the three models reviewed here consider the individual side of the issue. Perhaps the private prosecution under the criminal law is seen as a legal issue more than economical, which would explain why few economics researchers have wanted to discuss the topic.

All of the previous models assumed that the cartels are organized in order to increase the expected profits of the company. Thus the agent is assumed to be the company instead of any individual person. This is a traditional microeconomic custom. One might argue that cartels could be organized for personal benefit as well. Furthermore, it could be argued that the ones to suffer the punishments should not be the firm – or actually the shareholders – but the cartel-forming managers instead. In the following model, Aubert [2009] evaluates cartel sustainability following the assumption that cartels are formed for personal reasons only and the “company” itself does not decide anything. Thus her model differs fundamentally from all the previous ones, both in assumptions and in conclusions.

#### 2.4 Aubert’s model – Cartels and individual benefit

Aubert [2009] investigates cartels from a corporate governance viewpoint. She assumes that cartel decisions are always made by individual people. Usually they are cartel managers (CEO:s) or shareholders who persuade the managers to collude by presenting stock-based reward incentives. Thus the abstract “decision by firm’s interest” is left out of the model and expected profits of individual decision makers are employed instead.

In the model, the firms' CEO:s privately choose the competition strategy of their firms, potentially applying collusion. The managers make the decision regarding their own personal utility, which is a function that is increasing in profits and decreasing in personal effort. Thus strong effort incentives – usually through stock option programs – which are designed to induce more managerial effort, also make participating in a cartel more attractive.

The managers also choose their own effort level. The effort is assumed to increase profits and have an increasing marginal cost. One can notice that collusion and effort are substitutes in the model since both of them increase the profits of the firm and thus also the manager's income. Managers might seek to substitute their effort – measured for example by working hours – with collusion pacts. This causes inefficiency in the market since the companies do not try to outperform each other any longer.

The board of the company – the shareholders – might try to provide the manager with incentives to choose some given competition strategy they want. If the board wishes to avoid collusion, they should provide the manager with a weakly profit-linked reward system. Thus the manager's ability to gain profits by colluding is reduced. However this should reduce the manager's personal effort as well. Therefore to avoid cartelization, the owners may have to sacrifice some internal efficiency. The conclusion is that the sheer *possibility* of collusion might decrease efficiency and cause social losses, even if the firms eventually do not collude.

Owners who accept cartelization in order to improve their wealth should contrarily offer their managers highly profit-based reward systems. Thus the managers have higher incentive to exert effort, to collude or both at the same time. The shareholders might be assumed to wish that the CEO colludes, since cartel profits are higher than competition profits. Since exerting effort is thought to have an increasing marginal cost, the managers will soon realize that their utility is optimized by exerting some given amount of effort and additionally committing collusion.

The cartel punishments have a noticeable effect on manager incentives. If personal punishments are enabled and are sufficiently harsh, the managers who face strong personal reward systems have motivation to exert high effort instead of collusion, since by colluding they face the risk of punishment. In absence of personal punishments, the same manager is instead motivated to collude and to exert quite shallow effort. Besides Aubert, this conclusion is made by for example Fershtman and Judd [1987] and Sklivas [1987]. Thus there is a moral hazard problem in the firm's management.

Correspondingly, if cartel punishments are mainly targeted at individuals, the shareholders have a higher incentive to persuade the manager to commit collusion. The manager is the one to suffer the consequences if caught, and the corporate fine which reduces the share price is milder!

Thus the moral hazard's direction is dependent on the punishment system. If penalties are corporational, the managers have incentives to collude since lack of personal risk. If penalties are individual, the shareholders desire collusion since the personal risk is carried by the CEO. Finland can be classified to have the former type of moral hazard since cartel punishments are utterly corporational. United States has a legislation of the latter type since their legislation includes strong personal cartel punishments.

The model is formally built assuming the following:

- The oligopoly consists of  $N$  firms in a given market, in an infinitely repeated game
- The decision set  $A$  of the managers includes colluding, competing and blowing the whistle
- Managers also choose their effort level  $e$ , which is not observable to others
- Managers receive wage  $w$ , which depends on the firm's profits
- Each firm is assumed to be owned by its board members and run by a single manager
- Every agent is risk neutral
- The antitrust authorities catch and punish a cartel with a constant probability of  $p \in ]0,1[$

The typical assumptions of symmetric firms and economic rationality are additionally made. The model also implicitly assumes that no type one judicial errors are made, i.e. no innocent firms are ever punished. The competition process starts with managers considering their firms' corporate strategies. Each manager only cares about their personal profit, which of course also depends on what other managers decide. The competition authorities are searching for possible cartels and have success with probability  $p$ , which is notably assumed constant. Thus the time span of a potential cartel does not affect the detection probability, on the contrary to what Hinlopen suggested.

The firms' profits are  $\pi^X(e) = e + \pi^X$ , where  $e$  refers to the manager's effort and  $X$  to the competition strategy. The strategies' outcomes stand  $\pi^D > \pi^C > \pi^N > \pi^K$  where  $D$  refers to deviating from pre-agreed collusion,  $C$  to collusion,  $N$  to fair competition and  $K$  to a deviation by *another* firm, in other words getting betrayed. The profit brought by the manager's effort is always added to the gains no matter what the competitive outcome.

The antitrust authority can impose a fixed fine of  $F$  on colluding firms if it obtains evidence about the collusion. It can also impose a personal sanction  $J$  on the cartel managers. This is where the Aubert model starts to fundamentally differ from the other models.  $J$  is assumed to include all losses of utility the manager faces, including loss of reputation.

With these assumptions we get a set of constraints for sustainable collusion. In order to agree to maintain collusion, the CEO must receive sufficient compensation for his effort. Maintaining collusion must also be more profitable for him than choosing another corporate strategy. Notably, the punishment system has a significant effect on the CEO's decisions. If he faces a possible personal sanction, his willingness to choose collusion is decreased. Collusion pacts are remarkably easy to accept if one faces no personal punishments at all.

The collusion constraints are following if no personal punishments are used at all. In the equations,  $\delta$  refers to discount factor,  $w$  to wage,  $\pi$  to profits,  $C$  to collusion,  $N$  to competition,  $e$  to effort and  $\psi$  to the personal cost of exerting effort:

- i) The participation constraint, ensuring that the manager will receive adequate wage his exerted effort

$$\frac{1}{1 - \delta} [w(\pi^C(e)) - \psi(e)] \geq 0$$

- ii) The incentive constraint, ensuring that the manager will choose to collude instead of to compete.

$$\frac{1}{1 - \delta} [w(\pi^C(e)) - \psi(e)] \geq \frac{1}{1 - \delta} [w(\pi^N(e)) - \psi(e)]$$

The latter equation depicts that the manager's discounted present value has to be higher when colluding than when competing. If the shareholders should wish that the manager competes instead of colludes – for example if corporate fines are increased – the equation can be simply turned around.

If personal punishment  $J$  is enabled and is imposed at detection probability  $p$ , the equations will be as following:

1. The participation constraint

$$\frac{1}{1-\delta} [w(\pi^C(e)) - \psi(e) - pJ] \geq 0$$

2. The incentive constraint

$$\frac{1}{1-\delta} [w(\pi^C(e)) - \psi(e) - pJ] \geq \frac{1}{1-\delta} [w(\pi^N(e)) - \psi(e)]$$

In other words, the expected additional profits from collusion – through stock-based rewards – compared to profits through fair competition must exceed the deter  $pJ$  caused by the potential personal punishment. Otherwise the manager would decide to compete fairly.

Thus it can be noticed that including personal punishment renders colluding less attractive to the manager. The expected profit of the fair competition strategy is independent of any punishments and remains unchanged. The profits of collusion are visibly decreasing in  $p$  and  $J$ , meaning that the higher the detection probability and the personal punishments are, the less attractive is the collusion strategy. Compared to the equations used under no personal punishments, both of the constraint equations have become harder to fulfill. This means that accepting to collude in the first place and preferring collusion over competition have both become less likely.

From the shareholders' point of view, the question is how to motivate the manager to choose the strategy the shareholders want him to choose. The expected profits of the company under collusion are:

$$\pi^C - w(\pi^C) - pF$$

Here  $w$  refers to the wage of the manager and  $pF$  to the expected value of corporate fines. Notably  $\pi$  refers to firm's income rather than profits in this case. If the manager does not choose to collude, the firm's expected profit is instead:

$$\pi^N - w(\pi^N)$$



Thus the rate of corporate fines and the detection probability play a role in which strategy the shareholders want the manager to choose. If the shareholders want the manager to collude – for example if corporational fines are relatively low – they can try to persuade the manager to collude by offering a higher (stock-based) wage. If the reward is high enough, it offsets the deter of possible personal punishment  $pJ$  and the manager chooses to collude even when facing a personal risk. Intuition says that when the personal punishments are raised, the shareholders have to pay the manager more money in order to make him collude. This continues as long as the shareholders are indifferent to what the manager chooses.

What the legislators can do is to modify the detection probability, corporational fines and the personal fines ( $p$ ,  $F$ ,  $J$ ) to a high level so that meeting the conditions for sustainable collusion becomes challenging. Thus Aubert does not promote the importance of leniency programs, and does not take a stance on whether whistleblowers should be positively rewarded or not.

Aubert neither states whether or not it is possible to prevent all collusion by legislation structuring in a Beckerian way. Her argument is that personal punishments are the strongest way to deter cartel formation since they have the strongest direct effect on which corporate strategy is chosen. Empirical evidence supports the usefulness of personal punishments, as shown later in the thesis.

Harrington [2010] evaluates the claims on antitrust sanctions, both corporational and personal. His claims do not contradict to those expressed by the previous authors. He claims that punishments can be increased without fear since over-deterrence of collusion is hardly imaginable. Hard punishments are needed since many financial criminals are “myopic” meaning that they underestimate the future punishment compared with the profits they receive instantly. The myopia is also the reason why Harrington dismisses the idea of complete prevention of crimes as suggested by Gary Becker.

Harrington strongly advocates personal punishments for cartel managers, and thus agrees with Aubert. He further notes that in those countries where collusion is not regarded as a personal crime and thus jail sanctions are disabled, barring the managers from high positions could be an option. Preventing an individual person from serving as a CEO or in any other high position in any firm is a strong deter. The loss of income might be actually higher in this way than by imposing a fine. Not being able to work in a distinguished post is also socially harsh and acts as an emotional deter.

### 3 Leniency programs and other means to breach cartels

#### 3.1 Direct and indirect evidence

There are several forms of formal and informal collusion. Some of these forms are legal and others illegal. Also the level of evidence minimally required to pass a verdict is legislation-dependent. Typically the level of evidence required is expressed so that the guilt must be “beyond reasonable doubt”. It is remarkably difficult to quantify what this means.

There are two types of evidence – just as in other parts of legislation – direct and indirect (circumstantial) evidence. Regarding cartels, direct evidence conventionally means that someone confesses the collusion. Such a confessor acts as a *whistleblower*. This phenomenon is crucial for the efficiency of antitrust actions. Supporting and contributing to such behavior is extremely important in fighting illegal cartels. Since written cartel pacts are hardly found by the authorities, a confession is usually the only piece of “hard evidence” the authorities can receive.

Indirect evidence consists typically of economic data which gives a hint of oligopoly pricing. Equal pricing by the firms itself is nothing of sufficient evidence. It might be result of *conscious parallelism*, which means employing equal pricing by firms without any kind of a contract – even a wordless one. This type of activity is not considered illegal in any OECD country. However, strangely parallel prices can be used as a tip to dig deeper as they might suggest the existence of collusion.

So called “plus factors” are needed to dismiss the possibility of legal price parallelism. Okada [2005] describes the process so that authorities seek price decisions that are irrational assuming that the firms are acting independently. Then they test whether or not the decisions seem coherent when assuming collusion. If the authorities find price and quantity decisions which only seem sensible assuming collusion, the finding can be used as (indirect) evidence.

Such evidence is often crucial in excluding the possibility of independent action so that the collusion is “beyond reasonable doubt”, as is required. Also, as the evidence accumulates, the firms have a stronger incentive to confess. Motta [2004] describes: “Econometrics is more likely to give complementary evidence, rather than conclusive proof of collusion”. Thus he admits that investigating price data is seldom sufficient, but still useful.

Murakami [2005] claims that in Japan, the market share of the conspirators should surpass 50% in order to support econometric evidence of illegal conspiracy. Otherwise the alleged conspirators hardly have enough market power to sustain any illegal collusion.

Feuerstein [2005] points out that fishy exchange of corporate information can imply the existence of collusion. Such exchanges are employed by conspirators since deviations from the cartel agreement are easier detected when price and quantity information is shared. Competing oligopoly firms should hardly share their corporate schemes to their competitors. Thus such exchanges can be used as indirect evidence on the cartel.

However, one could argue that corporate transparency is merely a positive thing and could reduce temporary dispersions in the market. Further, what kind of information sharing should be considered suspicious then?

Motta [2004] offers a black list of malpractices which suggest collusion:

- i) announcements about future prices or production quantities
- ii) exchange of non-aggregate information about prices or quantities
- iii) any co-ordination among firms aimed at harmonizing business practices among competitors, so that price observability among competitors is increased
- iv) minority shareholdings among competitors

These conducts can be regarded as pro-collusive factors since they include exchanging individual information about the firms to their supposed *competitors*. Trying to increase market share with strong pricing of production decisions becomes impossible. No firm should have a rational incentive to share private corporate information to their rivals, assuming the absence of collusion. Thus the idea is the same as Okada's [2005] who claimed that authorities seek for actions which are incoherent as deeds of a competing firm in an assumedly competitive oligopoly.

Harrington [2011a] claims that the price or quantity posting has to be industry-wide in order to be employable as a plus factor, and in such a case is a strong plus factor. If only one or two firms commit to posting and others follow their prices, the situation is called *price leadership* and is not illegal in any country.

The problem in the prohibition of such information exchanges is that the activity could be shifted into deep secrecy. Then detecting the information exchange would present a new problem.

Symeonidis [2003] argues that collusion is more likely in oligopolistic industries with high capital intensity and low profit margins, such as bulk production industries. The intuition is that in such industries the products are more homogenous and it is harder to differentiate, which makes collusion more attractive. This can hardly be used as a plus factor, but it helps the authorities to allocate their monitoring resources effectively. The claims of Symeonidis seem to statistically hold, as one can notice from the trial cases in the appendices of this thesis.

It can be concluded that indirect evidence is shaky at best. It gives helpful hints on which industries and companies to concentrate on in further monitoring. However, it seldom stands in court as sole evidence and the authorities know this. Thus the legislators in Europe and North America have introduced “leniency programs” since 1978, in order to increase the probability of receiving direct evidence.

### 3.2 Leniency programs in United States and Europe

A leniency program refers to merciful treatment of the whistleblower. Namely this means complete or partial liberation of the subject from cartel punishments. Such programs have two goals. In the short run, they contribute to the detection of cartels and thereby reduce social damage. In the long run they deter companies from initiating collusive activities.

The lack of evidence is not the only weakness in antitrust regulation which the leniency programs improve. Antitrust enforcement by reviewing potential cartels is costly. Since antitrust authorities have limited resources, they cannot effectively review every potential cartel. Societal benefit therefore requires that cartel members come forward and confess the cartel themselves. Thus the leniency programs also contribute to cost-efficiency of antitrust enforcement. In a Beckerian view, cartels will become exempt if their formation is rendered fruitless by legislators. Thus it is possible – at least in theory – to create an antitrust legislation which requires a minimal or non-existent budget. This is exactly what Spagnolo [2005] claims as was shown earlier.

Since cartels are beneficial for their participants, additional incentives have to be presented in order to induce someone to kill their milking cow. As stated in the introduction, the 1890 *Sherman Act* was inefficient due of shortage of such incentives. Between years 1890 - 1977, there was no legal difference whether a cartel participant was a whistleblower or not. Thus firms lacked the incentives to confess and chose simply not to proceed with it. The original act was later replaced with *Clayton Act* in 1914, but the problems sustained. The newer act was basically the same as the *Sherman Act*

with only minor changes included, such as prohibiting exclusive dealings and product tying. No leniency was presented and the efficiency remained poor.

In 1978 the United States Department of Justice introduced *Amnesty Program*. Under this program, firms participating in cartels could be granted immunity to prosecution for violating antitrust laws in case they confess. Thus the *Amnesty Program* was the first leniency program on Tellus. It took surprisingly long to enact the law, since the inefficiency of the Sherman Act and its follower had been eminent for decades. Eligibility for the new program required that no formal investigation of the respective cartel had started yet.

Further, the managers of the culpable firms could gain immunity against criminal prosecution. As showed by Aubert [2009], cartels might be also formed for personal reasons, implying that breaking them down requires personal incentives as well.

The Amnesty Program allowed that if a firm confesses a cartel to the authorities before any investigation on the respective cartel is underway, the whistleblower might receive an amount of leniency which is decided by the court. Thus the program finally had reduced fines for whistleblowers, expressed as  $\Omega F < F$  in the models.

However, the Amnesty Program was surprisingly inefficient and triggered only a few amnesty applications and cartel busts. Not a single internationally operating cartel with activity in the U.S. was revealed with its contribution (Hammond [2000]). This was highly surprising as economists and legal authors had been driving for such a program for decades. What went wrong then?

Hammond [2000] and Hinloopen [2003] suggest that the uncertainty regarding the reward for confession was a major obstacle for blowing the whistle. The companies could not reliably *predict* how strongly their punishment would be alleviated, if at all. Thus producing any kind of an expected profit calculation was feeble. As the managers are assumed to consider the confessions on financial expectations, they should be given the possibility to predict the outcome of the confession as clearly as possible.

Thus the program was improved in 1993 by two ways:

- i) Full amnesty became *automatic* if a firm should report a cartel that is not yet under investigation

- ii) Further, it became possible for a firm to be granted full amnesty even if the cartel was already under investigation, in case the authorities did not possess enough evidence to convict the cartel at that point
- iii) Partial amnesty leniency could be imposed on the whistleblower even if the authorities could have convicted the cartel on the date of the whistle-blow

Motta and Polo. [2004] emphasize the second improvement since the whistle-blowing often turns attractive only when the authorities are already on one's trail. Since the probability of being convicted is increased, the whistle-blow unarguably becomes more attractive. The whistle-blows are desired also in this situation, since they are the only credible type of "hard" evidence as we learned before. The investigation itself does not necessarily present sufficient evidence to convict.

Hinlopen [2003], Stephan [2005] and Hammond [2000] on the other hand emphasize the meaning of the first improvement due to the certainty and predictability effect. A transparent leniency system is required, since the firms who consider the possible whistle-blows want to calculate the expected outcome. If there is too much obscurity involved in the process, firms avoid taking part.

Hammond claims that the improvements have substantially increased the effectiveness of the antitrust enforcement. Hinlopen further points out that in the early 2000's the U.S. leniency (amnesty) program has breached more international cartels than search warrants, secret audio and video tapes and FBI interrogations combined. Also the sheer number of detected cartels jumped up after the law's ratification. According to Hinlopen, it is unquestionably the greatest investigative tool available to U.S. antitrust enforcers.

Moreover, the use of leniency programs is not dependent on the type of crime the legal system considers the cartel as. Leniency can be potentially applied regardless whether the cartel is treated as a criminal, a civil or as an administrative offense. Some other investigative activities such as search warrants, phone-tapping and manager espionage are not available to antitrust investigators in countries where cartels are not regarded as a personal felony, since such methods are restricted solely to criminal investigations.

The European Union and its predecessors have followed the footsteps of United States in antitrust enforcement. The original European Community antitrust regulation was set in the *Treaty of Rome* in 1958. The principles were based on the American equivalent and so were their results: absence of leniency meant absence of cartel busts.

Following the experiences of the U.S. Amnesty Program, the European Commission introduced a leniency program in 1996. The principles of the initial EU leniency program – officially called the 1996 Leniency Notice – can be described as following:

- i) The member who first reports “decisive evidence of a cartel’s existence” received full or “very substantial” leniency
- ii) If the cartel was already under investigation, the first reporter *could* get some reduction to the fine payments.
- iii) Others than the first reporter could *not get any* alleviation to the punishment.

Thus the EU system strongly corresponds to the original Amnesty program of United States from 1978. The results were also similarly poor; only seven cartels were breached in the first five years. It is questionable why the Commission chose to follow the original U.S. leniency program instead of the improved one from 1993, even if its positive results could already be verified in 1996. It seems that the Commission follows antitrust events a few years behind.

The reasons for the failure can be assumed similar to the original U.S. system. Lack of predictability and insufficient leniency did not invoke firms to blow the whistle. Firms could not be certain if it was beneficial to confess, so they simply chose not to. Stephan [2005] claims that the worst problem was that firms could not be sure about the level of evidence the authorities had at a given time. If the authorities already had significant evidence in their possession, a whistleblower could no longer receive full or “very substantial” leniency, but the firm would not necessarily know about it. Moreover, the final amount of leniency would be learned only when the Commission delivered its final decision, which might take years.

In a 2002 Commission Competition Newsletter the 1996 Leniency Notice was labeled as an “indisputable success”, but a myriad of scholars have challenged this view claiming that the results could have been much better. Stephan [2005] states that several cartels that were breached by the program were already under suspicion or investigation in United States, which helped to convict them.

Six years later in 2002, the Commission followed the U.S. example and directed extended alleviation possibilities. The 2002 Leniency Notice (still valid in 2011) imposes:

- i) The member to first report an undetected cartel is *always* granted complete immunity to cartel prosecution.
- ii) The first reporter is granted full immunity even if the cartel is already under investigation, given that the authorities yet lack sufficient evidence for a conviction
- iii) Even if the authorities already possess sufficient information, the first reporter can get an alleviated punishment if it presents “additional and useful” information to the authorities
- iv) Others than the first reporter might also get some alleviation to the punishment, even if the cartel was already under investigation, given that they can present additional and useful information as well

Thus the current EU leniency system is strongly similar to its concurrent U.S. counterpart. We can notify that the European Union legislation follows the United States counterpart quite accurately. The EU laws are modeled after the US counterparts but the process is significantly slow. The evolution of antitrust legislation in United States and the EU can be illustrated in the following table:

Area of legislation	USA	EU
Antitrust law enacted, but no leniency included	1890	1958
First leniency program included	1978	1996
Effective leniency program employed	1993	2002

The last notable difference lies in the attitude to non-first reporters. In United States any leniency is never granted to others than the first whistleblower. Sometimes the order of the confessors can be a matter of hours or minutes, as stated by Hammond [2000]. The EU law does not separate the confessors so strictly; other participants can gain notable leniency as well, granted that they present the authorities with valuable information that was not possessed earlier. No law anywhere has ever permitted full leniency to more than one applicant.



Thus the U.S. authorities operate a system promoted by the model of Spagnolo [2005] who strongly opposed any leniency extended to other reporters, as it could reduce motivation to be the first confessor. The EU law would match better with Hinloopen's [2003] views since he claimed that additional evidence by other reporters is so valuable – for example to estimate the amount of damage – that the leniency can be partially applied on them as well.

The trade-off is such that when other reporters than the first do not get leniency, some pieces of valuable information might be lost as they do not confess. Thus it might be impossible to estimate the whole entity of the cartel, including the damage done and the superfluous utility gained by the participants. However, if other reporters gain leniency as well, the motivation to be the first reporter is reduced. This would stabilize cartels compared to the only-for-the-first leniency. Thus there is no Pareto-optimality between the two systems and neither can be ruled strictly superior to the other.

### 3.3 Questions on leniency programs

There are several confusing issues regarding leniency programs and their participants. Both the EU and the U.S. leniency regulations have described requirements for a program participant, yet remaining questions can be found when dug deeper. These mainly regard the status of individual people in the cartel companies.

If an executive leads a firm to a cartel, but has already left the company when the cartel is whistleblown, the personal leniency does not directly apply to the former executive. However, the U.S. Department of Justice has agreed to negotiate in such cases, so that the former employees of a collusive firm are granted leniency as well. [Spratling 2001]

If several cartel participants blow the whistle at the same time, who should receive amnesty? Spagnolo claims in his 2005 model that such a situation is not credible. There should always be at least a few seconds difference between the confessions. However, if it once happened, for example by a letter with each participant's signature in it, how would the authorities proceed? Since all of the firms have confessed simultaneously, all of them are "first" confessors. If the laws were literally applied, no one could be punished for the cartel since everybody is a first whistleblower. Such an outcome would not be acceptable. The only viable option is to consider no one a whistleblower in such a case. No one should receive leniency if more than one confess simultaneously.

Another issue is to know which managers agreed to whistle-blow the cartel. If only some managers of a given company confess the collusion, the others should not be granted personal immunity. Aubert [2009] claims that a firm should only be considered as a whistleblower if there was a consensus in the management that the firm should self-report to authorities. If the highest management of the company did not agree to confess, but someone blew the whistle anyway, the firm should not be considered as a whistleblower and should not receive corporate leniency.

Such a case actually exists. A senior executive in a vitamins manufacturer Roche blew the whistle against his own company. The company sewed him for industrial espionage (Roche vs. Adams 1973) and he got sentenced to jail in Switzerland. His wife committed suicide in consequence. Ironically the very same firm – Roche – would later receive the highest cartel fines of all time in another occasion. United States Court of International Trade (1999) and the EU Commission (2001) convicted the company to pay \$500,000,000 and €462,000,000 in fines respectively.

The object of punishment also presents some questions. In the models reviewed in chapter 2 – excluding the model of Aubert – the sole bearer of the cartel punishment is the company. In such cases the only possible punishments are monetary fines and possibly closing down the company. No personal punishments could be under such reasoning. If individual people however are to be penalized, it is mandatory that the felons are *identified* with high certainty. This can turn out very difficult, as claimed by Cseres et al. [2006]. It would be very difficult to make someone admit that she was the person who gave the orders. Without significantly high certainty about the decision maker, no one can be legally penalized.

Another problem is to evaluate the relative guilt of given executives. Who gave the initial order to commit collusion? Who could have prevented it? How much influence did certain people have? In the worst case scenario, somebody might be used as a scapegoat to prevent punishments to others. The antitrust enforcers will have to find answers to such questions despite their challenging nature.

Some individual countries in the EU allow personal punishments for cartel managers, but typically very low. Most EU countries have not enabled imprisonments of cartel managers. In the United States, the situation is different since a cartel is viewed as a personal felony of the engaged managers, as well as an administrative crime by the company. Thus, both the managers and the firms generally receive a penalty.

Consequently the moral hazard, or more precisely the *principal-agent* problem, is much worse in Europe. The cartel managers gain personal benefit, but cannot receive compensating punishments

for their wrongdoings. In the US, where the managers face jail for up to ten years and also the firms face punishments, the moral hazard is non-existent. The ones who receive potential personal benefit also bear high personal risk.

There is some hard evidence on the utility of personal punishments as well: during a lysine cartel in the 1990's, the cartel managers tried to avoid meeting in the United States in fear of jail sentences, and conducted the collusive decisions elsewhere. They admitted this in interrogations. [Aubert 2009, Hammond 2004]

Wils [2005] evaluates whether or not “criminalization” would help to reduce cartel damage in the EU area. With criminalization he means the process of revising the EU antitrust policies so that collusion would become a punishable personal felony. Wils claims that if only fines can be used to deter price cartels, the level of fines required would be in the order of 150% of annual turnover in the products concerned by the violation. He uses Bryant and Eckard's [1991] detection probability of 16% and an assumption that price fixing increases prices by 10%, a number he claims is often used in U.S. literature. Such high fines are likely to exceed the undertaking's ability to pay. The fact that companies have engaged in a price fixing and profited financially does not necessarily guarantee that they would be able to pay the minimum fine required for effective deterrence. Moreover, there are limits to cartel fines, as discussed later in chapter 4.4. Thus such colossal fines are not even available. Personal punishments seem to be required to maintain a sufficiently high deter.

Another reason why Wils believes personal “criminalized” punishments should be used is that they provide an incentive for individuals to co-operate with the investigators, even if it is against the interests of their employers. When personal rewards are not allowed, it is unlikely that executives would blow their own firms. They would obviously lose their jobs by doing so. Thus they need some other motivation – stick or carrot – to reveal collusion in their firms. Avoidance of personal punishments could be used as such a motivator, if personal financial rewards are not permitted.

Due to these reasons Wils concludes that EU antitrust laws should be “criminalized” and only sanctioning corporate fines as a punishment is a mistake. Both corporate and personal punishments should be imposed when relevant. The personal punishment programs must be organized so that the punishments are in accordance with the gravity of the individual's deeds. The highest manager is not necessarily the one with highest influence on the formation of the cartel.

Wils [2002] notifies two different cases in which individual employees of a company commit to cartels.

- i) The highest management accepts or commits to an existing cartel, or forms a new cartel
- ii) *Other* employees – usually the middle-management – engage in collusive activity and the highest management is not aware of this

“Accept” means that the management acknowledges the existence of the cartel, but does not engage in activities to try to stop it. Also, if the highest management were aware of cartel pacts committed by the middle-management and did not proceed to cancel the pact, the members of highest management are guilty as well.

There is a case from 2008 when the airline company SAS sued one of their own executives for cartel participation. The highest management claimed to know nothing about such a cartel and stated that SAS is a victim of its own executive. The case has not been solved yet.

## 4. Empirics on leniency and punishments

### 4.1 Empirics on leniency in United States and Europe

In both jurisdictions – U.S. and EU – the initial antitrust policy with no leniency had low success. The amount of breached cartels was very low both and was considered as a disappointment. Since the introduction of leniency program the cartel breaches started to unfold. In Europe the first leniency program was officially known as “Notice on the non-imposition or reduction of fines in cartel cases”, though its unofficial name “The 1996 Leniency Notice” has become mutual.

The EU Commission praised the program as an “indisputable success” in the EC Competition Newsletter of year 2002. The acclaim was based on statistics which show that as much as 20 of the 33 contemporary cartel investigations were initiated as a result of a leniency application – namely a whistle-blow. That totals sixty per cent of the whole amount.

Even though the cartel breaches were following each other, several law authors and economists could not agree on the “indisputable success”. They claim that the results could have been even better, had the program been somewhat different. Several important notifications have been made about the cartels uncovered in the period. These findings dispute the efficiency of the program in stopping active and lucrative cartels.

Stephan [2005] compares cartels which were prosecuted both in U.S and in the EU. These 13 cases constitute nearly 40% of all cartels taken into investigation by the commission between years 1996 and 2002. Thus notably many of the cartels had been operational both in United States and in Europe.

The following table by Stephan lists the times when the cartels were convicted in U.S and were under investigation in EU. The dates when Department of Justice initiated their investigations in United States are unfortunately undisclosed, so only the date when the conviction was announced can be expressed here.

The cartels are described by their industry:

Cartel description	First U.S. Fine imposed by DOJ	EU investigation underway and resulting in conviction
Amino Acids - Lysine	Oct-96	1996-2000
Citric Acid	Jan-97	1997-2001
Sodium Gluconate	Sep-97	1997-2001
Graphite Electrodes	Feb-98	1997-2001
Animal Feed Vitamins	May-99	1999-2004
Sorbates	May-99	1998-2003
Vitamins	May-99	1999-2001
Christie's & Sotheby's	Oct-00	2000-2002
MCAA Chemicals	Jun-01	2000-2005
Food Flavour	Aug-01	1999-2002
Organic Peroxides	Mar-02	2000-2003
Carbon & Graphite	Nov-02	2001-2003
Methylglucamine	Sep-03	2000-2002

Two notions can be made. Firstly, most of the cartels concentrate on chemicals and medicals industry. Stephan claims that the first EU cartel bust in the industry in 2000 and the punishments following it may have destabilized other cartels in the chemical industry. Cartels in other industries may have been breached with lesser efficiency.

Secondly, in all cases except the last one, the fines were imposed first in the United States. Convicting cartels is clearly easier after the same cartel has been found guilty elsewhere. It is also possible that the EU authorities had not even spotted the cartels at all if the U.S. Department of Justice had not informed them. This assumption cannot be verified however since exchanging such information is confidential.

Furthermore, Stephan states that several of the 33 cartels breached by the program had actually ceased to exist before the whistle-blow. The main interest would have been closing down the active cartels instead of the ceased ones. Thereby Stephan claims that the Commission exaggerates the efficiency of the system, and notes that it hardly was an “indisputable success”.

We can state a hypothesis that the 1996 Leniency Notice had success in motivating whistle-blows in those cases where the cartel had already failed or become unstable for some reason. Such circumstances would have been met when being under investigation in the United States, when several other cartels had been already convicted in the same industry, or when the cartel activity had

already ended. Thus the 1996 Leniency Notice helped to reveal cartels which had already been destabilized and might have been convicted even without the assistance of the Leniency Notice. Stephan claims that destabilizing the active and lucrative cartels would have required stronger tools.

Even though the system's details have been criticized, the introduction of leniency itself was seen as an improvement. The direction of the program was right but some fine-tuning would be needed. A total sum of 3,9 billion euros was collected in fines from the participants of the 33 contemporary cartels. As 20 cases out of 33 included some kind of a whistle blow and leniency application, a large proportion of the collected fines might have been lost in case no leniency had been in place.

Henry [2005] notes that since legislative changes happen at a remarkably slow pace, many individual countries are yet to reform their leniency systems based on the 1996 notice, and still bear its intrinsic weaknesses in their legislations.

The cases in the respective period included two interesting samples clarifying how the Commission evaluates the whistle-blows. In the amino-acids case, the revealing firm - Ajinomoto - was only granted 50% leniency because it held back important documents after the whistle-blow. Thus the firm violated the requirement of "continuous and complete" cooperation which was set mandatory in the 1996 leniency system. This implies that the Commission indeed requires full commitment to the confession and the conditions of leniency.

Another interesting case is the Animal Feed Vitamins cartel which was revealed in 1999 and convicted in 2004. EU Commission did not allow leniency to any of the applicants even though several firms confessed the collusion. An American company called Bioproducts Inc. initially blew the whistle for the U.S. Department of Justice and the cartel's activities in Europe were simultaneously revealed. The Commission thereby already had sufficient evidence for a conviction, and did not consider the following European confessions as full whistle-blows.

The European Commission changed the Leniency Notice in 2002, following a similar procedure in the United States. The new system – which is still in place in Nov. 2011 – gives wider leniency as it allows full immunity also in some cases where the authorities are already investigating, as stated in chapter three.

There are currently no prominent empirical studies on the 2002 leniency notice. Thus I took a look in EU Commission decisions myself. I chose cartel cases initiated since 2002, so that the Leniency Notice of 2002 has been applicable. There are a total of 36 cartel cases solved by the European Union's competitive authority, Directorate Generale de Competition since then. Of the 36 cases, at

least one whistleblower has been present in 28 cases. Thus nearly 80% of the convictions have resulted from co-operation with the EU competition authorities. Unfortunately the details of investigations are undisclosed, so I cannot evaluate which proportion of the cases could have been solved even without a whistle-blow.

The 36 cartels have occurred all around Europe, but with emphasis on the western, most affluent parts of the union. The industries vary widely from a condom rubber to road bitumen, window installer and banana cartels. The chemical and drug industry emphasis of 1996-2002 cases was not visible any longer. The connection to U.S. Department of Justice investigations seems to have broken as well. Most of the breached cartels have not been convicted in the United States. Thus the 2002 Leniency Notice does not seem to suffer from the flaws of its predecessor. The clues of inefficiency collected by Stephan [2005] do not seem to apply to the cartel convictions based on the current leniency.

The average time span of the cartels has been 9.7 years and the average number of member firms has been close to 7.4. Notably many cases have involved a repeated offender. As much as 16 cases out of 36 – that is 44.44% of the cases – included at least one firm who had been caught of cartel participation before.

It cannot be directly concluded that the probability of cartel destruction would have increased, but the data hints in that way. The 2002 notice seems to outperform the 1996 notice which had insufficient predictability and lack of leniency after the investigations had started. Polishing the flaws of uncertainty and constrained leniency seems to have improved the efficiency of the Leniency Notice, just as the theories in chapter 2 predicted.

In United States, extensive studies have been conducted on collusion trial outcomes under different eras of legislation. The general observation is that the more leniency has been allowed, the more cartel breaches have been witnessed. The proportion of convictions involving a whistle-blow has also increased as stronger leniency has been enacted. Thus the results in United States are in accordance with those in the European Union. For example Hammond [2004] notes that during 1978-1993, the Department of Justice Antitrust Division received only one leniency application per year, and not a single international cartel was breached by a whistleblower.

As the experiences with different competition laws have been notably similar in the EU and the United States, one could argue that the findings are generalizable. Empirically it seems that



allowing high leniency generally destabilizes cartels in any society, matching with the results of theoretic models.

Hypothetically the difference in detected cartel activity could be due to increased amount of cartels in society as well. However, this is not a credible explanation. There is no apparent reason why cartel practices should have boomed immediately after antitrust laws made it *easier* to reveal a cartel. Authorities of other OECD countries seem to have agreed, since at least Australia, Canada, France, Germany, New Zealand, the UK and Sweden have adapted a (near-)similar system after 1993 when U.S. extended the leniency.

The data does not reveal whether the improved efficiency of the law was due to the improved transparency and predictability or to the potential full amnesty even when the investigation was already underway. Most likely both effects play a significant role in the process.

Since the probability of detection is vital for the antitrust policies, a large number of estimations for the detection probability have been conducted. Bryant and Eckard [1991] estimated that in United States in years 1961-1988, the probability had been around 0,13 – 0,17. Most other studies do not strongly contradict with the result.

Since the U.S. leniency program (Amnesty Program) was improved in 1993, the probability has potentially increased since then. Wils [2005] reasons that the probability might now be at 0,33 or a little below. This would imply that improvements in antitrust have been made, but undetected cartel activity still renders a substantial social loss. It is possible that enabling “courageous” leniency programs – such that include positive rewards – would further discourage cartel activity and reduce the social losses. As such programs are already established in South Korea and United Kingdom, we might receive interesting information on the efficiency of rewarding in the following years.

#### 4.2 Cartel fines in the European Union

In 1998, the Commission published “Guidelines on the method of setting fines imposed pursuant to Article 15 (2) of Regulation No 17”. The document is generally known as “Guidelines” and called so even in official EU Commission releases.

According to the guidelines, the “basic amount” of the fine should be determined in accordance to the gravity and duration of the infringement. When measuring the gravity of the infringement, one must take in account the infringement’s nature, its impact on the market and the size of the relevant

geographic market. With these factors, the misdeeds can be divided to three categories, minor, serious and very serious infringements. They are described:

- i) Minor infringements – These might be trade restrictions, usually of a vertical nature, but with a limited market impact and affecting only a substantial but relatively limited part of the Community market. Likely fines: ECU 1 000 to ECU 1 million. (note that Euros were called ECU:s at the time)
- ii) Serious infringements – These will more often than not be horizontal or vertical restrictions on the same type as above, but more rigorously applied, with a wider market impact, and with effects in extensive areas of the common market. There might also be abuse of a dominant position. Likely fines: ECU 1 million to ECU 20 million.
- iii) Very serious infringements – These will generally be horizontal restrictions such as price cartels and market-sharing quotas, or other practices which jeopardize the proper functioning of the single market, such as the partitioning of national markets and clear-cut abuse of a dominant position by undertakings holding a virtual monopoly. Likely fines: above ECU 20 million.

The duration of the crime should also be taken into consideration when setting the fine. A distinction should be made between the following:

- i) Short duration – in general, less than one year. No increase in fine amount.
- ii) Medium duration – in general, one to five years. Increase of up to 50% in the fine amount.
- iii) Long duration – duration of more than five years. Increase of up to 100% in the amount of fine.

These two factors – gravity and duration – establish the basic amount for the fine. The basic amount will be increased where there are aggravating circumstances such as:

- Repeated infringement of the same type by the same undertaking
- Refusal to co-operate with the Commission or attempts to obstruct its investigations
- Role of leader or initiator in the infringement
- Retaliatory measures against other undertakings with a view to enforcing practices which constitute an infringement
- Need to increase the penalty in order to exceed the amount of gains improperly made as a result of the infringement when it is objectively possible to estimate that amount

The basic amount will be reduced where there are attenuating circumstances such as:

- An exclusively passive role in the infringement
- Non-implementation in practice of the offending agreements or practices
- Termination of the infringement as soon as the Commission intervenes
- Existence of reasonable doubt on the part of the undertaking as to whether the restrictive conduct does indeed constitute an infringement
- Infringements committed as a result of negligence or unintentionally
- Effective co-operation by the undertaking in the proceedings

These factors are considered in setting the fine. However, two possible reductions still affect the final amount of the fine. First is the leniency – granted that the firms have co-operated with authorities, the second is the fine limit.

Directorate General de Competition employs 10% of the cartel firm's last year's turnover as the maximum fine. If the cartel has been in place for several years, the amount is multiplied by the number of years. There are several reasons why this system is flawed and distorted:

Firstly, it neglects the firm's *profitability*, which is more important in measuring performance than its turnover. Thus the fine is disproportionately strong for weakly profitable firms and underproportional for highly profitable ones. One could argue that the firms' *profits* should be used in the measuring instead.

Secondly, it is set far too low. The utility the firm gains from collusion might be far higher than ten per cent of annual turnover. The reason for relatively low maximum penalties is to prevent the companies from insolvency. However, too low maximum fines fail to create a deterrence effect.

Thirdly, it neglects to consider the damage caused by the firm. Last collusive year's turnover fails to express how much damage the individual company caused as a cartel member. Larger firms do not necessarily cause more collusive damage than smaller co-conspirators, but nevertheless face a higher maximum fine. One could argue that the maximum fine should be tied to the damage caused instead of the firm's turnover.

Fourthly, the limit distorts the causality of the punishments. In a legal sense, those who commit the worst crimes should face the heaviest punishments. However, under the 10 % limit, the worst conspirators get a reduction in fines due to the fine limit. This is arguably the heaviest distortion in the fine system. One could argue that there should not be such fine limits at all in order to avoid causality distortions – they only benefit those who would get an even higher punishment otherwise!

The guidelines were renewed in 2006. The document expressed then-commissioner Neelie Kroes' views on cartel punishing. She claimed that the revised guidelines will better reflect the overall economic significance of the infringements as well as the share of each company involved.

The 2006 guidelines introduce a new punishment for infringements of a very brief time period, called "entry fee". This punishment equals 15-25% of annual relevant sales, whatever the duration of the infringement. This notification is added in order to clarify that even cartel memberships of a very short time period are punishable. A corporate strategy of entering a cartel and rapidly deviating of it becomes less beneficial.

Secondly, the new guidelines emphasize stronger penalties for repeat offenders. The common practice of the Commission was to increase the fines by 50% had the undertaking been found to previously commit a similar infringement. The new guidelines state that the increase should be up to 100% and each prior infringement will justify an increase in the fine. Also, the Commission takes national competition authorities' previous convictions into account, instead of merely its own ones as before.

#### 4.3 Econometrics – An OLS regression model of cartel fines

I formulate a regression equation (Ordinary Least Squares) to investigate the characteristics that affect the fine. The purpose is to examine whether or not the EU fines follow the EU guidelines for the fines, id est does the commission follow its own rules in imposing the fines. In order for the antitrust system to be effective, the punishments and levels of leniency should be somewhat predictable. Furthermore, the punishments must be based on some regulations in order to be justifiable. Thus it is important to examine whether or not the level of imposed fines follows the guidelines set by the Commission. Ordinary Least Squares method is chosen because the error terms can be assumed uncorrelated and should have the expected value of zero. Thus the OLS estimator is the maximum likelihood estimator (BLUE) as the Gauss-Markov assumptions hold.

The data consists of 23 EU Commission cartel convictions in which the newest (2006) guidelines for fines have been employed. Prior fines have been left out since the guiding for fines used to be a bit different and was improved then-commissioner Neelie Kroes. The conviction data is public and has been collected from the EU Commission's website. The sample size of 23 is relatively small, which affects the t-test and P-test values of the estimation. However, the sample size can be assumed sufficient.

I have chosen to investigate the fines per cartel instead of fines per firm, because a per firm regression would be heavily distorted by the firm's size, diminishing the effect of other variables. Thus it is more plausible to compare the fines imposed on cartels instead of individual firms.

The guidelines express that the fines can be reduced by co-operating with the authorities. On the other hand the factors which aggravate the fines are repeated offending, cartel time span and the gravity of the cartel. The gravity is affected by the size of the market where the cartel operates, the combined market share of the cartelists and the amount of firms in the cartel. The repeated offenders variable is a percentage variable which describes how large a proportion of a given cartel's participants already have a conviction in a prior cartel case.

STATA ordinary least squares regression gives the following results:

fines	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
whistleblow	-7.19e+08	1.46e+08	-4.92	0.016	-1.18e+09	-2.54e+08
nooffirms	1.03e+08	2.76e+07	3.74	0.033	1.54e+07	1.91e+08
timespan	2.72e+07	1.26e+07	2.16	0.119	-1.28e+07	6.72e+07
marketsize	.3832765	.0741812	5.17	0.014	.1471987	.6193543
combshare	1.51e+07	5080173	2.97	0.059	-1104661	3.12e+07
repeatedof~r	1.21e+09	3.89e+08	3.11	0.053	-2.68e+07	2.45e+09
_cons	-1.69e+09	4.57e+08	-3.69	0.034	-3.15e+09	-2.34e+08

The results are as expected. The coefficients of each variable have anticipated signs. Also the statistical significance of the results is on a high level. Only the time span variable has a P-value over 0.1 implying that the finding is not statistically significant using a 90% significance level.

We can judge that the EU Commission follows its own guidelines in imposing fines. The legislation has had success in following a consistent punishment level. Publishing the guidelines has had a desired effect as there is now a benchmark which can be followed when imposing punishments on cartel participants.

## 5. Conclusions

A debate on the usefulness of cartel enforcement still goes on. Authors associated to the so-called Chicago school claim that the enforcement policies cause more harm than gain, since protecting competition induces inefficiency in the market. However, majority of legal authors and economists agree on the desirability of antitrust enforcement since the social damage by cartels is perceived to be noticeable.

The primordial antitrust laws outlawed collusion but with little effect. Antitrust laws without a leniency program for whistleblowers did not produce satisfactory results either in the U.S. or in Europe. Such laws treated possible cartel confessors equally to the other cartel offenders. Thus no participant had motivation to confess collusion, and other means to defeat cartels were found feeble.

The initial leniency programs did hardly better in breaching cartels. The amount of leniency was weakly predictable and no leniency was granted after an investigation on the given cartel was already commenced. These flaws undermined the influence of the programs and cartel sustainability was not significantly reduced.

Since effective leniency programs were enacted, they have been the strongest investigative tool available to the antitrust enforcers. Currently a vast majority of antitrust convictions follow from confessions under a leniency program. Both theory and empirical evidence show that allowing strong leniency induces cartel destabilization.

Enabling positive rewards for the whistleblowers is theoretically beneficial, as long as the rewards are not excessive. Otherwise the program could be exploitable. Empirical evidence of such programs is brief, since only South Korea and United Kingdom have enacted such policies, and both of them did so quite recently. There is no evidence which contradicts to the acceptance of such programs.

A cartel is always formed by individual people. Thus regarding the incentives of individual people is vital in defeating cartels. Personal punishments are advocated since they further reduce the motivation to commit collusion. There is both theoretical and empirical evidence supporting the argument. Colluding managers have been known to avoid cartel participation in a country where the personal punishments for collusion are severe.

Lack of personal punishments to cartel managers leads to a moral hazard where managers are motivated to collude as the risk of punishment is borne by others. If instead corporate punishments are low, the shareholders are motivated to persuade the managers to collude and the moral hazard is inverted.

Also the whistle-blowing is executed by individual people. A firm should only receive corporate leniency if the executives were unanimous about the confession. If only one or few individuals accomplished the deed without the approval of others, the firm should not receive corporate leniency. In such cases, the whistle-blowing individuals should receive compensation for their actions since they clearly have little future in their current firms.

Increasing fines has an ambiguous effect on cartel sustainability. On one hand, it makes whistleblowing more attractive. On the other hand it also increases the fines the whistleblowers have to pay, granted that leniency is not absolute. If total leniency is available, then increasing cartel fines unquestionably has a cartel-destabilizing effect.

The antitrust authorities need resources in detecting cartels. The marginal utility of the resources is diminishing. Optimal budget of the authorities would be such that the marginal utility equals the marginal cost, however finding such an equilibrium in society is difficult.

There is no pareto-optimal solution to whether or not the leniency programs should be restricted to the first confessor or not. If only the first confessor gets leniency, cartel destabilization is maximized. However, such a policy might lead to imperfect cartel detections as only the information possessed by the first confessor is brought to the authorities. The details known by others would be undisclosed. If further confessors are to receive leniency, such information would be revealed, but the compensation received by the society in the form of fines would be reduced.

Cartel fines imposed by the European Commission correspond with the official guidelines of the fines and can be classified as predictable. This is required from an effective and fair legislation. The factors that affect the fine level are the time span of the cartels, the size of the market affected by collusion, the market share of cartelists, confessions to the authorities and repeated offending. The penal system of the European Commission is however flawed: it does not allow personal punishments and employs a maximum fine of 10% of annual turnover. Theoretically there should be no fine maximum at all. If such a maximum exists, it should be bound to annual profits instead of turnover.

## 6. Appendices

### 6.1 References list

Aubert, Cecile (2009) *Managerial Effort Incentives and Market Collusion*, Toulouse School of Economics working paper

Becker, Gary (1968), *Crime and Punishment: An Economic Approach*, Journal of Political Economy, Vol. 76

Bork, Robert (1978) *The Antitrust Paradox*, New York Free Press, New York City

Bryant, Peter and Eckard, E. Woodrow (1991) *Price Fixing: The Probability of Getting Caught*, The Review of Economics and Statistics, Vol. 73 No. 3

Connor, John (2004) *How High Do Cartels Raise Prices?* American Antitrust Institute working paper

Cseres, Katalin and Vogelaar, Floris (2006) *Criminalization of Competition Law Enforcement: Economic and Legal Implications for the EU Member State*, Edward Elgar Publishing, Cheltenham, UK

Fershtman, Chaim and Judd, Kenneth (1987) *Equilibrium Incentives in Oligopoly*, The American Economic Review, Vol. 77 No. 5

Feuerstein, Switgard (2005) *Collusion in Industrial Economics – A Survey*, Journal of Industry, Competition and Trade, Vol. 5/2005 No. 3-4

Fölster, Stefan and Peltzman, Sam (1997) *The Social Costs of Regulation and Lack of Competition in Sweden: A Summary*, University of Chicago Press

Gellhorn, Ernest et al. (2004) *Antitrust Law and Economics in a Nutshell*, Thomson West Publishing, Minnesota

Hammond, Scott (2002) *Detecting and Deterring Cartel Activity Through and Effective Leniency Program*, presentation at the International Workshop on Cartels Nov. 21 2000, Brighton, England



- Hammond, Scott (2004) *Cornerstones of an Effective Leniency Program*, presentation at the Workshop on Leniency Programs, Nov.22.2004, Sydney, Australia
- Harrington, Joseph (2008) *Optimal Corporate Leniency Programs*, Journal of Industrial Economics, Vol. 56 No. 2
- Harrington, Joseph (2010) *Comment on 'Antitrust Sanctions' by Douglas Ginsburg and Joshua Wright*, Competition Policy International, Vol. 6 No. 2
- Harrington, Joseph (2011) *Posted Pricing as a Plus Factor*, Journal of Competition Law & Economics 1/2011
- Harrington, Joseph (2011) *When is an Antitrust Authority not Aggressive Enough in Fighting Cartels?*, International Journal of Economic Theory, Special Issue March 2011
- Henry, David (2005) *Leniency Programmes: An Anaemic Carrot for Cartels in France, Germany and the UK*, European Competition Law Review 2005
- Hinlopen, Jeroen (2003) *An Economic Analysis of Leniency Programs in Antitrust Law*, De Economist, Vol. 151 No. 4
- Hovenkamp, Herbert (1985) *Antitrust Policy After Chicago*, Michigan Law Review, Vol. 94 No. 2
- Kaplow Louis and Shavell, Steven (1994) *Optimal Law Enforcement with Self-reporting of Behavior*, Journal of Political Economy, Vol. 102 No. 3
- Motta, Massimo and Polo, Michele (2003) *Leniency Programs and Cartel Prosecution*, International Journal of Industrial Organization, Vol. 3/2003
- Murakami, Masahiro (2005) *Antimonopoly Act – Rules of Fair Competition*, Iwanami Shoten, Tokyo (translated from Japanese)
- Okada, Yosuke (2005) *How to Fight Hard-core Cartels? Comments on Collusion in Industrial Economics*, Journal of Industry, Competition and Trade, Vol. 5/2005 No. 3
- Rey, Patrick (2003) *Towards a Theory of Competition Policy*, Advances in Economics and Econometrics, Volume II, Econometric Society Monographs, Cambridge University Press
- Sklivas, Steven (1987) *The Strategic Choice of Managerial Incentives*, Rand Journal of Economics, Vol. 18 No. 3

Smith, Adam (1776) *The Wealth of Nations*, W. Strahan and T. Cadell publishing, London, United Kingdom

Spagnolo, Giancarlo (2005) *Divide et Impera: Optimal Leniency Programs*, CEPR discussion papers 4840

Spratling, Gary (2001) *Detection and deterrence: rewarding informants for reporting violations*, George Washington Law Review, Vol. 69 No. 5-6

Stephan, Andreas (2005) *An Empirical Assessment of the 1996 Leniency Notice*, Centre for Competition Policy working paper

Symeonidis, George (2003) *In Which Industries Is Collusion More Likely? Evidence from the UK*, The Journal of Industrial Economics, Vol. 51

Thepot, Florence (2011) *Leniency and Individual Liability: Opening the Black Box of the Cartel*, Competition Law Review, Vol. 7/2011 No. 2

Wilberforce, Robert (1966) *The Law of Restrictive Trade Practices and Monopolies*, Cambridge University Press

Wils, Wouter (2002) *The Optimal Enforcement of EC Antitrust Law: Essays in Law & Economics*, Kluwer Law International publishing, The Hague

Wils, Wouter (2005) *Is Criminalization of EU Competition Law the Answer?*, Remedies and Sanctions in Competition Policy, Edward Elgar Publishing, London

## 6.2 Trial cases

The following cases have been employed in evaluating whether or not the EU Commission's leniency notice of year 2006 was successful. The pieces of information which were relevant to the study are the amount of fines, possible whistle-blowing, possible repeated felons, the time span of the cartel, number of firms included, the market size and the combined market share of the cartel participants.

The first 23 of the cases listed below were included in the econometric OLS regression model of cartel fines used in chapter 4. The rest of the trial cases were excluded since the latest guidelines for cartel fines were not yet employed when imposing the respective fines.

All of the information has been collected from the EU Commission's website and is available for public use. The following links lead to the English language reports of the cases but most of the information can be also found in Finnish.

Detergents cartel OJ C 193, 02.07.2011

<http://ec.europa.eu/rapid/pressReleasesAction.do?reference=IP/11/473&format=HTML&aged=0&language=EN&guiLanguage=en>

LCD panel producer cartel OJ C 295 7.10.2011

<http://ec.europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1685&format=HTML&aged=0&language=EN&guiLanguage=en>

Air cargo carrier cartel IP/10/1487

<http://ec.europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1487&format=HTML&aged=0&language=EN&guiLanguage=en>

Animal feed phosphates cartel OJ C 111 9.4.2011

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/985&format=HTML&aged=0&language=EN&guiLanguage=en>

Steel producers cartel IP/11/403

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/403&format=HTML&aged=0&language=EN&guiLanguage=en>

Bathroom equipment cartel IP/10/790

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/790&format=HTML&aged=0&language=EN&guiLanguage=en>

D-RAM producer cartel OJ C 180 21.06.2011

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/586&format=HTML&aged=0&language=EN&guiLanguage=en>

Plastic additives cartel OJ C 307, 12.11.2010

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1695&format=HTML&aged=0&language=EN&guiLanguage=en>

Concrete reinforcing bar cartel IP/09/1389

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1389&format=HTML&aged=0&language=En&guiLanguage=en>

Calcium carbide and magnesium cartel OJ C 301 11.12.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1169&format=HTML&aged=0&language=EN&guiLanguage=en>

Gas market cartel OJ C 248, 16.10.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1099&format=HTML&aged=0&language=EN&guiLanguage=en>

Marine hose producers OJ C 168, 21.7.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/137&format=HTML&aged=0&language=EN&guiLanguage=en>

Car glass cartel OJ C 173, 25.7.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1685&format=HTML&aged=0&language=EN&guiLanguage=en>

Banana cartel OJ C 189, 12.8.2009

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0812\(02\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0812(02):EN:NOT)

Wax producers cartel OJ C 295, 04.12.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1434&format=HTML&aged=0&language=EN&guiLanguage=en>

Aluminum fluoride cartel OJ C 40, 9.2.2011

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1007&format=HTML&aged=0&language=EN&guiLanguage=en>

Removal services cartel OJ C 188, 11.8.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/415&format=HTML&aged=0&language=EN&guiLanguage=en>

Synthetic rubber producers OJ C 86, 23.01.2008

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/78&format=HTML&aged=&language=EN&guiLanguage=en>

Chloroprene rubber OJ C 251, 03.10.2008

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1855&format=HTML&aged=0&language=EN&guiLanguage=en>

Flat glass producers OJ C 127, 24.05.2008

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1781&format=HTML&aged=0&language=EN&guiLanguage=en>

Videotape producers OJ C 57, 01.03.2008

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1725&format=HTML&aged=0&language=EN&guiLanguage=en>

Bitumen suppliers OJ C 321, 29.12.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1438&format=HTML&aged=0&language=EN&guiLanguage=en>

Cargo fasteners cartel OJ C 47, 26.02.2009

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1362&format=HTML&aged=0&language=EN&guiLanguage=en>

Beer cartel OJ C 122, 20.05.2008

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008XC0520\(01\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008XC0520(01):EN:NOT)

Elevators and escalators OJ C 75, 26.03.2008

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/209&format=HTML&aged=0&language=EN&guiLanguage=en>

Gas insulated switchgears OJ C 5, 10.01.2008

<http://ec.europa.eu/rapid/pressReleasesAction.do?reference=IP/07/80&format=HTML&aged=0&language=EN&guiLanguage=en>

Synthetic rubber cartel, OJ C 7, 12.01.2008

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/06/1647|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/06/1647|0|RAPID&lg=EN)

Copper fittings producers OJ L 283, 27.10.2007

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/06/1222|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/06/1222|0|RAPID&lg=EN)

Road bitumen cartel OJ L 196, 28.07.2007

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/06/1179|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/06/1179|0|RAPID&lg=EN)

Acrylic glass cartel OJ L 322, 22.11.2006

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/06/698|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/06/698|0|RAPID&lg=EN)

Bleaching chemicals cartel OJ L 353, 13.12.2006

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/06/560|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/06/560|0|RAPID&lg=EN)

Rubber chemicals OJ C 353, 13.12.2006

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006D0902\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006D0902):EN:NOT)

Industrial bags cartel OJ L 282, 26.10.2007

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/05/1508|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/05/1508|0|RAPID&lg=EN)

Italian raw tobacco cartel, OJ L 353, 13.12.2006

[http://europa.eu/rapid/start/cgi/guesten.ksh?p\\_action.gettxt=gt&doc=IP/05/1315|0|RAPID&lg=EN](http://europa.eu/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/05/1315|0|RAPID&lg=EN)

### 6.3 Laws and regulations

*The Sherman Antitrust Act (1890)*

<http://www.stolaf.edu/people/becker/antitrust/statutes/sherman.html>

*The Clayton Antitrust Act (1914)*

<http://www.stolaf.edu/people/becker/antitrust/statutes/clayton.html>

*United States Department of Justice: The Amnesty Program (1978)* is unfortunately not presented online at current time.

*United States Department of Justice: The Revised Amnesty Program (1993)*

<http://www.justice.gov/atr/public/guidelines/0091.htm>

*The EU Commission 1996 Leniency Program:*

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996Y0718\(01\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996Y0718(01):EN:NOT)

*The EU Commission 2002 Leniency Program:*

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002XC0219\(02\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002XC0219(02):EN:NOT)

*The EU Commission 2006 Notice on Cartel Fines:*

[http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52006XC1208\(04\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52006XC1208(04):EN:NOT)