Eur J Law Econ (2008) 25:209–229
DOI 10.1007/s10657-008-9046-x

On the rationale of leniency programs: a game-theoretical analysis

Ulrich Blum · Nicole Steinat · Michael Veltins

Published online: 11 March 2008

Abstract In order to enhance the enforcement of Antitrust Law, leniency policies were introduced in nearly all industrialized countries. These programs aim at deterring and eliminating cartels. In this paper we analyze the rationale of the current European and German leniency regulation. We challenge the contemporary view that the standard leniency privilege is incentive-compatible with respect to its aim to enhance competition. Instead, we argue for it to be used as a preemptive strike against competitors under circumstances where cartels become unstable. This implies a tightening of markets in subsequent periods and, thus, a potential reduction in competition intensity. Given strategic reasoning by agents, the principal witness may assure an economically privileged position in the future. This consequence might not be intended by the bonus regulations. Nevertheless if the leniency policies lead to more competition in the market the results should be welcomed by the national cartel offices. We give anecdotal evidence of the German cement case and base our arguments on a game-theoretical model.

Keywords Cartel · Leniency · Cement industry · Games · Chief witness · Bonus regulation · Germany

JEL Classifications K2 · K21 · K42 · L1 · L4

U. Blum (✉) · N. Steinat
Institut für Wirtschaftsforschung Halle, Kleine Märkerstr. 8, 06108 Halle, Saale, Germany
e-mail: praesident@iwh-halle.de

N. Steinat
e-mail: Nicole.Steinat@iwh-halle.de

M. Veltins
LSV Rechtsanwalts-GmbH, Bockenheimer Landstr. 51-53, 60323 Frankfurt, Germany
e-mail: michael.veltins@lsv-legal.com

1 Introduction

In 2003, the Bundeskartellamt (the German Federal Cartel Office, FCO) fined six large suppliers of cement in Germany 661 million Euro. What had happened? From spring 2002 onwards, German cement prices started to take a dive. This was the result of a multi-market competition initiated by one large supplier in the East, Readymix, now Cemex. The latter tried at the end of 2001 to improve the use of his facilities and to distribute more cement among his clients and better use freight capacities in his concrete production and distribution network. This made the quota-cartel that existed in East Germany obsolete.[1] Parallel to this development, the FCO started pre-investigations against all major producers of cement in Germany, confiscated files in spring 2002 and announced to the press a fine of "billions of Euros" to be due.[2] The initiator of the volume offensive finally took the case to the FCO as a chief witness and received a reduction of fines under the federal leniency program.

The cement case is often used as a positive example for the effectiveness of the German leniency program, only enacted in the year 2000. Seemingly, it had eased and speeded up investigations and, thus enforced antitrust law as a primary justification of any leniency program. The European Commission already set up a leniency program according to the American standard in 1996. Leniency regulations are generally intended to create an incentive for undertakings involved in cartels to leave the cartel and cooperate with the Commission.[3] To make the leniency programs even more effective several jurisdictions revised their programs in the last couple of years. Since its introduction the European Commission redesigned its leniency policy twice (2002 and 2006)[4] in order to increase the attractiveness of the leniency policy for companies. Germany revised the so called *bonus regulation* in 2006 which shall—analogous to the EU policy—increase the attractiveness of this regulation.[5]

Recent papers discussed the optimality of leniency programs in Antitrust Law, usually using a game theoretical framework.[6] The main results are: (i) leniency programs may help in enforcing the law as they increase the probability to cheat on the partner; (ii) the design of such regulations is important, as it influences the classical trade-off between long-term reward (staying in the cartel and benefit),

[1] It is doubtful whether the agreement was effective because of imports, price-offensive medium-size enterprises and unregistered quantities that were dumped into the market; c.f. Blum (2007). A publicly available description of the leniency aspect was forwarded by Lutzhöft (2006).

[2] FCO, press release from 9 August 2002.

[3] Commission notice on the non-imposition or reduction of fines in cartel cases, OJ 1996, C 207/4 from 18 July 1996.

[4] Commission notice on immunity from fines and reduction of fines in cartel cases, OJ 2002, C 45/3 from 19 February 2002. Commission notice on immunity from fines and reduction of fines in cartel cases, OJ 2006, C 298/11 from 8 December 2006.

[5] Notice by the German Federal Cartel Office No. 09/2006 on waiving and reducing fines in antitrust matters—bonus rule.

[6] C.f. Motta and Polo (2003), Spagnolo (2000b, 2004, 2006), Buccirossi and Spagnolo (2001), Ellis and Wilson (2003), Aubert et al. (2003), Brisset and Thomas (2004).

and short-term reward (defect from the cartel and increase short term revenues and potentially the market share); (iii) moderate leniency programs may even stabilize cartels or provide incentives to form cartels as a credible threat against defectors.

However, one important factor missing in these analyses is the ability of the antitrust authority to make a rather voluntaristic use of leniency programs, i.e. set rebates to those that report. Furthermore, the number of firms included in a cartel is not necessarily clear: an inner circle of "hard core partners" may be complemented by firms that play tit for tat and/or free riders that benefit from high prices. As we know from the seminal work of Selten (1973), the allocation structure may be entirely different depending of whether "many" or only "few" players engage in non-competitive behavior. Finally, under conditions of rationality, the risk of being detected implies that games may not being sub-game perfect. As Kühn (2001) observes, the difference between a legal cartel and an economic cartel may be vast. There are cases where the legal proof of a cartel does not imply that supernormal profits were generated. And under different conditions, specific market behavior may generate increased profits in the absence of any cooperation among players. Under both conditions, the rewards from squealing or cheating are very limited.

Thus, we take a fresh view on the issue and use the cement case as an example. Contrary to conventional thinking, we argue that the intended and strategic use of the leniency privilege by this producer is detrimental to long-term competition as it tightens markets, increases individual market power, and leads to a monopolization as final market outcome. In this paper we show that the incentive structure of the leniency program either leads to a stable cartel or to a break up because of defection and squealing. We furthermore introduce the possibility of a player to first cheat and then squeal to obtain the maximum reward by first expanding the market and then collecting a rebate. The "carrot-and-stick" problem of the antitrust authority, especially the importance of properly identifying first movers and discriminating between leaders and followers in the leniency program, is—in our view—the most important element in cartel detection and more important than first-come-first-take rebates. We extend our argument by including two aspects that have drawn recent attention:[7] (i) leniency programs, by their success, may jam the antitrust authorities which then will arbitrarily fail to take up certain cases. As a consequence, whistle blowers will not receive the bonus but suffer from losses from the end of the cartel. (ii) If consecutive private claims are possible, this can entirely offset any bonus and make the system unattractive.

The remainder of the paper is organized as follows. In the next paragraph we will outline the legal regulations of the leniency policy before we inquire in the rationale of leniency programs in chapter three. In chapter four we develop a simple model of antitrust regulation followed by the examination of deficiencies of such regulations. Finally, the paper closes with economic recommendations for the legislator.

[7] C.f. FAZ (2006)

2 Background

2.1 The European leniency policy

Leniency is "nothing new under the sky". Julius Caesar had already used such an arrangement (divide et impera, see Spagnolo 2006). Thereby a lenient treatment has been commonly used for the exchange of information as a standard tool. In fact, leniency was used in the past in criminal law as a secret arrangement. However, there has been no regulation and no generality as it has been decided case by case.

What is new with the leniency policies used in antitrust "is their being ex-ante, general and public" (Spagnolo 2006, p. 7). In order to enforce the implementation of antitrust law competition authorities in various countries focus on the application of leniency programs. In 1978, the United States were the first country to introduce a leniency program in Antitrust Law that allowed for the possibility of a reduction of fines if specific conditions were fulfilled. But only very few firms applied for leniency under this program as it was not very transparent and generated a lot of uncertainties on the likely outcome of a leniency application. Thus, in 1993 the policy was revised and significant modifications were introduced. Today, the US Corporate Leniency Policy[8] is considered to be the most effective means against cartels since the enactment of the Sherman Act in 1890.[9]

In 1996, the European Commission followed the example of the US and adopted its first leniency program that was intended to create an incentive for undertakings involved in cartels to leave the cartel and cooperate with the Commission by providing generous fine reductions up to immunity.[10] One of the main differences between the US and the EU leniency system is that, in the US, only one company receives either immunity or a reduction (strict leniency). In Europe, several companies can receive reductions (moderate leniency). However, as it already had happened to the first US regulation, the European leniency notice failed to meet the high expectations. The major deficiency of the 1996 notice seemed to be legal uncertainty for companies as it was difficult to assess for firms whether they would receive leniency. Only after the termination of the administrative procedure, i.e. when the Commission adopted its decision, the Commission decided whether or not to grant a waiver or reduction of the fine.[11] In the period from 1996 to 2002 the Commission has taken formal decision in 16 cases where companies cooperated with the Commission.[12] However, most of the leniency applications were made

[8] The US Corporate Leniency Policy was adopted on 10 August 2003, available at: www.usdoj.gov/atr/public/guidelines/lencorp.htm.

[9] See Riley (2005, p. 377).

[10] Commission notice on the non-imposition or reduction of fines in cartel cases, OJ 1996, C 207/4 from 18 July 1996.

[11] See Commission notice on the non-imposition or reduction of fines in cartel cases, OJ 1996, C 207/4 from 18 July 1996, para E.2.

[12] See Questions and Answer on the Leniency Policy, Press Release of the European Commission MEMO/02/23 from 13 February 2002, p. 1.

following Commission inspections or the cartel was already under investigation in the U.S.[13] Hence, instead of full immunity only a reduction of fines could be granted.[14] Consequently, in 2002, the Commission redesigned its leniency policy[15] in order to "make the policy even more effective and attractive for companies to come forward".[16]

The revised leniency notice specified the requirements in order to receive immunity or a reduction in fines. A complete waiver of fines will be granted if the undertaking is the first to submit evidence which enables the Commission to carry out an investigation or if the undertaking is the first that enables the Commission to find an infringement.[17] Thus, immunity is not only possible before an investigation is opened but also afterwards if no other undertakings have come forward so far. Additionally, leniency was now also open to ringleaders provided that they did not coerce other firms to join the cartel. Furthermore, the procedural modalities were improved as leniency applicants were informed speedily on their situation. If they qualified, conditional immunity was granted or respectively they were informed on the expected level of reduction. By means of these modifications the 2002 leniency policy has increased the effectiveness of the prosecution of hardcore cartels as it has increased transparency, legal certainty and the amount of fine reductions for applicants. In the first year of the 2002 notice the Commission received more than 20 applications for leniency.[18] After 3 years more than 140 applications were made, thereof 75 for immunity. Hence, the latter were filed before the Commission has started an investigation. So far more than 38 conditional immunity decisions were released.[19]

However, there were still concerns about the effectiveness, particularly with regard to submissions of companies which could be used in civil law suits that might follow a litigation. Thus, the leniency notice was revised for a third time in 2006.[20] As the Commissioner in charge for Competition, Neelie Kroes, stated "these changes will further strengthen the effectiveness of the Commission's leniency program in the detection of cartels". The main modifications in the 2006 leniency notice are the introduction of a so called marker system for immunity applicants.

[13] C.f. Van Barlingen (2003, p. 16), Stephan (2005).

[14] Only three companies benefited from full immunity until the announcement of the new notice in February 2002, Aventis with regard to two of three Vitamins Cases, (see IP/01/1625, from 21 November 2001); Brasserie de Luxembourg in the Luxembourg Brewer Case (see IP/01/1740, from 5 December 2001); and Sappi in the Carbonless Paper Case (see IP/01/1892, from 20 December 2001). After the release of the new leniency notice in 2002 full immunity under the old notice was granted in more cases.

[15] Commission notice on immunity from fines and reduction of fines in cartel cases, OJ 2002, C 45/3 from 19 February 2002.

[16] See Questions and Answer on the Leniency Policy, Press Release of the European Commission MEMO/02/23 from 13 February 2002, p. 2.

[17] Commission notice on immunity from fines and reduction of fines in cartel cases, OJ 2002, C 45/3 from 19 February 2002, para A8.

[18] C.f. Van Barlingen (2003, p. 16) and Riley (2005, p. 378).

[19] C.f. Spagnolo (2006, p. 13).

[20] Commission notice on immunity from fines and reduction of fines in cartel cases, OJ 2006, C 298/17 from 8 December 2006.

Furthermore, it introduces a procedure to protect statements made by companies under the leniency notice from being made available to claimants in civil damage proceedings. The 2002 notice still stated that "the granting of a waiver or a reduction of the fine does not affect the consequences a company has to face under civil law if these consequences result from an action based on its participation in a violation of antitrust law". Enterprises presenting evidence of a cartel worried that their submissions might become discoverable in civil law suits which would discourage cartel members to apply for leniency.[21] In particular if one takes into account that the amount of compensation can be higher than the actual fine which would be a further signal to the industry not to reveal information.[22] However, practitioners expressed their concerns that—even if company statements are protected—already the final decision of the Commission can be used in a civil law suit. Leniency programs are nowadays an important tool for the competition authorities to enforce their competition laws. However, also civil law suits serve the aim to enforce the competition rules.

Another concern Commissioner Kroes announced is that a too successful leniency program might lead to a serious workload problem that the modernization package of European Antitrust Law[23] just intended to abolish. But this problem might be solved by applying the concept of settlements, which includes plea-bargaining, which would shorten proceedings and thus free resources that can deal with new cases. The Commission has therefore just published a draft notice in October 2007 containing the procedure of settlements, preconditions and advantages.[24]

Finally, given the existence of multiple leniency programs in Europe,[25] one application does not guarantee the granting of immunity in all European countries because an application to one competition authority does not constitute a valid application in another jurisdiction. Hence, there is no "one-stop-shop". Not only that an enterprise seeking full immunity has to be the first in every member state, in addition, the leniency policies are not identical. A legal solution therefore is not yet in sight. At least the Community has ensured that any leniency information cannot be used for criminal prosecution by courts in member states.[26]

[21] See Baer et al. (2006, p. 61).

[22] This is currently the case in the civil law suit regarding the cement cartel. Cemex was condemned to pay a fine of 24 Mio € which was reduced to 12 Mio € according to the bonus regulation. However, Cemex is now sued for damages totaling 115 Mio €.

[23] For a detailed survey and evaluation from an economic perspective, see Barros (2003). Kaplow and Shavell (1994) argue that leniency programs always reduce the workload and are not "exploited".

[24] Draft Commission Notice on the conduct of settlement proceedings in view of the adoption of Decisions pursuant to Article 7 and Article 23 of Council Regulation (EC) No1/2003 in cartel cases, OJ 2007, C 255/51 from 27 October 2007.

[25] Belgium, Cyprus, Czech Republic, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, The Netherlands, Slovakia, Sweden and the United Kingdom.

[26] The German legal norm "*ne bis in idem*" may not be applicable if the same offense is prosecuted under different national law codes or under European law. According to the FCO, this is not the problem of the cement cartel which clearly was limited to regions in Germany, but potentially a problem for the newly disclosed airline freight cartel.

2.2 The German leniency policy

The German FCO enacted its leniency policy—the so called *bonus regulation*—in the year 2000. It underwent a revision in 2006. The new bonus regulation aims at increasing the incentives for participants in cartels to leave the cartels and to cooperate with the FCO in uncovering the situation.[27] According to this, the first applicant cooperating with the FCO will receive a complete waiver of the fine when this places the FCO in the position to obtain a search warrant; subsequent parties cooperating with the FCO may obtain a limited reduction of their fines. Furthermore, the new regulation establishes a so-called "marker system" allowing any person willing to cooperate with the FCO and having a minimum amount of information to set a "marker" guaranteeing a first priority. The marker system is intended to simplify the procedures to leave in an early phase from the viewpoint of the participants in a cartel, correspondingly to the change in the European leniency program.

The complete waiver of the fine can also be obtained after or during an investigation if no other participant in the cartel has used the bonus regulation by that time. Each participant losing the race for the first place can reduce its fine by up to 50% as second or third applicant if he provides information and evidence to the FCO which contributes in a material degree to proving the case. Within the scope of the reduction of the fine which is granted, the FCO will normally order neither the dissipation nor the surrender of the economic advantage. As the bonus regulation only refers to the administrative laws any criminal charges of the cartel offenders remain untouched.

Contrary to the new European leniency policy, the bonus regulation clarifies that the consequences under civil law relating to the participation in a cartel are not affected by the leniency regulation. Accordingly, claims by persons and companies from the opposing side of the market can be asserted against the participants in the cartel.[28] Any economic advantages resulting from a violation of antitrust law can also be dissipated by associations in the form of legal entities with the purpose of promoting commercial or independent professional interests if the participant in the cartel has realized an economic advantage at the expense of a large number of customers or suppliers.[29]

2.3 Economic theory of leniency policies

The economic theory of leniency programs is directly linked to the literature on optimal law enforcement. The rationality of crime and punishment or the ability to

[27] Notice by the German Federal Cartel Office No. 09/2006 on waiving and reducing fines in antitrust matters—bonus regulation.

[28] 33 para 3 GWB (Gesetz gegen Wettbewerbsbeschränkungen, Federal Antitrust Code).

[29] 34 a GWB.

evade it has an important root in economic thinking. The first literature on law enforcement dates from the eighteenth century. Montesquieu (1748), Cesare Beccaria (1767) and Jeremy Bentham (1789) were the first analyzing crime deterrence. 200 years later, Becker (1968) in his seminal work, took up the issue again. Following his reasoning, the probability of being caught and the severity of punishment, i.e. the expected value, are the appropriate measure of crime deterrence. Therefore, the fine should be maximal since it is a costless transfer whereas the probability of detection and conviction is costly.

Kaplow and Shavell (1994) analyzed the impact of leniency in general on law enforcement costs. Using a static model they found that self-reporting has two major advantages: first, no effort needs to be spent on those delinquents who self-report their unlawful conduct, which in turn reduces enforcement costs; second: when individuals are risk-averse, risk bearing costs are eliminated.[30] Malik (1993) was the first to study the design of law enforcement taking into account avoidance activities. He found that optimal sanctions need not be set to maximum levels as proposed by Becker (1968). Innes (1999, 2000) studied self-reporting in environmental crimes. A central insight from this work was that self-reporting results in an early remediation of damages from such crime. However, all studies included in his analysis focused on a single violator and an isolated crime.

In recent years a variety of papers discussed the optimality of self-reporting regimes by focusing on Antitrust Law. Therefore, these studies analyzed strategic behavior of a group of violators, usually by using a game theoretical framework.[31] The main results are: (i) leniency programs may help in enforcing the law as they increase the probability to cheat and squeal on the partner; (ii) the design of such regulations is important as it influences the trade-off between long-term reward (staying in the cartel and benefit) and short-term reward (defect from the cartel and increase short term revenues and potentially market shares); (iii) moderate leniency programs may even stabilize cartels or provide incentives to engage in cartels as a credible threat against defectors.

1. Motta and Polo (2003) analyze the effects of leniency programs on cartels by focusing on rebates offered to firms already under investigation. The main result of their model is that an optimal leniency program should provide full immunity to all firms that collaborate with the Commission. They also underlined that a leniency program may encourage pro-collusive effects as it prevents defection from the cartels agreement. Thus a leniency program is only second best and should only be introduced if an Antitrust Authority is short of resources.
2. Buccirossi and Spagnolo (2001, 2006) study whether the threat to defect from illegal transactions and to report the illegal behavior to an Authority will stabilize such arrangements which would not be enforceable without such a

[30] For an overview on the economic literature on law enforcement see Polinsky and Shavell (2000) and Garoupa (1997).

[31] The Prisoner's dilemma is probably the best known model of leniency in return for an information exchange. On the literature see e.g.: Motta and Polo (2003), Spagnolo (2000b, 2004, 2006), Buccirossi and Spagnolo (2001), Ellis and Wilson (2003), Aubert et al. (2003), Brisset and Thomas (2004).

threat. Their model shows that 'moderate' leniency programs (without rewards) have the negative side effect of facilitating occasional, and even some repeated transactions. This counterproductive side effect can be destroyed by awarding rewards to the first party that reports the cartel.

3. Spagnolo (2000a) finds that this side effect applies also to bidding rings in multi-unit auction markets. Furthermore, this effect is reinforced by current regulation as procurement auctions have to be repeated if it turns out that bids were rigged. This rule guarantees that it is not profitable for a firm to undercut the agreement and then blow the whistle as the auction must be repeated and all profits from defecting disappear. Another paper studying the effect of leniency programs in an auction design is by Brisset and Thomas (2004). They find that current leniency programs support the formation of cartels ex-ante. However, it is possible to prevent cartel formation by rewarding firms that report hard evidence before an investigation is open as it prevents cartel members from internal coordination.
4. The option to reward whistle blowers is studied in more detail by Spagnolo (2000b, 2004). He questions whether current leniency policies are successful in deterring cartelizing or encouraging firms to self-report their illegal behavior. Based on a dynamic, multi-agent model, he finds that leniency programs are always preferable but best solutions are obtained only if the first applicant receives a high "fines-financed" reward. Cartel agreements would then become unsustainable. However, as political and institutional constraints prevent rewards to be offered, at least the usual leniency policy should be implemented as cartel agreements are harder to sustain. In contrast to Motta and Polo (2003) he finds that only the first company that reports, should receive the privileged treatment. In addition, leniency policies that reward whistleblowers influence the deterrence level (Buccirossi and Spagnolo 2005). The minimum fine which has a deterrent effect seems to fall to extremely low levels. Problems of limited ability to pay should be abolished. Furthermore, Buccirossi and Spagnolo argue that imprisonment may not be necessary to obtain a sufficient level of deterrence.
5. Aubert et al. (2003) consider the costs and benefits of creating an agency situation between firms and their employees by allowing employees to cash rewards for reporting unlawful conduct of their own firm. They suggest that a well designed policy that rewards the first agent would increase cartel deterrence and simultaneously reduce the costs of law enforcement.
6. Ellis and Wilson (2003) assume that a firm in a cartel has three options: comply with cartel rules, squeal the cartel to the antitrust office and defect, which may be detected by other cartelists with a certain probability but which also may remain undetected. They show that a leniency program may induce firms to report information only to damage competitors, i.e. "to raise (future) rivals' costs" through fines, thus obtaining a strategic advantage. Placing their model in a Bertrand competition regime they predict two opposite effects. On the one hand leniency programs will destabilize cartels in markets with less concentration. Firms that report will earn "supernormal profits which can exceed those

from participating in the cartel".[32] But in tight markets with increased concentration leniency programs tend to strengthen cartels as they do not induce firms to self-report to the competition authority. Thus, the switching between an efficient leniency program and an auto-stabilization of the cartel rests on the number of cartelists involved.

Whether leniency programs lack of incentive-compatibility and thus might be misused by competitors in order to get rid of competitors will be discussed in the following paragraph.

3 Challenges to the rationale of leniency programs

According to the theory of rational choice individuals behave as rational utility maximizers. Although reality shows us that not every individual behaves rational, i.e. does not choose the action that satisfies his preferences best,[33] in our model rational choice remains a reasonable description of individual choice.

According to Spagnolo (2004) the implementation of any leniency program generates a rationality problem. If such a program exists and if it is a-priori clear that it will be used, no cartel will ever be formed, i.e. the program would never be applied. In a game-theoretical context, it would not be sub-game perfect. However, under conditions of a legal exemption system, the legal evaluation of cooperations among firms might be very open and, in any case, will be carried through well after the cooperation under investigation was started. Furthermore, doubt can be cast on the assumption of cartelists' rationality, i.e. that punishment deters offenses, as the rationality theory supposes.[34]

Two experimental studies analyzing the design and use of leniency policies show that rational behavior is often found but has also its limits. Apesteguia et al. (2003) find that leniency programs provide a deterrent effect as it implies the lowest number of cartels formed. In addition they show that the highest affinity to collude exists under a bonus scheme. Individuals follow the strategy of colluding and reporting in order to obtain a cartel profit and the leniency reward. However, in reality there does not exist such a reward scheme yet. Hamaguchi and Kawagoe (2005) also compared several institutional designs of leniency programs. Their experimental results show that the large size cartel is more easily dissolved than the small size cartel and that the schedule of leniency (all reporters can get leniency or only the first reporter can) does not affect the likelihood of cartel formation.

[32] Ellis and Wilson (2003, p. 3).

[33] By using more realistic psychological foundations, behavioral economics tries to better understand economic decisions as economic agents do not always behave consistently with rational choice theory. Therefore, behavioral economics integrate psychological aspects into the neo-classical models. However, in our setting rational choice is a reasonable description of individuals behavior.

[34] There exists a huge literature on the issue that shows that punishment to a certain extent may deter crime—but that many other factors are important and may override this primary effect; see for instance Becker (1968), Chiricos and Waldo (1970), Cornish and Clarke (1987), Punch (1996), Gobert and Punch (2003).

As the European *Hydrogen-Peroxide* case shows, rationality emerges after the first whistle blow has occurred in order to secure a maximum rebate.[35] Furthermore, rationality may be influenced by the probability that, after the initial whistle blow, the case is taken up by the antitrust office and that consecutive civil liability claims are launched.

Thus, in many circumstances rational choice remains a reasonable characterization of individual choice because many—though not all—cognitive biases are muted as people learn by experience, work within organizations, or obtain advice from experts.

3.1 The case

In 2003, the FCO fined six large suppliers of cement in Germany 661 million Euro. One of the participants of the alleged cartel was fined far less due to its role as a chief witness. The leniency privilege, which may reduce the fine to zero under certain conditions as laid down in the bonus regulations of 17. April 2000 and which was introduced as an incentive for insiders to blow cartels, was applied in this case.

Let us start by looking into the evidence: according to federal statistics we find that from spring 2002 onwards cement prices started to take a dive (Fig. 1). As we know, this development started in the East German market, followed, with little delay, by the West German market and half a year later by the South German market. This was the result of a multi-market competition initiated by one large supplier with a large cement factory (including a clinker kiln and a mill) in East Germany and a nationwide concrete business. Management tried to improve the better use of facilities and either distribute more cement among its down-stream clients or obtain rebates for its downstream business in areas where it had to purchase cement from competitors. As these competitors were not willing to comply, it started to ship cement into distant areas to fuel its concrete business. This put prices under stress and, as a consequence, led competitors to dump cement at large quantities in to the local market of the defector. This price-war made a quota-cartel, which was agreed in the East German market and had, according to allegations by the FCO, allegedly existed in the three other regional markets,[36] obsolete. In autumn 2001, there were rumors that the FCO had started pre-investigations. In spring 2002, the FCO searched all major producers of cement in Germany, confiscated files and announced to the press a fine of "billions of Euros" to be due.[37] Coincidently, the initiator of the volume offensive finally took the case to the FCO as a chief witness.

[35] See Press Release: "Commission fines seven companies €388.128 million for bleaching chemicals cartels" (IP/06/560); Following the European leniency program, the first leniency applicant may obtain a rebate of up to 100%, the second 50%, the third 30% and the fourth 10%. This degression led to a rats' race for confession in order to secure maximum rebates.

[36] It is doubtful whether the agreement was effective because of imports, price-offensive medium-size enterprises and unregistered quantities that were dumped into the market; see Blum (2007).

[37] FCO, press release August 9th, 2002.

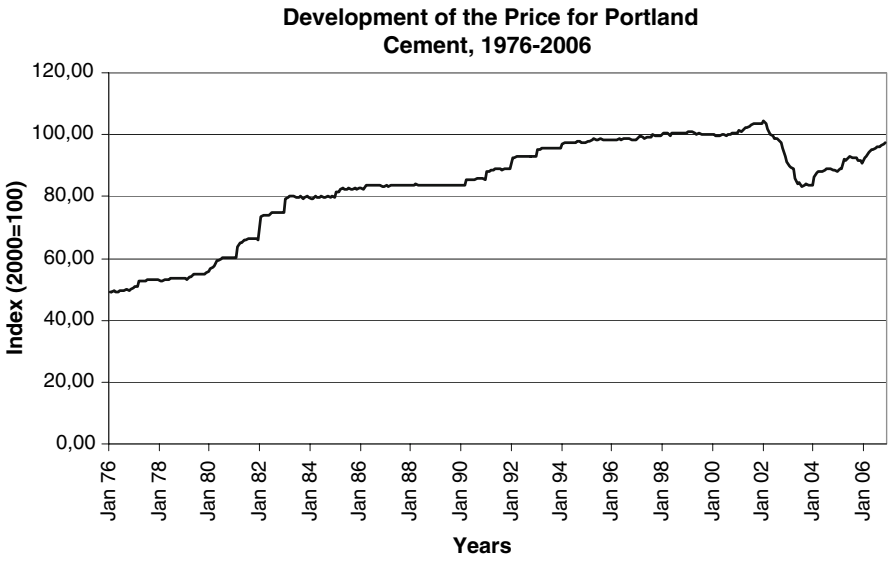


Fig. 1 Development of the price for Portland cement, 1976–2006

3.2 Leniency and the optimal strategy of whistle blowing

Based on strategic logic, we challenge the view that the decision to become the first leniency applicant in the cement case was the consequence of a price war which led to the squealing of the cartel. Our reasons for this argument are as follows: we argue that the initiator knew that expanding its sales in a depressed market would ultimately lead to a price war and the collapse of any explicit or implicit agreement; thus, in order to reduce his own burden, the preparing of a leniency statement and the taking of the case to the FCO can be seen as a preemptive strike against the competitors. This implies that the alternative to maintaining a cartel, i.e. playing an assurance game, may not solely be the prisoners' dilemma, i.e. the Bertrand case. It is also possible that a cartel is maintained if one party cheats as the punishment of this player would be too costly.

Let us give an example in a cartel of two suppliers in Table 1: if both comply, their reward will be 5 units each; if they engage in a price war and cheat, their profit will be 0. In case of a one-sided defection, the reward will be 8 to the defector and 2 to the party that adheres to the cartel understanding. In case of the cement cartel, the player that finally squealed in 2001/2002 had already cheated for the first time at the end of the 1990s by dumping additional quantities[38] into the market—and no price-war action was taken by the disadvantaged players, but compensation was internally organized.

All this clearly lies within the structure of a chicken game: the first mover wins and produces a Pareto-efficient solution from which deviation is impossible. Under

[38] These amounted to some 8% of the total market and were to be known as "bullshit" quantities among the players.

Table 1 The cartel game

		Player 2	
		comply	defect
Player 1	comply	5 / 5	2 / 8
	defect	8 / 2	0 / 0

these circumstances the leniency privilege turns into an intensifier of an unfriendly competition strategy which uses the antitrust office to drive competitors to the ground: parallel to defection, the cheater squeals to the antitrust office and collects the chief witness rebate. The rest of the cartel, however, has to pay the full fines out of depressed profits. This implies that the information provided by the first defector to the cartel office is sufficiently "hard" and credible to guarantee prosecution and conviction. Furthermore, we assume that he will also be secured from secondary prosecutions, i.e. civil liabilities. Thus, the defector incurs no risk.

In the cement industry, which is an industry with a high share of sunk costs in which market exit is extremely costly, the vital blow against the competitor(s) must contain a considerable financial leverage. If a firm plans to increase its production to better use idle facilities and knows that this will result in a price war, its initial advantage lies in a volume expansion. However, if the FCO can be instrumentalized as we argue for the German case, a strategic advantage can be gained. In our view, a rational defector should expand production, expand markets, open his files to the antitrust agency, and then collect the bonus. This action will reduce or even eliminate his fines, heavily disadvantage competitors in terms of penalties and losses of market shares. He finally will end up in dominating the market.

Strategic cheating and consecutive squealing may even be logical under more friendly circumstances, for instance when forming an alliance in order to coordinate the purchases of goods, which was allowed by German cartel law to counter the market power of large companies.[39] By organizing such an agreement and later blowing it under the pretext of an implicit cartel, the initiator may improve his market position. Repeated games, which produce a trustworthy and reputable stability, will not occur in reality as the time span is simply too short. The new legal exemption provision by the cartel law may even aggravate the situation. Hostage taking might be an answer to enforce trust in the short and medium run. In the standard trust game (Dasgupta 1988) of a non-cooperative exchange, the first mover decides whether to grant or withhold trust (i.e. observe the quota)—in the latter case, the game ends. Otherwise, the second player chooses whether to honor the first mover (i.e. also observe the quota) or to abuse trust (i.e. cheat and even go to the cartel office). Pre-commitment (Lapan and Sandler 1988) may be decisive, for

[39] Following the concept of countervailing power, small and medium-size enterprises may form alliances, for instance in retail business, to be able to buy from producers under comparable conditions as large retail chains.

Table 2 General structure of the cartel game

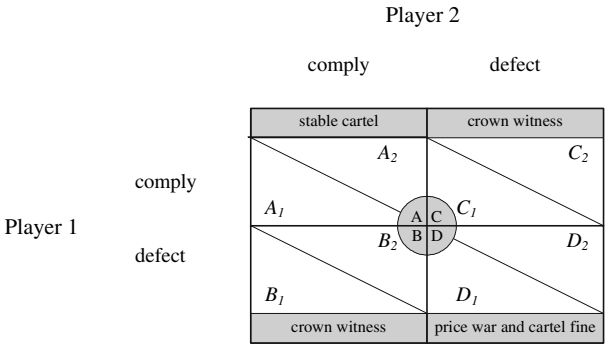


Table 3 Typology of games and payoffs

Type of game	Line player (Player 1)	Column player (Player 2)
Prisoners' dilemma	$B_1 > A_1 > D_1 > C_1$	$C_2 > A_2 > D_2 > B_2$
Chicken game	$B_1 > A_1 > C_1 > D_1$	$C_2 > A_2 > B_2 > D_2$
Assurance game	$A_1 > D_1 > C_1$ and $A_1 > B_1$	$A_2 > D_2 > B_2$ and $A_2 > C_2$

instance in the form of hostages (Mlicki 1996). The fundamental problem that a commitment to enforce illegal behavior is illegal by itself limits this approach.[40]

On and above, planned cheating will be detrimental to any common-sense thinking. The firm that plans to erase competitors will set up a perfect documentation of its wrongdoings in order to later obtain absolution.

3.3 Modeling cartel games and leniency programs

Let us generalize the structure of the cartel game according to Table 2. As we clearly see, three types of games can be numerically distinguished, which is displayed in Table 3: the prisoners' dilemma, the chicken game, and the assurance game. It is in the interest of the FCO to generate the conviction among all parties that any party can defect; thus, the leniency privilege must be accessible to all players. It is the interest of all cartelists to play the

[40] Cartels in Germany were legal until the end of WW-II: When commercial freedoms were introduced in Prussia in 1869, the necessity to regulate competition arose. In a famous decision, the Imperial Court ruled in 1897 that the right of companies to make agreements which limited competition was part of contract law and thus legal. Only in 1923 a law was passed to supervise and potentially break up cartels. Cartels thus formed that were enforced by bills of exchange that were signed but on which the amount due was left open. In case of cheating, the cartel coordination office would present the bill of exchange worth the estimated cartel cheating damage to a bank, thus making bank law the enforcer; for more detail see Blum (2004, pp. 563–564).

assurance game. It is the interest of the individual cartelist to play the chicken game.

Let us depart from a market-performance model proposed by Blum (1997) by adding the cartel dimension: the market reward is m_i and the cartel surplus (net effort to sustain the cartel) is c_i. The fine for a proven cartel is f_i and the leniency reduction is w_i. The first mover will have an additional advantage of a_i, this can be based, among others, on an improved cost structure or the expectation of finally conquering an increased market share. If the leniency privilege is granted to several parties confessing subsequently, the cartel office might offer z_i instead of w_i to the follow-up witness ($0 \leq z_i < w_i$); here, z_i applies to the second confessor. Note that z_i is non-negative because it reduces the fine f_{i} that is subtracted. The general payoff thus becomes:

$$P = m + c + a - f + w,\ a,\ c,\ \ f,\ m,\ w > 0;\ a > c,\ w < f;\ f \leq m + c. \tag{1a}$$

$$P = m + c + a - f + z,\ w > z > 0. \tag{1b}$$

We assume that all values equally apply to all parties included; thus, the subscripts can be neglected. We further assume the fine to be limited to the sum of market and cartel revenue;[41] this condition, however, is not essential for the outcomes. We further assume that the reward from moving first dominates the cartel profit, for instance because it permanently increases market shares. Finally, the nature of the coordination game is fully described by the model and independent of the process of gathering evidence.

Note that the cartel office may have problems to properly identify a first mover; then $w > z$ is not guaranteed. Under extremely adverse conditions, a chief witness may be subject to extra fines by outside claims which cannot be levied from other cartelists if their involvement is not proven as they were free riders under advantageous market conditions. In the cement case, this could, for instance, apply to some of the "Mittelstand" companies and eventually even to some of the large suppliers in certain well-delimited markets. Thus, $z < 0$ and $w < 0$ might be possible[42] through outside claims.

Let us go into the individual payoffs in Table 4:

- If both parties comply, monopolize the market and are not caught, the payoffs are

$$P^{MM} = m + c. \tag{2}$$

- If one party defects and the other complies, the payoffs are

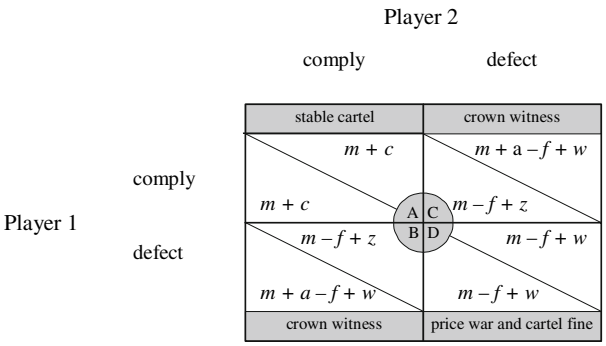
$$P^{D} = m + a - f + w, \text{ and} \tag{3}$$

$$P^{C} = m - f + z \text{ with } z = 0; \tag{4}$$

[41] In practical terms, it may be 100% of the fine and up to 10% of turnover.

[42] If all were fined symmetrically, this would become part of the general cartel fine, f.

Table 4 Structure of the leniency game



with $0 < z < w$ a second chief witness is defined. This situation of an imperfect chicken confrontation will be looked at later.

- If both simultaneously defect, the payoffs are

$$P^{DD} = m - f + w. \tag{5}$$

Note that in most cases the leniency privilege or bonus rule does not over-compensate the fine and that the fine should never amount to more than total payoff; thus, no true reward in the sense of Spagnolo (2004) is given.

3.4 Incentives and dilemmas of the leniency game

The following games will now be analyzed (for the row player):

1. Prisoners dilemma game (player 1: $B_1 > A_1 > D_1 > C_1$); this game is favored by the cartel office as it would most likely not have adverse effects on market structure.
2. Chicken game: (player 1: $B_1 > A_1 > C_1 > D_1$); if the cartel comes under stress, this is the option favored by the cartelist; the only question is, which party breaks first.
3. Assurance game: (player 1: $A_1 > D_1 > C_1$ and $A_1 > B_1$); this is favored by the cartelists as a sustainable solution.

As w, the leniency rebate, and f, the fine, are the carrot and the stick of the cartel office, they are used as principal coordinates.

Prisoners' dilemma (PD):

$$B_1 > A_1 \Leftrightarrow m + a - f + w > m + c \Leftrightarrow f < (a - c) + w.$$
$$A_1 > D_1 \Leftrightarrow m + c > m - f + w \Leftrightarrow f > w - c.$$
$$D_1 > C_1 \Leftrightarrow m - f + w > m - f + z \Leftrightarrow w > z.$$

Chicken game (CG):

$$B_1 > A_1 \Leftrightarrow m + a - f + w > m + c \Leftrightarrow f < (a - c) + w.$$
$$A_1 > D_1 \Leftrightarrow m + c > m - f + w \Leftrightarrow f > w - c.$$
$$D_1 < C_1 \Leftrightarrow m - f + w < m - f + z \Leftrightarrow w < z.$$

Assurance game (AG):

$$A_1 > D_1 \Leftrightarrow m + c > m - f + w \Leftrightarrow f > w - c.$$
$$D_1 > C_1 \Leftrightarrow m - f + w > m - f + z \Leftrightarrow w > z.$$
$$B_1 < A_1 \Leftrightarrow m + a - f + w < m + c \Leftrightarrow f > (a - c) + w.$$

The important discriminants thus become:

$$f = (a - c) + w, \tag{6}$$
$$f = w - c, \tag{7}$$
$$w = z. \tag{8}$$

Figure 2 portrays the situation. It is clear that combinations of low fines and leniency reductions (given $f > w$) lead to the prisoner-dilemma outcome. Especially low values for secondary leniency deductions, z, promote this outcome. If $z = 0$, the chicken-game solution disappears.

It is essential that the first mover, i.e. the party that defects and becomes chief witness, be properly identified. If not, i.e. $z > w$, then the chicken game comes into play. If one of the cartelists is unsure about whether he is moving fast enough to be properly rewarded as (first) chief witness, he will tend to move faster. His advantage, i.e. its incentive to do so, increases with the level of first mover advantage, a, and decreases with the amount of cartel profit, c.

As a limit case, once no first mover advantage exists, the chicken game and the prisoner's dilemma will disappear and the assurance game is a prominent outcome.

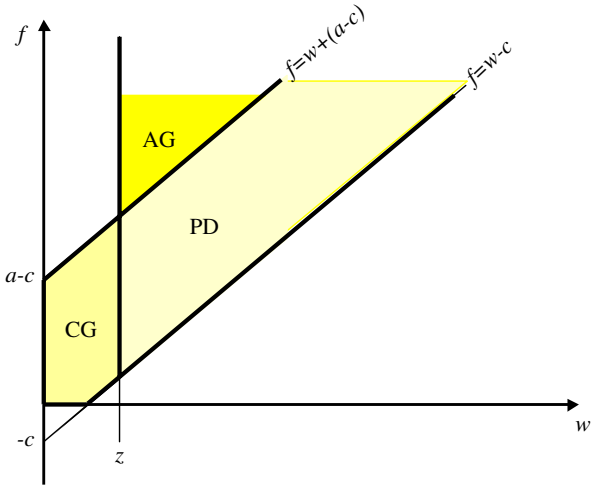


Fig. 2 Different regimes of the general leniency game

$$\begin{cases} w - c < f < (a - c) + w \\ a = 0 \end{cases} \Leftrightarrow w - c < f < w - c \tag{9}$$

Thus, the cartel office must have a very sound knowledge of fundamental changes in market structure and cartel profits under cases of price wars that are preceded by cartels blown by at least one participant in order to secure success and not promote the contrary. It is of special importance to properly discriminate between the first, the second and subsequent movers and give them their changes in the market that evolves. However, if all cartelists know that first movers cannot succeed as the rats' race to the cartel office is too fast, they must accept that no first mover advantage exists. Then it is rational to collude. We follow that it is in the cartel office's interest to keep secrecy around a chief witness confession.

We may extend the problem by assuming that confessions at the cartel office are not processed because of work overload. Let p be the probability of a confession being processed, $0 < p < 1$. This affects the first mover advantage, a, the leniency bonus of the first mover, w, and of subsequent movers, z, and the cartel fine, f. Formulae (6) to (8) thus become:

$$pf = (pa - c) + pw \Leftrightarrow f = (a - c/p) + w = (a - c*) + w, \tag{10}$$

$$pf = pw - c \Leftrightarrow f = w - c/p = w - c*, \tag{11}$$

$$pw = pz \Leftrightarrow w = z. \tag{12}$$

As c* > c, both functions (10) and (11) move downwards, thus increasing the assurance area of the game. This implies that a leniency program that floods the antitrust commission with self-reports of offenses becomes counterproductive as it stabilizes cartels.

How does this situation change if z and w become negative because chief witnesses are subjected to additional civil claims? This situation is given in Fig. 3.

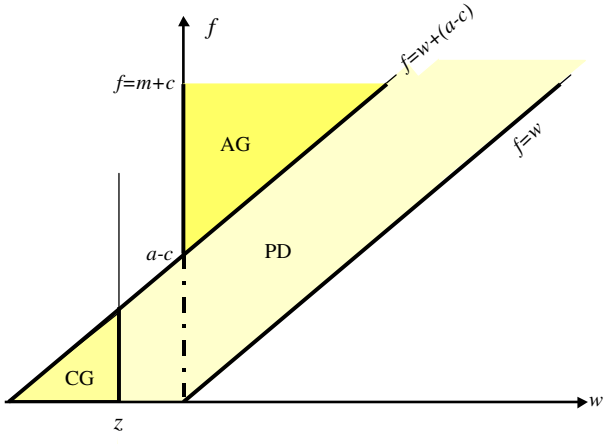


Fig. 3 The leniency game with civil damage claims

As we see, this reduces the chicken-game area and increases the prisoner's dilemma area. Risk-averse cartelists will thus be less inclined to become first movers.

4 What the FCO can do

The single most important factor for the stability of cartels, in the absence of any leniency program, is low expected gains for the first who blows the cartel. Conversely, high expected gains and a generous leniency bonus increase the instability of a cartel.

Cartel instability was analyzed under two dilemma conditions: the first mover situation of a chicken game or a mutual and simultaneous destruction of the cartel by all participants. The first case has the advantage that it is incentive-compatible for one single cartelist to break out of the cartel. However, he will only do so if he expects a favorable rearrangement of the market against which the cartel office does not intervene. More specifically, price wars which offer opportunities of future stable markets and increased market shares induce first movers to blow the cartel if agents are unsure of getting their proper leniency reward. Thus, the "right" to profit from a chief witness and the rationality of the respective level of the reduction of the cartel fine become crucial.

Offering to one party or a group of first confessors only the benefits of the leniency privilege (or reducing consecutive benefits drastically) induces, from the perspective of the FCO, the advantageous prisoner's dilemma outcome, i.e. it would most likely not have an adverse effect on the market structure.

Self-confessions are positive unless they flood the office, thus reducing its possibility to prosecute offenses—this would stabilize cartels.

If we analyze the cement-cartel situation under these circumstances, it becomes very clear that the value of the advantage factor, a, was very high for the first mover: he could drastically improve his cost structure because he had a technology based only on one clinker kiln. Furthermore, the way the FCO would use the leniency privilege was still open as it was the first time of this instrument being used at such a large scale. In addition, the possibility of civil damage claims remains until today and leaves unclear perspectives. Thus the company exercised a straightforward market penetration strategy by provoking a price war which ensured it an improved future market position. We conclude that, given the adverse market situation of these times, blowing the cartel was part of an incentive-compatible strategy. The decision was not to destroy the cartel and then suffer from a price war but to start a price war which would destroy the cartel anyhow. As a consequence the first mover benefited from the leniency program and, more importantly, from a strategic repositioning of the own firm under potentially adverse conditions with respect to cartel fines and civil damage claims. We finally note that this firm was sold two years later. As we know, market shares are important factors determining the sales price—more important than revenue that can change. Thus, the strategy may even be seen as some sort of sales promotion. From the point of view of the FCO this consequence might not be intended by the bonus regulations. Nevertheless if the

leniency policies lead to more competition in the market the results should be welcomed.

Acknowledgments The authors are indebted to Thomas Feltes, who provided valuable information on rational choice in criminology, and to Birger Nerré for his comments on an earlier draft of the paper. We also thank an anonymous referee for helpful comments.

References

Apesteguia, J., Dufwenberg, M., & Selten, R. (2003). Blowing the whistle. Research Papers in Economics 2003:5, Stockholm University, Department of Economics.

Aubert, C., Kovacic, W., & Rey, P. (2003). The impact of leniency programs on cartels. Manuscript, Institut d'Économie Industrielle (IDEI) Toulouse.

Baer, W. J., Frazer, T., Gyselen, L., & Liss, F. (2006). International leniency regimes: New developments and their strategic implications. *Global Competition Review*, 61–64.

Barros, P. P. (2003). Looking behind the curtains—effects from modernizing of European union competition law. *European Economic Review, 47*, 613–624.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy, 76*(2), 169–217.

Blum, U. (1997). Greed and grief in East Germany—the socialist system's crisis, collapse and transformation. *Beihefte zur Konjunkturpolitik (Applied Economics Quarterly), 45*, 11–33.

Blum, U. (2004). *Volkswirtschaftslehre*. München: Oldenbourg.

Blum, U. (2007). The East German cement cartel: Cartel efficiency and cartel policy after economic transformation. *Eastern European Economics, 45*(6), 5–28.

Brisset, K., & Thomas, L. (2004). Leniency program: A new tool in competition policy to deter cartel activity in procurement auctions. *European Journal of Law and Economics, 14*, 5–19.

Buccirossi, P., & Spagnolo, G. (2001). The effects of leniency on illegal transactions: How (not) to fight corruption. Working paper.

Buccirossi, P., & Spagnolo, G. (2005). Optimal fines in the era of whistleblowers. Should price fixers still go to prison?" *Lear Research Paper* 05-01.

Buccirossi, P., & Spagnolo, G. (2006). Leniency programs and illegal transactions. *Journal of Public Economics, 90*(6–7), 1281–1297.

Cornish, D. B., & Clarke, R. V. (1987). Understanding crime displacement—an application of rational choice theory. *Criminology, 25*, 993–947.

Chiricos, T. C., & Waldo, G. P. (1970). Punishment and crime: An examination of some empirical evidence. *Social Problems, 18*, 200–217.

Dasgupta, P. (1988). Trust as a Commodity. In D. Gambetta (Ed.), *Trust: Making and breaking corporate relations* (pp. 49–72). Oxford: Blackwell.

Ellis, C., & Wilson, W. (2003). Cartels, price-fixing, and corporate leniency policy: What doesn't kill us makes us stronger. Manuscript, University of Oregon.

FAZ—Frankfurter Allgemeine Zeitung. (2006). Mehr Rechtssicherheit für Kronzeugen. 5 December, p. 22.

Garoupa, N. (1997). The theory of optimal law enforcement. *Journal of Economic Surveys, 11*, 267–295.

Gobert, J., & Punch, M. (2003). *Rethinking corporate crime*. Butterworths: London.

Hamaguchi, Y., & Kawagoe, T. (2005). An experimental study of leniency programs. Discussion Papers Series 05-E-003, Research Institute of Economy, Trade and Industry (RIETI).

Innes, R. (1999). Remediation and self-reporting in optimal law enforcement. *Journal of Public Economics, 72*, 379–393.

Innes, R. (2000). Self-reporting in optimal law enforcement when violators have heterogeneous probabilities of apprehension. *Journal of Legal Studies, 29*, 287–300.

Kaplow, L., & Shavell, S. (1994). Optimal law enforcement with self-reporting of behavior. *Journal of Political Economy, 102*, 583–606.

Kühn, K.-U. (2001). Fighting collusion by regulating communication between firms. *Economic Policy: A European Forum, 32*, 167–204.

Lapan, H. E., & Sandler, T. (1988). To bargain or not to bargain: That is the question. In *American Economic Review, Proceedings of the 100th Annual Meeting* (Vol. 78, No. 2, pp. 16–21).
Lutzhöft, N. (2006). Und Petzen lohn sich doch. *Financial Times Deutschland*, 12 December, p. 28.
Malik, A. (1993). Self-reporting and the design of policies for regulating stochastic pollution. *Journal of Environmental Economics and Management, 24*, 241–257.
Mlicki, P. (1996) Hostage posting as a mechanism for co-operation in the prisoner's dilemma game. In W. B. G Liebrand & D. M. Messick (Eds.), *Frontiers in social dilemma research* (pp. 165–183). Berlin: Springer.
Motta, M., & Polo, M. (2003). Leniency programs and cartel prosecution. *International Journal of Industrial Organization, 21*, 347–379.
Polinsky, M., & Shavell, S. (2000). The economic theory of public enforcement of law. *Journal of Economic Literature, 38*, 45–76.
Punch, M. (1996). Dirty business: Exploring corporate misconduct; analysis and cases. *Sage Conduct*. Unbecoming: London.
Riley, A. (2005). Beyond leniency: Enhancing enforcement in EC antitrust law. *World Competition, 28*, 377–400.
Selten, R. (1973). A simple model of imperfect competition, where four are few and six are many. *International Journal of Game Theory* No. 2, pp. 141–201.
Spagnolo, G. (2000a). Self-defeating antitrust and procurement laws: How leniency programs solve Bertrand's paradox and enforce collusion in auctions. FEEM Working Paper 52.00, Milano.
Spagnolo, G. (2000b). Optimal leniency programs. *FEEM working paper*, Milano.
Spagnolo, G. (2004). Divide et impera—optimal deterrence mechanisms against cartels (and organized crime). *FEEM working paper*, Milano.
Spagnolo, G. (2006). Leniency and whistleblowers in antitrust. CEPR Working Paper No. 5794.
Stephan, A. (2005). An empirical assessment of the 1996 leniency notice. CCP Working Paper 05-10, Norwich.
Van Barlingen, B. (2003). The European commission's leniency notice after one year of operation. *Competition Policy Newsletter*, Summer, 16–21.