The effectiveness of Leniency Programs on Cartel Prosecution

An Economic Analysis of the European Case

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Abstract

In the last decades Antitrust Authorities have invested in the development of aggressive anti cartel programs in order to prevent and detect cartel cases. In this context were introduced leniency programs that have became a central tool on cartel prosecution. These programs are a legal revelation mechanism in which firms that report their participation in a cartel are granted with fine reductions, total immunity or even rewards. There are several dimensions over which leniency programs can be designed which have an important role determining its effectiveness. This thesis provides a survey on this topic and performs an economic analysis of the European Commission' leniency program. We conclude that the program is effective in the sense that is able to induce self-reports and therefore increase the number of cartels detected and the level of fines imposed. The program allows detecting long lasting cartels and decrease cartel size. However, there is some room for improvement. The number of repeated offenders is substantial and it's not found a significant reduction on investigation duration. The treatment of ringleaders and private damages actions are other issues that arouse discussion and are carefully addressed in this thesis.

Resumo

Nas últimas décadas as Autoridades da Concorrência têm investido no desenvolvimento de programas anti-carteis agressivos de modo a prevenir e a detectá-los. Neste contexto, foram introduzidos os programas de clemência que se tornaram uma ferramenta fulcral na luta contra os cartéis. Estes programas são um mecanismo de revelação legal no qual as empresas que denunciam a sua participação num cartel são recompensadas com reduções na coima, imunidade ou até mesmo compensações. São vários os aspectos sobre os quais os programas de clemência podem ser concebidos o que tem um papel importante na determinação da sua eficácia. Esta tese apresenta um resumo da literatura sobre este tema e realiza uma análise económica do programa de clemência da Comissão Europeia. Conclui-se que o programa é eficaz no sentido em que consegue gerar denuncias e assim aumentar o número de cartéis detectados e coimas aplicadas. O programa permite detectar cartéis de longa duração e diminuir a sua dimensão. Contudo, existe algum espaço para melhorias. O número de reincidentes é substancial e não foi encontrada uma redução significativa da duração das investigações. A abordagem aos líderes dos cartéis e às acções de indemnização privada são outras questões que suscitam discussão e são cuidadosamente tratadas nesta tese.

Acronyms

1997LN – Leniency Notice of 1996

2002LN – Leniency Notice of 2002

2006LN – Leniency Notice of 2006

AA – Antitrust Authorities

DOJ – The department of Justice

EC – European Commission

ECLP – European Commissions' Leniency Program

LP(s) – Leniency Program(s)

R&D – Research and development

TFEU - Treaty on the Functioning of the European Union

US – United States

USLP – United States' Leniency Program

Table of Contents

1. Introduction

A cartel consists in the joint coordination of firms' efforts with the aim of increasing profits through market manipulation, reducing or eliminating competition. The primordial collusive action under a cartel is the concerted increase in prices, if possible to the monopoly level. However, agreements may include many other collusive activities as setting of output levels, allocation of market shares, delineation of sales territories and customers, prevention of new firms' entry or avoiding the expansion of firms that do not belong to the cartel, sharing investments in capacity or in R&D. Nowadays AA consider most cartels an illegal activity, once the cartel's joint maximized profits are achieved at the expense of the consumer welfare. In the US cartels are considered a criminal activity.[1] That is not the case in Europe. In the EC Article 101 of the TFEU prohibits cartels, but states that some collusive agreements, e.g. related with R&D should not be considered illegal.[2]

A crucial objective of AA on competition law enforcement is the prevention and detection of cartel cases. To deter cartel formation AA pretend to weaken the profitability and stability of cartels by the threat of onerous and prompt expected sanctions, among other mechanisms. Indeed, trust among potential cartel members may be undermined increasing the probability that one of them could lose confidence and denounce the other potential partners. Relatively to the detection objective, AA seek to discover and destroy the cartels that were not deterred, by inducing them to voluntarily interrupt the illegal practice and report their involvement, or by direct fieldwork with dawn raids. Achieving these objectives is not straightforward since there are substantial assessment difficulties. Cartels have a covert nature which implies that they are resource intensive to detect, investigate and prosecute. In contrast, AA have finite resources whereby the time and effort dedicated to cartels could be spend combating other types of anti-competitive behaviour.

Cartels are, in a sense, like organized criminal activities as they take the form of ongoing relationships, which presupposes flows of present and future expected benefits and costs. Knowing that the cooperation between several agents can give rise to problems like free-riding, hold-up and moral hazard, for a cartel to be feasible it must be able to monitor cartel members' compliance with the agreed terms, setting penalty mechanisms in case of deviation. Therefore, firms need to credibly threaten react with price cuts to possible

[1] See Sherman Act in Appendix 1.
[2] See Article 101 of the TFEU in Appendix 1.

deviation of cartel members, avoiding their temptations to cheat for fear of provoking an undesirable price war or other retaliation actions. Another important feature is the fact that cartel members end up having information about each other evolvement in the illegal activity and can report that evidence to third parties as AA.

When a firm is considering joining a cartel there are three main questions that it should address: what is the colluding gain, what is the likelihood of being caught and condemned and what is the punishment if convicted. Firms have an incentive to collude if the benefit of collusion is higher than the risk and severity of the punishment. Thereby, AA seek to increase the probability of cartel detection and punishment (fines or even imprisonment) in order to maximize cartel deterrence. Besides the probability of detection and the level of punishment there are many other factors that influence the collusion benefits and the deviation gains making collusion less or more likely. Among the factors that facilitate collusion, we can highlight entry barriers, symmetry between firms regarding their market position and strategy which facilitates coordination, higher degree of market concentration and a positive demand growth rate expected to be maintained in the long-run. Oppositely, a high number of firms within a cartel decrease the collusion benefits and difficult coordination. Collusion is also more difficult in industries with less price transparency, meaning that the observability of the prices is reduced, increasing the difficulty of detect deviators. Furthermore, there are factors that difficult collusion by making deviation more attractive. One factor is the rigidity in prices that makes firms to take longer to apply the punishment in case of deviation. Thus, it is more difficult to sustain collusion if the prices are not flexible. A transitory upward shock in demand is other factor since gives incentives to deviate to benefit from an increased temporary demand. When there is substantial excess capacity, so that the deviator has sufficient capacity to take over the entire market, collusion is more difficult. Other factor that can be considered is low brand loyalty, meaning that is easy to steal market share from rivals in case of deviation. Finally, there are factors that affect both sides of the incentive constraint the deviation benefits and the punishment and therefore can either facilitate or difficult collusion. That's the case of elastic demand and homogenous goods. High demand elasticities discourage collusion, as deviation is more likely, but as punishment is less costly for non deviating firms, collusion is facilitated. With respect to homogenous goods, by allowing capturing a more important market share, it incentives deviation and therefore makes collusion unlike. In turn, homogenous goods make punishment more efficient facilitating collusion.

It has been argued[3] that cartels will inevitably dissolve without AA intervention due to its intrinsic instability, but AA have invested in the development of aggressive anti cartel programs. In that context were introduced LPs that nowadays became a central tool in the fight against cartels. A LP is a legal revelation mechanism in which firms that report their involvement in a cartel, or cooperate with the AA, are granted with fine reductions, total immunity or in some cases rewards.

Historically, promises of lenient treatment have been commonly used in war situations, for the exchange of information as a standard tool. The concept of *divide et impera* (divide and rule), highlighted by Spagnolo (2004), was used by Julius Cesar and other commanders as a strategy of breaking coalitions of enemies by striking advantageous deals with one or few of them. Also Nazi occupants have used rewards to induce enemies to become informants. More recently, this system allowed finding the location of some Al-Qaeda terrorists. However, this lenient treatment did not have a general rule as it was decided case by case. Therefore, what is new and make LPs somewhat special are its ex-ante general and public characteristics. LPs are ex ante because they are directed to cartel members that have not yet been identified. They are general since they are anonymous and available to anyone who is in a codified situation and behaves in a certain way. Finally they are public since they are automatic and publicly advertised.

Potentially, LPs undermine the trust between cartel members which is the crucial and cohesive element that keeps cartels operating. By increasing the risk that one of them will unilaterally report the cartel to enjoy the benefit of leniency, LPs help prevent cartel formation, which is called the deterrence effect. They deter firms' involvement in anticompetitive activities because they know that it only takes one cartel member to whistleblow to bring down all the firms involved. Hence, the reasoning regarding cartel deterrence is that if a firm is more profitable by itself than joint in a cartel, it will not be part of it. Therefore, AA search for leniency schemes that lead to a situation in which is in a firm best interest not joining a cartel. In what regards the improvement in cartel detection, the reasoning is the same, undetected cartel members are induced to spontaneously self-report cartels that had not been discovered. Then, the main issue regarding the optimal design of LP is how to extract this freely available information from cartel members.

There are several dimensions over which LP can be designed. They have an important role determining the effectiveness of the program in deterring and detecting cartels. One

[3] See for example Stigler (1964)

dimension is the time at which the cooperation starts: before an investigation is opened (new case) or after the formal investigation has started. The time ordering of reporters (first or later reporters), their behaviour during and after the investigation and their role in the collusive agreement (ringleaders or minor partners) are other dimensions considered. The question of recidivism is also addressed on LP design. Also the question whether the norms in place entail personal or only corporate liability. Other crucial dimension is the design of fine reductions or positive rewards that should be in accordance with all the above elements. And finally, it is necessary to define the degree of discretionary power of AA applying the rules announced.

This thesis discusses the rationale of the ECLP, trying to assess how the way it is designed affects its effectiveness on cartels prosecution. The discussion is based on an extensive literature review and in a descriptive statistic performed with data collected from the EC' case decisions. The cartel size, investigation and cartel duration, fines, timing of leniency application and fine reductions granted are some of the variables examined. This descriptive analysis contributes to the existing literature by extending the data set from 1980 to 2015, which allows to compare the situations before and after the LP' introduction. Moreover, it allows comparing the performance of the 1996, 2002 and 2006 leniency notices.

The thesis is organized as follows. Section 2 survey theoretical and empirical studies organizing them according with the most relevant LP' dimensions. In section 3 is performed an economic analysis of the ECLP. Section 4 concludes and suggests some further research. All figures and table are in appendix II on Section 5.

2. LPs and cartel activity: a survey

It seems reasonable to admit that LP increase the number of convicted cartels, but its effect on cartel deterrence is not straightly observable, as the number of existing cartels is not known. An increase in convicted cartels could be just a result of an increase in cartel activity. Even assuming that LPs have a cartel deterrence effect, it is still necessary to analyze whether differently designed programs would have a better performance. This argument highlights the importance of theoretical, experimental, and econometric research.

2.1 Theory Studies

Most literature on LPs is based on theoretical models that try to identify their most efficient design. The first approximation of a model of information exchange and leniency is the Prisoner's Dilemma. The majority of the models used are game theoretic dynamic models based on the concept of the Prisoner's Dilemma.

Initially, literature focused only on isolated crimes committed by single agents. Becker (1968) showed that optimal policies to combat criminal behaviour are part of an optimal allocation of resources. In this line of reasoning, Kaplow and Shavell (1994) showed that a system that includes self-reporting saves law enforcement resources. According to them, LPs reduce the social cost of collusion by restricting the investigation only to the fraction of the population that does not report and by the early cessation of cartel activity. Using a simple setting they showed that leniency allows achieving the same deterrence level but with AA' lower costs. The role of self-reporting in reducing auditing costs in environmental regulation was discussed by Malik (1993). Using a principal-agent framework, found that the introduction of self-reporting decreases the need of firms auditing but increases punishment. Innes (1999) highlighted the benefits of granting leniency treatment to self-reporting wrongdoers that committed an environmental damage. Hence, LPs allow the earlier detection of environmental damaging activities, assuring a faster compensation to victims and reducing social harm.

2.1.1Leniency after Investigation Opening – Plea bargaining

The concept of plea bargaining refers to the situation in which firms cooperate with AA, reporting relevant information, only when their cartel has been discovered and an investigation was opened. Motta and Polo (2003) made a seminal contribution, explicitly addressing the effects of LPs on cartels using a dynamic analytical structure. In their model

firms strategically interact in an infinite repeated oligopoly game, choosing whether or not to collude given the probability of being detected and prosecuted by the AA[4], which has an exogenous budget constraint that can be allocated to the detection and prosecution of detected cartels. Leniency is only available for colluding firms that only begin its collaboration during prosecution. In the model there are only two collusive strategies: firms never report and go back to collusion after the investigation, playing Nash forever as soon as one of them reports or firms report to the AA whenever an investigation is opened, not colluding for some period of time, but then sliding back to collusion. Two main simplifying assumptions are considered. The first is that firms sustain a collusive agreement based on trigger strategies. The second is that a deserting firm cannot be condemned for having been part of a cartel nor report his former partners. Under this simplifying assumptions, cartel members only report when they all agree to do so as part of their collusive strategy. Thus, LPs do not induce non-cooperatively self-report. The central result of Motta and Polo (2003) is that LPs have a pro-collusive effect by reducing the overall sanctions, but in turn increases the ex-post deterrence since induces cartel members to cheat and break up the collusive agreement. LPs increase the probability of conviction and self-reporting become an equilibrium outcome. The positive effect on deterrence makes prosecution faster, cheaper and more effective. Considering that AA have limited resources, the positive effect dominates the negative on. There are also some secondary and less intuitive conclusions. One of them is that the same lenient treatment should be offered to all firms independent of the order with which they report. And if AA have sufficient resources to deter cartels with fines and inspections, it should not introduce LPs. Therefore, LPs are a second best instrument that is only optimal when the authorities' resources are limited.

Harrington (2008) also considers that leniency is applied in the prosecution stage. The novel feature of this model is that when a cartel is put under investigation firms may precipitate to report information in a non-cooperative manner under a sufficiently generous LP. Such rushes do not occur in Motta and Polo (2003). Harrington (2008) uses a repeated oligopoly model that enriches previous analysis by considering the probability of successful prosecution as a stochastic, continuous and fluctuating variable. Indeed, the probability of conviction is allowed to change over time taking any value from [0, 1], while Motta and Polo (2003) restricted the probability to take only two values, one of which zero. The conclusion is that when the probability of successful conviction is high there is an equilibrium report during

[4] The probability is allowed to change over time but it is restricted to take only two values, one and zero.

prosecution. However, with a low probability the equilibrium is not collaborating or report even in the prosecution stage. Therefore, a more lenient program might induce firms to switch from a non self-report equilibrium to an equilibrium in which all firms self-report.

2.1.2 Leniency before Investigation Opening – Ex ante Deterrence

Plea bargaining do not capture the most novel and distinctive feature of LPs, which are the ex ante effects relative to cartels that have not yet been detected rather than just the improvement in prosecution. A different focus is on ex ante deterrence by restricting LPs to firms that spontaneously report their cartel involvement before an investigation was open.

In this context, Hinloopen (2003) using a dynamic oligopoly model where the probability of detection changes over time, shows that cartel ex ante deterrence increases with the generosity of the LP. Hence, LPs' effectiveness is enlarged by the increase in the fine reduction level and the increase in the probability of cartel detection. Also Spagnolo (2004) developed a stylized dynamic model of self-reinforcing collusive agreements, assuming that whenever a cartel is detected it is also convicted (contrary to Motta and Polo), which allows to focus on the impact of LPs on cartels that are not already under investigation. He shows that a "moderate" LP, where reduced fines are bounded to be non-negative, may make collusion harder to sustain having three effects: the protection from fines effect, the protection from punishment effect and the direct deterrence effect by making cartels more risky. Spagnolo (2004) also analysis the impact of a more "courageous" leniency that offers rewards to whistleblowers that will be addressed later.

Chen and Harrington (2007) analyzed the deterrence effects of LPs considering a dynamic Bertrand oligopoly model with homogeneous goods and where the probability of detection and conviction is endogenous and sensitive to price changes. Therefore, a cartel selects a price path that ensures compliance from all firms and tries to avoid raising suspicions that they are colluding. In that setting, the introduction of a LP will impact the price path through its influence on the incentive compatibility constraints. Through numerical simulations, they show that when leniency is significantly generous it achieves positive results in terms of direct deterrence, since LPs either deter cartel formation or reduce the optimal collusive price path of cartels that were not deterred.

2.1.3 Leniency restricted to first reporter

As mentioned previously, the time ordering of reporters, (that is whether the lenient treatment is given just to the first reporter or to later ones), is a crucial element in the LP design. According to Feess and Walz (2004a) if only the first reporter can apply for leniency and the other cartel members are forced to pay high fines, ex-ante deterrence is maximized since self-reporting become a credible threat. The same concludes Motchenkova (2004) using a dynamic model that tries to capture the time dimension of the rush to report idea. Limiting amnesty only to the first reporter is crucial to induce such rush for reporting. On the other hand, less strict LPs that are generous also to the following reports are found to produce negative side effects as the increase of cartel duration. Harrington (2008), beyond corroborating this idea, ads that is optimal to restrict amnesty to the first reporting firm only when the additional information is sufficiently valuable regarding its impact on the likelihood that the investigation ends with a successful condemnation.

Chen and Rey (2012) also confirm the advantage of restricting leniency to the first informant, but consider the case of keep offering leniency once an investigation is underway. Also Spagnolo (2000a) defends the restriction of maximum benefits to first reporters, since allowing more agents to obtain leniency reduces deterrence by reducing the number of cartel members that must pay the full fine. The model used to reach this conclusion relies on the Motta and Polo assumption that a cartel member which deviates by undercutting the cartel price is no longer subject to be condemned for his past collusive behavior.

In a context of asymmetric information between the AA and cartel members, Sauvagnat (2010) also confirm the advantage of restricting leniency to the first reporter. Therefore, the optimal scheme involves a single informant rule, which makes amnesty function as a lure, since all cartel members face the same unilateral incentives to blow the whistle.

2.1.4 Minimum Information requirements

The quality and relevance of the evidence required for reporters to obtain immunity is another important nuance to include in theoretical analysis on LP. Harrington (2008) was one of the few to analyze this critical issue of how valuable the reported information must be to make awarding amnesty worthwhile. Harrington (2008) considers as hard the information that is verifiable by third parties (like judges) and leads to sure conviction and soft the information like testimonies not supported by documents that are not sufficient to give immunity. The

probability that an open investigation end up with a conviction is taken as a continuous stochastic variable. Therefore, if this probability is high, further information from whistleblowers has little value, if is low the additional information is higher valuable. Exploiting this variation, Harrington (2008) shows that to maximize desistance, leniency should be granted only if it increases significantly the likelihood that prosecution traduces in successful conviction. To avoid strategic or distorted reports, authorities must always deny leniency or even consider aggravated sanctions for reporters that withheld some information.

Also Feess and Walzl (2004b) analyzed the minimum level of evidence that should be reveled in order to obtain leniency. Through the exploration of the differences between the USLP and the ECLP, found that a more informed reporting firm should receive a more generous compensation then a less informed cartel member. According to their results, grant total amnesty to cartel members that provide a low evidence level is not optimal. Thus, granting always full fine reduction, as occurs under the USLP to the first self-reporting firm, is suboptimal. Cloutier (2011) extends this analysis by setting the study in the period after an investigation has started rather than in the pre-investigation period. Using a repeated game similar to the prisoner's dilemma, Cloutier (2011) shows that by conditioning the imposed fine on the quality of the evidence firms will apply more often than they would in the unconditional situation, providing higher quality information. Thus, a more generous LP induces firms to report higher quality information.

2.1.5 Asymmetries

Another interesting issue that can be introduced in theoretical models is the existence of asymmetric information or asymmetries within a cartel. In this context, it can be analyzed the case in which is AA that have private information unknown by cartel members. This type of asymmetry was addressed by Sauvagnat (2010) who designates as a fool's game the period following an investigation, in which AA pretend having more relevant information than it actually have. Indeed, AA want cartel members to believe that the risk of conviction is eminent in order to induce them to report their own information to avoid higher sanctions. In this context, the model used is built on the idea that AA may run an investigation against a cartel even having very limited evidence of its culpability. Once the amount of evidence held is private information of AA, firms may be tempted to self-report and provide hard information that enables his conviction. However, AA should choose a generous LP design, granting full amnesty, when the probability of successful prosecution is low since it diminishes the risk of conviction faced by cartel members and therefore lowers the likelihood

of leniency applications. Thereby, is desirable offering more leniency in order to counterbalances the dilution in the risk of conviction, allowing the AA to open more successful investigations.

Other asymmetry in information that can be addressed is the possibility of firms to have private information regarding the probability of a successful prosecution and conviction by the AA without the cooperation of cartel members. This is precisely the key modification introduced by Harrington (2013) who distinguishes between prosecution and pre-emption effects. The first effect is related with the fact that firms apply for leniency because of the fear of being convicted. Regarding the pre-emption effect, a firm decides to apply for leniency due to its concern that another cartel member apply for it first, even if the firm believes that the probability of conviction is low. Harrington (2013) developed a model that explores antitrust policies that aim to magnify the pre-emption effect to better understand firms' incentives to apply for LPs. He shows that the presence of private information has a significant effect in the way LPs are able to generate convictions, since the pre-emption effect creates a multiplier effect with an increase in the prosecution effect. Marvão (2013) presents an extension of the model used by Harrington (2013) since besides allowing firms to have private information consider that firms are heterogeneous in terms of sales. The theoretical result confirms the existence of a pre-emption effect but adds that the decision of reporting is also influenced by firms' sales level and not only by the perceived probabilities of detection and conviction. Indeed, she finds that the turnover of the first reporter after an investigation was open is higher than the other cartel members. To support the theoretical model uses a database composed by cartels convicted in the US and by the EC and the OLS estimation method. The empirical analysis confirm the theoretical result since reveal that chief witnesses tend to be repeat offenders in the case of the EC and cartel leaders in the US which are often the firms with higher sales.

Besides asymmetries in information may exist also asymmetries within the cartel regarding the firm's dimension and the markets in which they operate. Motchenkova and Van der Laan (2005), using a dynamic repeated duopoly model similar to Motta and Polo (2003), evaluate the deterrence effects of LPs taking into account these asymmetries. They consider that cartel members face other costs beyond fines, namely reputation costs that are associated with the reduction on sales in the markets firms operate apart from the market of the convicted cartel. Thus, they show that colluding firms that are heterogeneous in size and degree of market diversification will react in a different way to the introduction of LPs if their conviction has significant negative reputation effects. Larger and more diversified firms are

present in more markets than those in which they are colluding. Thus, it's possible that the negative reputation effects have repercussions on the markets in which the firm cannot avoid the losses with leniency. Therefore, larger firms have less incentive to enter in a cartel and higher incentives to keep the cartel secret in case they enter.

2.1.6 Ringleaders

Cartel members who assume a leading role in the cartel are usually called ringleaders. They grant cartel stability and functionality by organizing the first meetings, collecting and distributing relevant data and ensuring a continuous communication between participants. According with Herre, Mimra and Rasch (2012), despite ringleaders be crucial to cartel stability, it's not clear that they need to be necessarily the firms with larger dimension or relevance in the market. Oppositely, Ganslandt, Persson and Vasconcelos (2008) show that ringleaders tend to be large firms since have firm-specific indivisible costs associated with collusion as the cost incurred when protecting the cartel from potential entrants. Also Bos and Wandschneider (2011) found that a defining feature of ringleaders is their market position, since in 11 of the 14 cases analyzed the ringleader was the largest firm in terms of market share.

Kobayashi (1992) provided the first economic analysis of the existence of asymmetry between cartel members regarding their role in the cartel. In this sense he considers that since ringleaders are the members that have more information about the cartel and the other wrongdoers, for the probability of conviction to be maximized, it is optimal to lower their penalties. In turn, suggests harsher penalties to less culpable cartel members. Similarly to the case of rewards, the implementation of this conclusion can presuppose a social disapproval since ringleaders are the cartel member that are most responsible and culpable for the cartel and therefore for the social damage.

Herre, Mimra and Rasch (2012) also address the impact of ringleader discrimination on cartel's stability. They found that both the approach of allowing and excluding ringleaders from leniency may be used as an effective tool to fight against cartels, depending on the magnitude of evidence held by the ringleader. If the ringleader relative evidence about the cartel activity is high its exclusion from LPs has no impact on cartel stability. Therefore, differencing the treatment of ringleaders plays no role in this case since they will never report. If ringleader's relative evidence is small, excluding it from LPs creates an asymmetry among cartel members, making collusion harder to sustain. This is still more valid if we added the fact that the AA has a large probability of successful conviction. Finally, if the level of

evidence held by ringleaders is intermediate or if the AA has a small probability of successful prosecution, allowing them to obtain leniency is the best option, since their exclusion facilitates collusion. Likewise, Chen, Ghosh and Ross (2015) found that the exclusion of ringleaders can have ambiguous effects on the elimination of cartels. By one hand, excluding ringleaders destroys some of the potential benefit that leniency was intended to generate, making more credible the ringleader commitment to its partners and contributing to cartel stability. By the other hand, its exclusion creates an asymmetry between cartel members by punish ringleaders in a more severe way, reducing their incentive to commit the crime.

The effects of ringleaders' exclusion from LPs on the collusive price level are explored by Bos and Wandschneider (2011). Attempting to deal with the fact that very little is known about the nature and role of ringleaders, they have conducted an informative survey of 75 European cartel cases, evidencing the frequency and characteristics of ringleaders. Between 2000 and 2011 they found that in 14 of the 75 cases the EC identified a ringleader. Performing then a theoretically analysis, they conclude that for the majority of the cases in which collusion is sustainable, impeding ringleaders to obtain leniency leads to lower prices. Nevertheless, its exclusion may lead to higher prices but only under a set of restrictive conditions. Specifically, it is needed that the profit-maximizing price is not sustainable when ringleaders can apply for leniency and that its incentive compatibility constraint is less tight when they cannot apply. This last restriction requires a sufficient number of cartel members and a substantial fine reduction for the first reporting.

2.1.7 Personal liability and whistleblowers' reward schemes

Personal liability and the possibility of grant rewards to whistleblowers are other dimensions that could be consider in LPs design. Aubert, Rey and Kovaric (2006) defend personal liability and propose the introduction of compensations for individual reporters, showing that it have a larger deterrence effect than reduced fines. The model used allows employees to directly cash monetary rewards when reporting their own firm's collusive behaviour. The authors show that individual rewards can be more effective than the ones granted to firms, or can be seen as a useful complement of corporate amnesty programs. The basic idea is that if AA offer rewards to employees that report evidence, then colluding firms will have to pay additional bonuses to pay for the silence of the informed employees, which increases the colluding costs and makes collusion less attractive and more fragile and unsustainable. Since firms must pay a bonus to each informed employee the impact of this policy is multiplied when compared with a corporate one. Other relevant fact is that, when

personal liability adds to corporate liability induces managers and executives to report more frequently, since the possibility of imprisonment presupposes a greater loss when compared with the fines paid by a firm or even it possible bankruptcy. Aubert, Rey and Kovaric (2006) also highlight that the possibility of individual leniency gives employees an additional bargaining power to obtain a better employment contract with higher wages which increases even more collusion costs.

Besides its positive effects, Aubert, Rey and Kovaric (2006) also analyzed the possible adverse effects of rewards and its potential implementation issues. An adverse effect highlighted is the possibility of deter or discourage productive and valuable intra-firm and inter-firm cooperation. Namely, a legitimate joint venture that restricts the freedom of its participants could erroneously be considered as illicit collusion by increasing the incentive to report it with the purpose of getting the reward. Regarding the potential implementation issues they are related with the concern that may arise from the large size of the rewards that is needed to deter collusion. In this context, the first question highlighted is a problem of credibility since the limited budget impedes the authority to credibly commit to large rewards. The second issue highlighted is related with its political implementability, since public opinion has difficulty in accepting the idea of transfer high amounts to firms that belonged to a cartel. The last problem addressed is that a reward program generates more incentives to collude since it could become profitable for firms to collude and then report or to 'take turns' for reporting collusion.

In the context of individual leniency there is also some sociological literature which evidences the problems faced by whistleblowers. According to Spagnolo (2008) individual reporters face severe punishment from their former partners and from the business community in general during the several years that prosecution may lasts and even before it ends. Also Alford (2002) highlighted that whistleblowers have difficulties finding work and experience trouble in their social and private life after reporting. Indeed, colleagues, friends, neighbours and, chiefly, potential employers turn against them. In some cases even family members reproach their behaviour. According to him, about half of all whistleblowers get fired and many of them lose their homes and then their families too**.** Thus, whistleblowers must be generously rewarded and protected in order for them to report. Polo and Motta (2005) have stressed that despite the difficulty to maintain secrecy over the identity of cooperating companies, when we consider individual leniency there is some more scope for trying to protecting the identity of witnesses when compared with corporate leniency.

Beyond individual reward schemes it is also possible to consider monetary compensations for reporting firms. Spagnolo (2004) shows that in the context of a stationary environment (probability of condemnation without LPs fixed over time) and with a budget-balancing constraint, a first best solution (complete deterrence without any prosecution costs) can be achieved by giving to the first reporting firm a reward equal to the sum of the fines levied on the remaining cartel members (courageous leniency). Such rewards make leniency particularly attractive and hence weaken cartel stability. For Buccirossi and Spagnolo (2006) granting rewards eliminates the leniency counterproductive effect of cartel stabilization. Also Houba et al. (2009) defends that an effective ex-ante LP involves necessarily rewards, which should differ depending on cartel's economical sector, offering just the minimal amount necessary to induce self-reporting. Finally, according with Buccirossi and Spagnolo (2007) the inclusion of rewarding schemes makes the minimum fine with deterrence effect fall to low levels. To be more precise, below 10 percent of the optimal fine estimated by Becker (1968) on which must of the previous works have focused. By considering that antitrust sanctions are influenced (or should be) by the presence of different leniency and whistleblowers schemes, they show that previous simulations exaggerate the minimum fine necessary to ensure deterrence effects, since ignore the different types of deterrence that LP presupposes.

Regarding the relation between individual and corporate leniency, Festerling (2005) presents a rich dynamic duopoly model with the aim of study its interaction in the US. In his model each firm has a hierarchical structure composed by a principal, firm owners and a manager where there are conflict of objectives regarding the legal consequences of conviction. The author states that individual leniency is effective once that it induces firms to self-report due to treats of individual managers. Therefore, as said by Hammond (2004), "the real value of the individual leniency program is not the number of individual reports received but the number of corporate application that it generates". Thereby, corporate and individual sanctions leniency policies give rise to a multistage revelation game in which either the manager or the firm owner can report.

2.1.8 Perverse effects of LPs – Cartel stabilization

Some authors have adverted for the stabilization effect that LPs can have on cartels whose formation was not deterred. Since LPs make self-reporting more attractive, the threat of self-reporting to punish a deviated cartel member may become credible. Therefore, some LPs designs may be faced by cartel members as a punishment mechanism that avoids deviation and helps in the cartel stabilization. Buccirossi and Spagnolo (2006) show that

‘‘moderate’’ forms of leniency can have this counterproductive effect which facilitates illegal transactions. As in Spagnolo (2004), here “moderate” leniency means that it only eliminate or reduce self-reporting fines to a level below that the one faced in case of no report, which is indeed what is often implemented in the real world. Also Chen and Harrington (2007) through its aforementioned numerical simulation show that for intermediate and low levels of leniency collusion may end up stabilized, since LPs are only used as a resource in case of detection. Considering that the information that can constitute evidence of the collusive behaviour is durable, Spagnolo (2000b) finds that LPs can enforce collusive agreements in multi-unit auctions. Once more, LP confers credibility to the threat of report in case of deviation. Similarly, the analysis of Ellis and Wilson (2001) suggests that LP has the effect of stabilizing the cartels that were not deterred, which turns out to be the ones with worse social welfare consequences and ,therefore, the most important to deter.

Spagnolo (2004) refers other feature of LP design that can enhance cartel stabilization, which is to fine firms that have deviated from a cartel agreement. Thereby, by prosecuting firms that have unilaterally deviate from a cartel, AA may end up contributing to the cartels stabilization since it reduces firms’ expected defecting gains. Indeed, if cartel members know that they will not be punished for their past collusive behaviour if they defect, they have an incentive to do so, making cartels harder to sustain.

2.1.9 Private damage actions

Leniency in principal does not immunise cartel members against the risk of exposure to civil damages actions in private suits. There is a legal debate that tries to discuss at what extend private action for damages may reduce LPs’ attractiveness. If the cooperation with AA increases the likelihood that cartel victims will successfully reclaim private damages, this could have a negative effect on LPs effectiveness. The evidence provided by the leniency applicant may be used by claimants to prove the existence of the infringements and its effects. Therefore, the incentive to apply for leniency to avoid fines may be counterbalance by the disincentive of being condemned to pay private damages.

Spagnolo (2004) showed that is optimal to minimize the damages paid by the first reporter in order to increase the deterrence effect of LP. However, the author does not addresses the question of how much information from the LP report should be made available to cartel victims in order for them to exercise their right of compensation. In turn, Buccirossi, Marvão and Spagnolo (2015) present a more complete analysis, extending the approach of Spagnolo (2004) by determining the optimal combination of damage liability of the reporting

firm and the amount of information which should be provided to claimants. They show that limiting private damages is not necessary to preserve the effectiveness of LP and may have a counterproductive effect. To maximize the deterrence effect and the LP attractiveness it is optimal to minimize (or eliminate) the damage liability of cartel members that received immunity and maximize claimant's access to evidence collected under LP. Thus, under the author's proposal the damage liability of leniency applicant is assumed by the other cartel members as long as they are able to jointly cover the amount of compensations.

2.1.10 Global Cartels and LP in the context of multi-markets

Other relevant issue is when AA deal with global cartels which operate at an international level. This may arise some questions regarding the cooperation between AA of different jurisdictions. According to Connor (2009) there were 516 official investigations of suspect international cartels between 1990 and 2008 with total effected sales estimated at $16 trillion**.** Other relevant data is that three quarters of the cartel cases between 1996 and 2005 opened by the EC due to leniency were also under investigation in the US, indicating that a significant proportion were already discovered or at most close to detection (Arlman 2005). According to Spagnolo (2008), this fact does not mean that the EC should not grant full amnesty, even if they had already information about the cartel. The reasoning is that providing leniency to cartels that was already detected in other jurisdiction encourages self-reporting there which facilitates the detection of international cartels.

In this sense, antitrust cooperation and information sharing between authorities plays an important role. Hammond (2003) emphasized the need of local authorities share information regarding their cartel prosecution saying that "we must share leads and information, coordinate our investigative strategies and must gain access to subjects, evidence and witnesses that are located outside our borders". However he also stressed that information sharing might be limited specially the obtained under LPs. In this context, Jay Pil Choi and Heiko Gerlach (2012) analyze cartel formation and self-reporting incentives of firms operating in several geographical markets and under different antitrust jurisdictions. In this sense, the question of how much information and of which type should AA share to fight cartels effectively is addressed. Considering a repeated price game with two firms operating under different antitrust jurisdictions three scenarios are analyzed. The first is the benchmark in which AA are not coordinated not sharing any information about their investigations. The second scenario allows sharing between authorities but not the information obtained under

LP. Finally, in the third scenario AA share cartel leads, information from procedural investigation and from leniency applications. Their results show that when authorities are not sharing any information global firms report less, being easier to sustain a cartel compared to strictly local firms. On the other hand, when authorities cooperate by sharing leads and case information, excluded the obtained from LP, the probability of detection and the probability of conviction increases in each local market. This increases self-reporting and reduces cartel formation. Regarding the extensive information sharing it decreases the number of leniency applicants if fines and the probability of conviction are low and increases self-reporting and deters cartel formation if they are high. Therefore, in the absence of confidentiality agreements with local lenient applicants, the cartel strategy of self-reporting may no longer be optimal.

2.2 Empirical studies

A second category of literature on LP is empirical economics which provides tools that are useful in the identification of collusive markets. Moreover, it allows testing existing theories regarding their structural assumptions. Probably due to the difficulty in the collection of reliable data by the empirical researcher, experimental and econometric studies available on the effects of leniency in antitrust is much more limited then theory studies. Indeed, empirical analysis must be treated with precaution since the whole population of cartels cannot be observed, thus samples may be biased because its dependency on prosecution as a mean of sample selection. In this context, we are in a presence of a self-selection problem, since it is not possible to observe all the cartels but only those that are detected. Therefore, it is hard to identify whether overall deterrence has been improved due to LPs and which types of cartels are more likely to be discovered and reported. In the following section are present some of the more relevant experimental and econometric studies.

2.2.1Experimental studies

Experimental studies are highly indicated for LPs analysis especially which regards general deterrence effects. Apesteguia, Dufwemberg and Selten (2007) provided the first experimental study addressing the effectiveness of LPs. They developed a stylized theoretical framework that aimed to capture the main features of the direct effects of LP on cartel deterrence present in the theoretical literature, undertaking an experimental analysis of such effects. Using a market game in form of a one-shot Bertrand oligopoly with homogeneous goods they test four legal frameworks for antitrust legislation (ideal, standard, leniency and

bonus) which they call experimental treatments. In the ideal treatment there is no antitrust law and communication between firms and consequently cartel formation is impossible. The second is the standard treatment wherein firms face a fine in case of conviction, and there is no reduction if they report. The third is the leniency treatment upon which reporting firms receive a fine reduction. And finally, in the Bonus treatment reporting firms receive a reward that is a percentage of the fines collected from the other firms. The experimental results suggest that LPs are able to deter cartel formation and induce self-reporting, which leads to a more competitive outcome and are. However, the results also show that firms use the threat of report in case of deviation as a way to ensure the sustainability of collusion. Surprisingly, results show that rewarding does not increase deterrence. Indeed, is in the Bonus treatment where are found the highest number of cartels and market prices. The oligopoly game used is not repeated which does not allow agents to learn the game. This may be in the origin of some counterintuitive results as agents not reacting to rewards.

Hinloopen and Soevent (2006) provide a more advanced experimental design that intends to overcome some shortcomings present in Apesteguia, Dufwemberg and selten (2007). In Hinloopen and Soevent (2006) firms play for at least 20 periods in a discrete homogenous goods Bertrand price game rather than a one-shot Bertrand which allows overcoming the problem of overstating the positive effect of LPs due to the non existence of reporting costs. It also creates a "race to report" situation, as larger fine reductions are granted to first reporters and introduces an exogenous probability that cartels are detected by AA. The experimental results show that LPs undermine the trust among potential colluders which traduces in fewer cartels established (significant direct deterrence effect). The lifetime of cartels that were not deterred are shortened when a LP is in place, since they are less successful in sustaining collusive prices having lower survival rates. Indeed, there is an increase in price cuts performed by cartel members that deviate. Finally, the data provides no evidence that LPs have an attenuation effect on cartel recidivism, since the same percentage of convicted cartels starts colluding again after some time with and without LP.

In contrast, the experimental study undertaken by Bigoni et al. (2012) show that leniency performs poorly. The results show that the introduction of LPs increase collusive prices and stabilize the surviving cartels. However, leniency reduces recidivism, since in the experiment cartels are almost never reformed. The exclusion of ringleaders from LPs does not influence the deterrence effect of leniency but increase the price level. The results also suggest that rewarding whistleblowers is the only policy that is able to reduce collusive prices and seems to improve welfare. In this experiment firms are allowed to self-report before price

choices are observed by other firms and after which may be in the origin of these different results.

Hamaguchi and Kawagoe (2005) analyzed the probability of being reported a cartel depending on the cartel size[5] and the schedule of fine reductions. The experimental results show that LPs and cartel size are positively correlated, since the larger the cartel the more effective is the program in their dissolving. Cartels with seven members become unstable with LPs, being that the estimated average cartel size is six. Also find that change the coverage of reduced fine, this is whether leniency applies just to the first reported or to all reporters, seems to have no significant effect on the program effectiveness in inducing cartel members to self-report for both cartel size cases.

2.2.2 Econometric studies

Steffen Brenner (2009) provides one of the most relevant econometric analyses on LPs, which examines the efficiency of the 1996LN considering its effects on the number of applications, the size of the fines applied to infringers and the duration of AA investigation. Also study if a LP is well succeed on extracting information from cartel members and if increases cartel deterrence. Uses the duration of the investigations as a proxy for their cost and assumes that the imposition of higher fines is a signal of better information available in prosecution process. His results suggest that LPs provide incentives for cartel members to reveal information on their collusive activities, which supports the theoretical analysis of the most relevant literature as Motta and Polo (2004), Spagnolo (2004) and Aubert, Rey and Koravic (2006) analyzed previously. Despite that LPs help to increase the information collected and thus impose higher fines, is also found that these are not high enough to increase cartel deterrence. The author does not find any significant effect on the speed of completion of the investigation. The empirical research does not support the view that LP destabilizes cartels decreasing their duration. Likewise Arlman (2005) performs an empirical study about the 1996LN. The results show that leniency is effective destroying long lasting hard cover cartels, since cartels involving full immunity had a higher duration that cartels involving partial immunity. The econometric analysis also suggests that leniency decreases significantly the duration of the investigation and increases fines. However, leniency does not provide more and better information about the cartel. In the interpretation of this result we should take into account that the author uses the number of words in the final decision as a

[5] Are considered two cases: a small (with two cartel members) and a large (with seven)

proxy for quantity and quality of information. This is a debatable assumption, once one can consider plausible to assume that when the evidence is very strong the decision is more concise and then uses less words. Hereupon, both Brenner (2009) and Arlman (2005) concluded that leniency has a positive impact in the number of cartel detected, however none of them was able to find conclusive evidence of a deterrence effect each one of them using a different method to proxy for it. This fact may just reflect difficult assessment of this issue. Nevertheless, Miller (2007) was able to provide evidence that LP might have positive effects on deterrence. He developed a theoretical model of cartel behaviour and then provided empirical predictions. The results are obtained through a direct estimation of the model via the method of moments. The results from the statistical tests are consistent with the notion that leniency enhances deterrence and detection capabilities. Through the study of the US cartel cases between 1985 and 2005 he shows that the number of cartels detected increased significantly after the introduction of the USLP in 1993. This pattern is consistent with enhanced cartel detection and improved deterrence. However, despite this study be a large step in the provision of substantial evidence that LP lead to more deterrence and less collusion, results are still only derived by data from detected cartels.

In a more recent study Marvão (2014) analyses the ECLP using as a data set the cartels convicted between 1998 and 2011. The results confirm that the first reporter receives much higher fine reductions, independently of the timing of the application (before or after an investigation is underway). Also conclude that repeat offenders receive higher reductions, which suggest that firms learn how to play the game in the sense that they report or cooperate with higher quality. Recidivists often collude with the same set of firms and seem to agree on reporting the cartel in turns, since they accept to collude again with the firms who reported their previous cartel involvement

3. The European Commission's Leniency Program

3.1 Legal Framework

The first LP was introduced in the US in 1978. The program lacked transparency giving a high discretionary power to DOJ in its implementation. The resulting uncertainty acted as deterrent to potential applicants and the program received few applications. To increase its attractiveness, DOJ introduced significant changes in the 1993 revision. It started to grant complete amnesty to the first firm reporting before an investigation is underway, showing more clearly the benefits for the applicants. Amnesty to firms that reported the cartel after the opening of the investigation was also allowed, provided that at the time the DOJ lacked enough evidence to convict wrongdoers. Moreover, firms that were not able to obtain leniency for the involvement in one cartel, might obtain full immunity if they reported a new cartel as well as obtain a substantial fine reduction regarding the first cartel. In 1994, the DOJ extended the coverage of corporate LP to individuals allowing managers and other employees to self-report and contribute with additional useful information, but also made them susceptible to obtain jail sentences. After these revisions the number of applications increased from 1 per year to 3 per month on average and the level of fines imposed also increased (Spagnolo, 2008).

Following the example of the US the EC introduced his first LP in 1996. The 1996LN allowed a non-imposition of fine or very substantial reduction (75-100%) to the first firm reporting an undetected cartel, a substantial reduction (50-75%) to parties offering an irrefutable prove after the EC had undertaken an investigation and a significant reduction (10-50%) to late comers that cooperated with the EC providing useful information. To be entitled to a non-imposition of fine or very substantial reduction a firm had to end its cartel involvement at least at the moment of the cartel disclosure, had to provide the EC with all relevant information cooperating in a complete and continuous basis and must not have acted as an instigator or played a determining role in the cartel. This notice had a retroactive effect meaning that it might be applied to investigations started before 1996 but, at the time, without a final decision. It did not cover applications from individual employees, just persons empowered to represent the reporting firm. Disappointing the expectations, this notice failed exactly in the same point as the first American program. The program had not allowed firms to clearly assess which fine reduction they would receive if they report or cooperate, since fine reductions were uncertain and discretional. In this sense, the EC revised the program introducing the 2002LN. The objectives were to increase generosity, transparency and

coverage of the program. Therefore, the program started to grant automatically total immunity to the first undertaking reporting the cartel before an investigation was open. Likewise, the notice allowed full amnesty to cartel members reporting after the opening of an investigation provided that the EC did not have any relevant information about the cartel. The boundaries of fine reductions were re-designed depending on the time at which the evidence was disclosed and the added value it represents. To the first firm to disclose valuable information a reduction of 30-50% is granted, to the second a reduction of 20-30% and to subsequent firms a reduction up to 20%. The program coverage was extended also to ringleaders provided that they did not have exerted a coercive power to force other firms to join the cartel. This notice replaced the 1996LN for the new cases, not having a retroactive effect.

On December 2006 another revision was made through the 2006LN which increased the level of specification regarding the information firms must provide to obtain immunity. This notice required that applicants provided a 'detailed description of the alleged cartel arrangement, including for instance its aims, activities and functioning; the product or service concerned, the geographic scope, the duration and the estimated market volumes(…)". It also demanded the disclosure of names and addresses of the applicant and all the other cartel members, as well as names, positions and office locations of all individuals whose have been involved in the cartel. Finally, it required information on which other AA have been approached or are intended to be regarding the infringement. Other change introduced by this notice is that applicants cannot disclose its participation on the program until the EC found it appropriated which may imply the continuity of the applicant in the cartel after its disclosure.

Regarding private damage actions, the ECLP does not protect leniency applicants from civil law consequences of their participation in the cartel. Directive 2014/104/EU on antitrust damage actions has the purpose of ensuring that each cartel victim can effectively exercise its right for compensation. The Directive confirms the leniency applicants' liability, however immunity recipients have its liability limited 'to its direct or indirect purchasers or providers' (Art. 11 n.4 a)). The Directive also shows the EC concern in protecting leniency material, prohibiting the disclosure of leniency statement for damage actions purposes (Art. 6 n.6).[6] In Table 1 and 1.1 in appendix II contains a comparison between the 3 European' leniency notices and the USLP and the guidelines for fines setting.

[6] See Directive 2014/104/EU in appendix I.

3.2 What do we know about ECLP evolution and effectiveness?

To address this issue a data set on ECLP was built. It is composed by 139 cartel cases that were decided by the EC between 1980 and 2015 falling under Art. 101 of the TFEU, or Art. 81 of the EC Treaty or further back Art. 85. A total of 957 firms were convicted during the 36 years considered. In this analysis are only considered the cases in which a fine was imposed. The information was collected from the publications available on the DG competition website[7] which includes press releases, summary decision and non-confidential versions of final decisions. From each case the same variables were collected, namely, cartel size, duration of the investigation[8], fines imposed[9], cartel duration, timing of leniency application and fine reductions granted.

In the period analyzed were detected an average of 3,9 cases and convicted 26,6 firms per year. The average cartel size[10] obtained was 7,1 members which is above the estimation of six members obtained in the experimental study of Hamaguchi and Kawagoe (2005). Comparing the period afore the introduction of the first LP (1980–1996) with the period after its introduction (1996 –2015), we observe a higher cartel size in the first period (9,4) than in the second (6,2). As mentioned, Hamaguchi and Kawagoe (2005) found that cartels with seven or more members become unstable with the introduction of LPs. The data suggest that LPs reduce cartel size, however it should not be forgotten that it is only related to detected cartels, which limits the analysis. The average number of cases initiated per year and the fines level are the variables in which is verified a more significant increase after the introduction of the 1996LN: from 2,5 to 5,3 and 1,5 million Euros to 43 million Euros per firm, respectively. (See figures 1 and 2 in appendix II.) The duration of the investigation increased from 3 years and 3 months to 4 years with the introduction of LPs. However, the duration per firm decreased from 11 to 10 months which is more relevant to analyze since there is a positive correlation between cartel size and investigation duration. This result is consistent with Brenner (2005) and contrasts with Arlman (2005), since 1 month is not a significant difference. Investigation is facilitated with firms cooperation, but prosecution becomes more time consuming. Regarding cartel duration, before the introduction of the 1996LN cartels lasted on average 6 years and after its implementation 7 years and 5 months. (See table 2 in

[7] http://ec.europa.eu/competition/
[8] Measured in months
[9] Fines are considered after applied all the reductions and is measured in million Euros
[10] In the calculation of the cartel size are excluded the cases in which the cartel is an association of firms

appendix II.) Motchenkova (2004) suggested that if LPs were generous to subsequent reporters, which is the case of the ECLP, the duration of the cartel will increase.

Focusing the analysis on the period with leniency (1996 –2015), in the first 5 years of the program there was no case with full immunity. In contrast in the last 5 years, with exception for 2014, in all cases full immunity has been granted. (See figure 3 in appendix II.). Between 1996 and 2015 in 64% of cartel cases a firm received full immunity, 28% a fine reduction <100 and in only 8% of the cases any fine reduction was granted. Looking at the firms convicted, 53% received fine reductions and the remaining 47% did not received any reduction. (See figure 4 in appendix II.) The reduction between]20,40] is the one with higher proportion (18%) followed by the reduction between]0,20] (16%) and by full immunity (10%). (See figure 5 in appendix II.) Regarding the timing of the leniency application, 72% of the cases were reports before an investigation was open and the remaining 28% refers to cases in which occurred cooperation after the opening of the investigation. (See figure 7 in appendix II.) The duration of the investigation does not seem to be much affected by the timing of the leniency application. For the cases in which the report is before the investigation its duration is, on average, 3 years and 11 months and for the cases with cooperation more 2 months. The level of fines imposed is higher in the first case (€261 million) than in the second case (€210 million). And is even lower in the cases in which has not existed leniency (€149 million). This may suggest that the quality of information is superior in the cases started due to reports allowing setting higher fines. Finally, cartel duration is significantly higher for the cases in which a report by a cartel member occur (8 years and 4 months) comparing with the situation in which the opening of the case is by the EC initiative (5 years and 7 months with fine reduction due to cooperation and 4 years and 10 months without leniency). This may suggests that LPs induce more long lasting cartels to report than cartels with lower duration, which is in accordance with the conclusion of Arlman (2005). (See table 3 in appendix II.)

To conclude this descriptive statistics it is relevant to compare the performance of the three notices. The 1996LN underperformed on inducing firms to self-report, especially in the first years, having a average number of cases initiated due to reports per year of 2,8 which increased to 4,2 with the 2002LN and to 4,9 with the 2006LN. Similarly, the proportion of investigations started due to firms' reports increased from 52% with the 1996LN to 71% with the 2002LN and to 86% with the 2006LN. (See figure 8 and Table 4 in appendix II.) The 2006LN registers the lowest investigation's duration, 8 months than in 1996LN and 11 months lower than in 2002. Cartel duration has a downward trend. (See table 5 in appendix II.)

3.3 Room for improvement?

Following the previous analysis it way suggested that there are some issues in the design and implementation of the program that deserve further consideration. The first concern that springs out is the existence of innumerable repeated offenders, meaning firms which were convicted for more than one cartel. Indeed, in the period analyzed 24% of the total convicted firms were repeated offenders. (See table 6 in appendix II.) The legal framework has two contradictory approaches, since by one side recidivism is one of the aggravating circumstances that increase fines imposed to repeated offenders, by the other side they are allowed to apply for leniency and get full immunity or fine reductions under the same conditions as the other cartel members. This implies that in one cases penalization for recidivism exceeds the leniency reduction as occurred in the elevators and escalators cartel convicted in 2007 wherein Thyssen Krupp received a 50% increase for being a repeated offender and a 20% reduction under the LP. In other cases one effect cancels the other as in the organic peroxide case (2003) wherein Atochem received a 50% leniency reduction and a 50% aggravation for recidivism. Finally, in other cases the penalization for recidivism is milder than the leniency reduction. For example on the Chloroprene Rubber cartel (2007) Bayer received full immunity and an increase of 60% for recidivism. This trade-off needs to be carefully assessed, but first it's crucial to discuss the concept of recidivism. In the 2006LN recidivism constitutes an aggravating circumstance if 'an undertaking continues or repeats the same or a similar infringement after the Commission(…)has made a finding that the undertaking infringed Articles 101 or 102 of TFEU'. In order to discuss the EC' application of this concept let us analyze firms Akzo Nobel and Degussa. When was initiated the investigation of the first cartel in which Akzo took part (Sodium Gluconate I), this firm was involved in other 6 cartels.[11]. All these cartels ended before the first case 'decision date, thus was not applied any fine aggravation due to recidivism in those six subsequent decisions. In 2009 Akzo was convicted for another cartel whose formation is posterior to the first conviction, whereby a 100% fine aggravation was applied. Now let's see what happens with Degussa who was convicted on seven occasions. After being convicted for the first time in 1984 (peroxygen products cartel), Degussa joined other four cartels for which received a 50% fine aggravation, with exception for the methionine cartel (2002) in which did not received any fine increase. This constitutes an inconsistency in the light of what the notice foresees and

[11] Note that this number can be underestimated since there is no information on unknown cartels, both past and present.

is applied in the case of Akzo. Thereby, the EC reveals some ambiguity in the determination of the undertakings that are considered repeated offenders. Degussa was also convicted in 2003 by a cartel that despite having started before the first conviction in 1984 ended only in 1999 whereby an increase of 50% was correctly applied. (See tables 7 and 8 in appendix II.) Retaking the trade-off, imposing higher fines to recidivists seems reasonable because they have higher propensity to commit the infringement and can learn from the first prosecution process which can give them an advantage to better hide the infringement or prepare their defence. Moreover, a recidivist deserves a moral condemnation for its behaviour. However, to give, under LP, the same treatment to recidivists as to first offenders is a different question and requires some attention. One option is its exclusion from LPs as stipulated in the Greek LP until its revision in 2011[12]. This not seems to be an effective option since can have the counter-productive effect of encouraging recidivism. The reasoning is that if we consider the extreme case wherein a cartel is exclusively composed by repeated offenders, their exclusion from leniency would protect the cartel from the positive enforcement effects of the program, becoming it easier to maintain and more difficult to detect. Thereby, a convicted cartel has more incentives to re-establish. As seen in the literature, Chen and Rey (2012) also do not support the idea of prohibiting leniency for repeated offenders. Marvão (2014) considers that LPs should be less generous regarding how recidivists are treated. Accordingly, we suggest that the EC should continue to accept immunity applications from recidivists. However, in the cases wherein recidivists only cooperate with the AA after opening the investigation it's plausible to still grant a fine reduction, provided it does not cancel the effect of the aggravating circumstance. Therefore, should be applied a fine increment between 100 and 50% due to recidivism and a fine reduction up to 50% under the LP. The fine aggravation should be harsher for 'pure' recidivists[13] (e.g 100%) and milder for the ones that once catch by the AA did not revealed their past or current involvement on other cartels. Note that this is a broader concept of recidivism than the one used by the EC. When a 50% increase is applied for recidivism the fine reduction should be lower than 50%. In this way, leniency is able to still induce firms to cooperate with AA after the cartel discovering, but it also punishes the recidivism behaviour.

[12] See http://www.epant.gr/img/

[13] Firms that after being caught and convicted return to a collusive agreement in the same on in other market

Besides punishing firms that when convicted for their participation in one cartel do not report their involvement in other cartels[14], LPs should compensate generously the ones who report. Actually, US legislation provides that firms which were not able to obtain leniency for the involvement in one cartel, can obtain full immunity if they report a new cartel as well as obtain a substantial fine reduction regarding the first cartel. This is not applied by the EC since the maximum a firm can get from denouncing a new cartel is the immunity in that case, having no repercussions in the first cartel involvement. For example in 2001 the EC, after accomplishing its own initiative investigation, convicted four companies regarding the Belgian beer market cartel. One of the firms convicted (Interbrew) informed the EC about its participation in other cartel in the Netherland market and the existence of a similar cartel in the French market in which Interbrew had not participated. This information allowed the EC to convict both cartels and Interbrew received full immunity in the Netherland market cartel. However, regarding the initial case (Belgian Market) Interbrew only received a 30% fine reduction relative to its bilateral agreement with Alken-Maes and 50% relative to the private-label beer cartel. The fact that this firm provided information that allowed discovering two more cartels was not taken into account in the reductions granted.

The EC's legal framework is also driven by contradictory forces in the treatment of ringleaders. The EC considers that exerting a leading behaviour in a cartel is an aggravating circumstance. However, it also allows ringleaders to apply for leniency provided that it did not have exerted a coercive power in inducing other firms to enter the cartel, contrary to US that exclude them. For example, in the bitumen cartel convicted in 2007 Repsol and Pras received an increase of 30% in their fines for acted as co-leaders. However, in compensation for their cooperation they received a fine reduction under LP of 40% and 25%, respectively. In the case of Repsol the LP cancels the effect of the aggravating circumstance. In turn, for Pras the aggravation due to its leading behaviour prevails over the leniency reduction. As discussed in the literature review it is not a straightforward question whether to exclude or not ringleaders from LPs. A firm that behaves as a leader should have a higher fine relative to its minor partners. However, ringleaders are likely to be the ones with more valuable information for the EC. Thus, not excluding them from LPs is the most direct way to extract this information from them. Contrary to what happens in the recidivism context, in this case I consider that the fine reduction obtained under the LP should be allowed to exceed the fine aggravation for being a ringleader. The reasoning is that the advantage that arises from the

[14] Even if its involvement has ended

possibility of obtaining more valuable information is higher than the damage caused by the behaviour of the ringleader in particular. In terms of social welfare it is much worse the damage caused by recidivism than by the fact that one cartel member behave as a ringleader since probably the cartel would have existed without its action.

Other point that deserves some attention is that one of the requirements under the leniency notice to obtain full immunity is to keep confidential the collaboration with the EC until at least the starting of the inspections of the other undertakings. This requirement introduced by the 2006LN was an essential change to preserve the integrity and effectiveness of inspections. In fact, it is essential to ensure that the other cartel members are surprised by the AA inspections in order to avoid the destruction of incriminating evidences. In the Italian raw tobacco cartel (2006), Deltafina lost the amnesty because its chairman, besides being aware of the confidential commitment, voluntarily disclosed its immunity application to other two cartel members days before the starting of the investigations. This fact unleashed the leniency application of the two informed firms and jeopardized the effectiveness of the investigations. In this sense, it is crucial to punish the undertakings that break the confidentiality agreement by excluding them from the program or granting them just a moderate fine reduction. However, looking at this question from the firm's perspective, impose punishments in this context can disincentive firms to apply for leniency, since there is some degree of difficulty in keeping an immunity application confidential. Thereby, it is important to guarantee that firms are only punished when is proved that the disclosure of information results undoubtedly of an intentional and voluntarily decision of the leniency applicant.

As seen some authors defend the incorporation of a reward scheme on the design of LPs. South Korea has been a pioneer in this matter, having introduced a cash rewards scheme for individual whistleblowers in 2002. Initially the amount of the reward was too low to generate reports (the maximum was around $20,000). In November 2003 the ceiling was increased to $100,000 but generated only 5 reports until May 2005 when was increased to $1 million (Spagnolo, 2008). In December 2012, the maximum reward was again increased to $2.8 million (Stephan, 2014). This possibility is until now discarded by the EC which seems to be a good option since its implementation entails some problems which limit its effectiveness. As seen in section 2.1.7, Aubert, Rey and Koravic (2006) explored the adverse effects of rewards as political implementation difficulties. Also some sociological literature points out the difficulties experienced by individual whistleblowers which inhibit them from reporting. Therefore, the high individual costs and risks associated with individual

whistleblowing imply that rewards would need to be extremely large in order for reporting to be worthwhile. And since measures for protection from retaliatory to employers are not easy to implement a rewarding scheme is not likely to be. However, its implementation in a corporate context should be considered by the EC, since as seen some authors defend that its introduction is the only way to avoid the undesirable cartel stabilization effect.

Concerning the conflict between public and private enforcement we find two questions that should be addressed when to find the right balance between protection of LP and protection of cartel victims. The first question is whether leniency applicants and the other cartel members should be subject to the same treatment regarding its liability. The second is whether claimants should have access to documents and statements collected under the LP. Consider leniency applicants not liable for damages and give full access to leniency material would be the ideal solution to maximize LP's attractiveness. However it's not feasible since in 28% of the cases concluded by the EC after the introduction of LP all undertakings cooperated under LP. Thus if none of them is liable for damages, injured parties are not able to exert their right for compensation. If only full immunity recipients are not liable for damages and are the other undertakings who assume the compensations, as proposed by Buccirossi, Marvão and Spagnolo (2015), the incentives of these cartel members to cooperate with the EC will decrease under penalty of contribute with additional information that can be used against them in private damage actions. Therefore, the most reasonable option is to protect leniency material such that whether or not to participate in the program does not influence the information used by injured parties. Once leniency material is protected it's not necessary consider immunity recipients not liable for damages. However, partial limit its liability only to the harm caused by them seems reasonable. Indeed, this is the EC' approach.

Another noteworthy observation is that besides the 2002LN started to grant full amnesty to cartel members that report after the case opening, in only one occasion this occurred. It was in the power transformers case (2009) that Siemens received full immunity for providing crucial information to the EC after the case opening.

To conclude, despite the advances that presupposed the two revisions the EC should strive to design a notice even more specific. As seen during the application of the 2006LN the duration of the investigation was lower, which suggests that the introduction of specified guidelines regarding information requirements contributed positively to the acceleration of the leniency application process. Therefore, in further revisions the EC should attempt to increase the level of explicitness not only as a way to reduce the process time as to guarantee that firms clearly access the consequences they face with their application

4. Conclusions and further research

LPs are a powerful weapon to fight against cartels. Eliminate or reduce fines for reporting firms has allowing AA to increase the number of convicted cartels and the level of fines imposed. This is evident in the EC case, in which the number of cases initiated per year increased, according to our descriptive statistics, from 2,5 to 5,3, on average, after the introduction of leniency. However, its introduction does not seem to reduce significantly investigations duration and therefore not reduce AA' costs. Moreover, the number of repeated offenders accounts for 24% of the convicted firms which evidences the importance of increase recidivists' punishment. Nevertheless, it exclusion from LPs can have the reverse effect of encouraging recidivism. Thereby, immunity should be available for repeated offenders, as well as fine reductions, but provided that the reduction due to leniency does not cancel the effect of the fine aggravation due to recidivism. The same applies to the ringleader's case, whose exclusion is even more damaging to LP effectiveness since they are, in principal, the cartel members with more valuable information for AA. Regarding private damage actions, protect leniency material and partially limit immunity recipients liability seems to be the best approach.

The analyzed literature suggests that LPs must be generous to avoid the undesired effect of stabilize cartels and be able to induce firms to report higher quality information. The first reporter should receive the higher fine reduction or immunity, both before and after an investigation has been launched. In addition, rewards may be considered, however they are better suited to firms than to individual whistleblowers. The reasoning is that the risk and cost for employees that report are very high whereby for rewards to be effective would need to be extremely large which becomes unfeasible its application.

In summary, the ECLP seems to be effective, especially in cartel detection, but there is some scope for improvement. Whether this increase in cartel detection is due to its effectiveness or just due to a rising of cartel activity remains a question for clarify, which demands further research. Experimental economics seems to be the most adequate to address this deterrence effect question. Also, the issue of recidivism was not much explored in theoretical studies being sometimes taken as a way to simplify the model.

5. Appendix I. – Legislation

Sherman Act

Section 1 of the Sherman Act (1890) states that "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. (...) shall be punished by fine not exceeding $100,000,000 if a corporation, or, if any other person, $1,000,000, or by imprisonment not exceeding 10 years'

Article 101 of the TFEU

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

(a) directly or indirectly fix purchase or selling prices or any other trading conditions;

(b) limit or control production, markets, technical development, or investment;

(c) share markets or sources of supply;

(d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;

(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.

2. Any agreements or decisions prohibited pursuant to this Article shall be automatically void.

3. The provisions of paragraph 1 may, however, be declared inapplicable in the case of:

- any agreement or category of agreements between undertakings,
- any decision or category of decisions by associations of undertakings,
- any concerted practice or category of concerted practices,

which contributes to improving the production or distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit, and which does not:

(a) impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives;

(b) afford such undertakings the possibility of eliminating competition in respect of a substantial part of the products in question.

Directive 2014/104/EU

Article 6

Disclosure of evidence included in the file of a competition authority

(...)

6. Member States shall ensure that, for the purpose of actions for damages, national courts cannot at any time order a party or a third party to disclose any of the following categories of evidence:

(a) leniency statements; and

(b) settlement submissions.

Article 11

Joint and several liability

1. Member States shall ensure that undertakings which have infringed competition law through joint behaviour are jointly and severally liable for the harm caused by the infringement of competition law; with the effect that each of those undertakings is bound to compensate for the harm in full, and the injured party has the right to require full compensation from any of them until he has been fully compensated.

(...)

4. By way of derogation from paragraph 1, Member States shall ensure that an immunity recipient is jointly and severally liable as follows: (a) to its direct or indirect purchasers or providers; and (b) to other injured parties only where full compensation cannot be obtained from the other undertakings that were involved in the same infringement of competition law.

Appendix II – Tables and Figures

Table 1 – Comparison between 1996, 2002, 2006 leniency notices and the 1993/1994 US LP

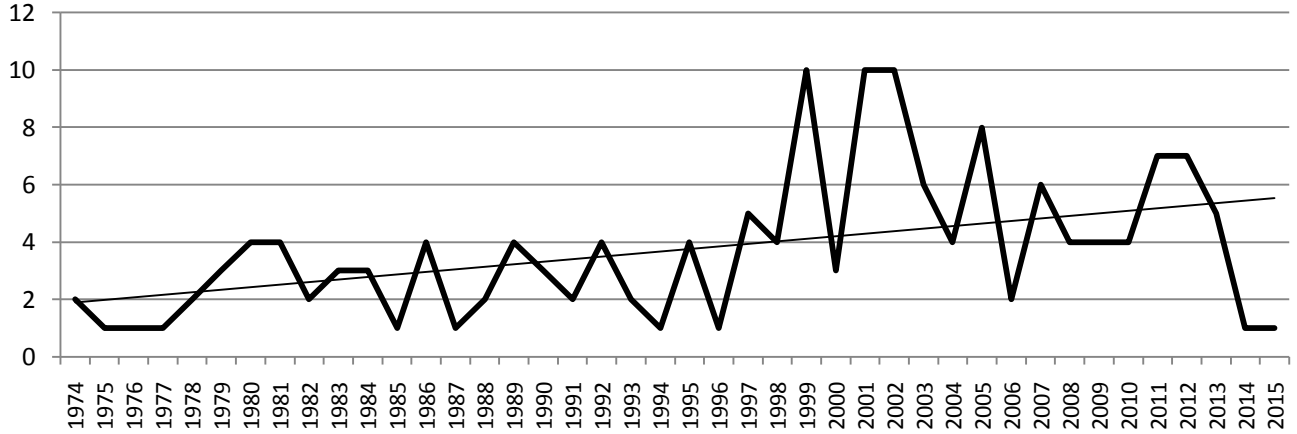
	1996 LN	2002 LN	2006 LN	1993/94 US
When applicant must end its involvement in the cartel?	'no later than the time at which it discloses the cartel'	'no later than the time at which it submits evidence'	'immediately following its application, except for what would, in the EC's view, be reasonably necessary to preserve the integrity of the inspections'	'prompt and effective action to end its participation in the activity'. Participation can continue with DOJ's approval
When applicant learns level leniency granted?	'only on its adoption of a decision'	'once the commission has received the information and evidence (...) and has verified that it meets the conditions'	'once the commission has received the information and evidence (...) and has verified that it meets the conditions'	Assistant Attorney General for litigation makes final decision once application has been considered
Full immunity granted just 1st reported?	YES	YES	YES	YES
Fine reductions to subsequent applicants?	YES 10-75%	YES 30-50% first 20-30% second up to 20% subsequent	YES 30-50% first 20-30% second up to 20% subsequent	NO But reductions for cooperation can be considered at plea bargain
Full immunity available after investigation?	NO Just fine reduction 50-75%	YES 'on the condition that the EC did not have sufficient evidence'	YES 'on the condition that the EC did not have sufficient evidence'	YES DOJ 'does not have evidence (…) that is likely to result in a sustainable conviction'
Information requirements to qualify immunity	'is the first to adduce decisive evidence of the cartel's existence'	'first to submit evidence which in the EC's view may enable it to adopt a decision to carry out an investigation' or 'find an infringement'	'first to submit information and evidence which in the EC's view will enable it to carry out a targeted inspection' or 'find an infringement' The information needed is 'listed' and specified.	first to 'report illegal antitrust activity'
Parties excluded from immunity	'has compelled another enterprise to take part in the cartel and has acted as instigator or played determining role'	'take steps to coerce other undertakings to participate in the infringement'	'took steps to coerce other undertakings to join the cartel or to remain in it'	'coerced another party to participate in the illegal activity or clearly was the leader in, or originator of, the activity'
Available for individual employees?	'does not therefore cover requests from individual employees'	NO	NO	'leniency will be granted to an individual reporting illegal antitrust activity'
Private Civil	LP 'cannot protect an enterprise from civil	LP 'cannot protect an undertaking from	LP 'cannot protect an undertaking from civil	ACPERA limits private damage

Damage	law consequences'	civil law consequences'	law consequences' Limited liability - Directive 2014/104/EU	actions – amnesty recipients are not liable for treble damages just single damages

Table 1.1 – Guidelines for setting fines

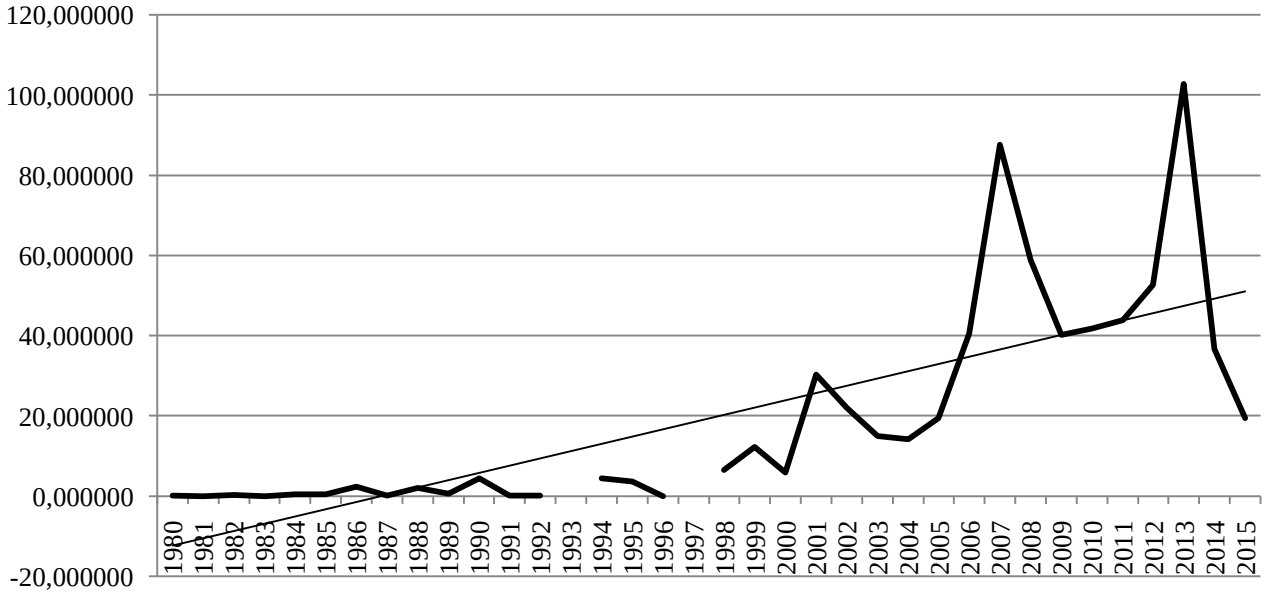
1998	**2006**
Step 1 – Set Basic Amount (x+y) • Gravity of offense (x) o Minor (€1000 – €1million) o Serious (€1 – €20 million) o Very serious (above 20€ million) • Duration Infringement (y) o ≤ 1 year – not increase fine o 1-5 years – increase by 50% o More 5 years – increase 10% for each year after the 5th **Step 2 –** Consider aggravating & Attenuating factors • Aggravating – recidivism, leading role, obstruction EC investigation, retaliatory behaviour against other undertakings; among others • Attenuating – passive role, non-implementation of the offending agreement, termination of the infringement as soon as the EC intervenes, infringement committed as a result of negligence; among others **Step 3 –** legal maximum fine – 10% of total turnover **Step 4 –** Leniency Reductions	**Step 1** – Set Basic Amount (x*y) • Value relevant sales (x) – Is considered a proportion up to 30% of the annual value of sales depending on the degree of gravity of the infringement • Duration Infringement (y) – number years and months the infringement lasted • Additional basic amount ('entry free') – sum between 15-25% of the value of sales used as an additional deterrent effect **Step 2 –** Consider aggravating & Attenuating factors • Aggravating – recidivism, leading role, obstruction EC investigation, retaliatory behaviour against other undertakings; among others • Attenuating – passive role, non-implementation of the offending agreement, termination of the infringement as soon as the EC intervenes, infringement committed as a result of negligence; among others **Step 3 –** legal maximum fine – 10% of total turnover **Step 4 –** Leniency Reductions

Figure 1 – Number of Cartel Investigations Started



Note: Are included all the cases initiated that resulted in successful conviction and the cases under investigation

Figure 2 – Average Fines per firm

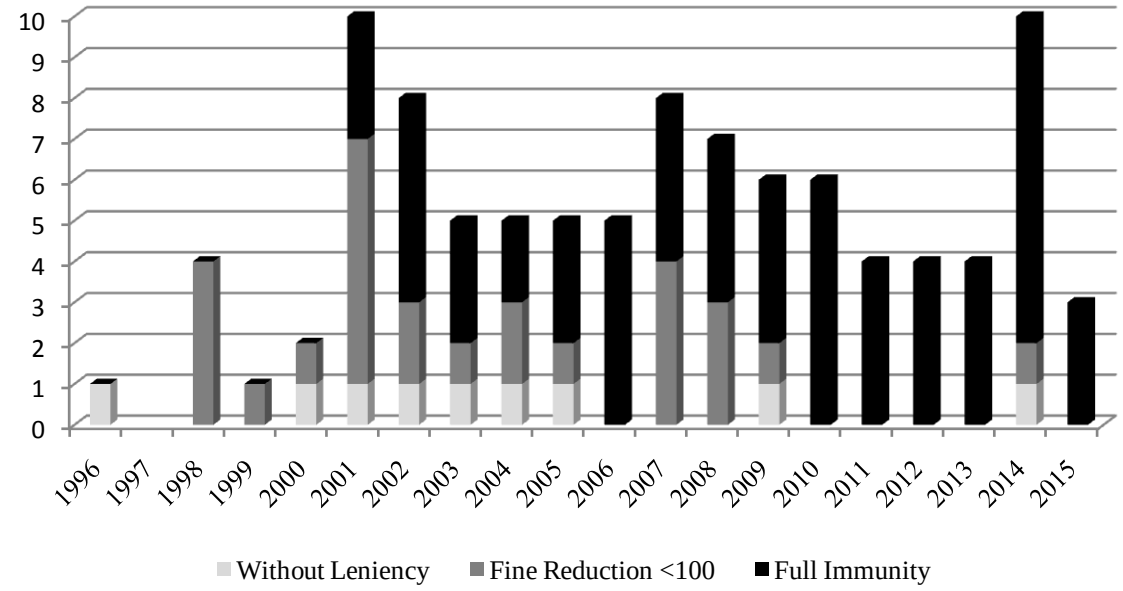


Note: In 1993 and 1997 there were no concluded cases

Table 2

	Before Introduction Leniency Program	**After Introduction Leniency Program**
N. cases initiated per year	2,5	5,3
Cartel Size	9,4	6,2
Duration Investigation (months)	39	48
Duration Investigation/firm (months)	11,5	9,6
Fines (million €)	16,078981	236,540854
Fines/Firm (million €)	1,482083	42,991724
Duration Cartel (months)	73	88

Figure 3 – Number of cartel cases convicted after the introduction of the 1996LN



Note: In 1996 there were concluded two cartel cases however one was before the notice (18/07/1996), thus is not considered here

Figure 4 – Cartel Cases concluded after the introduction of the 1996 Leniency Notice

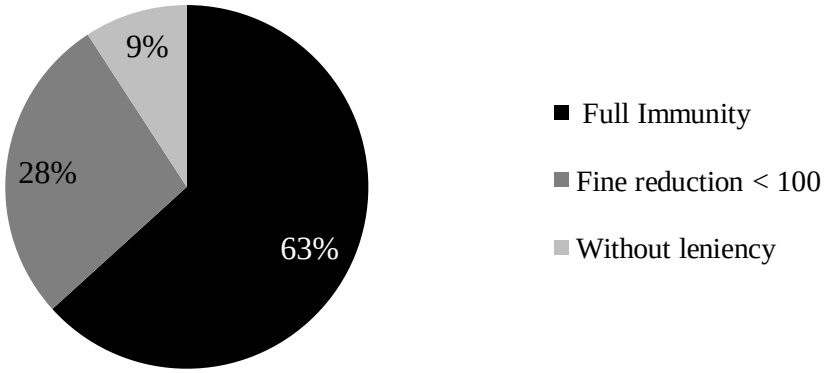


Figure 5 – Number Firms Convicted after the introduction of the 1996LN

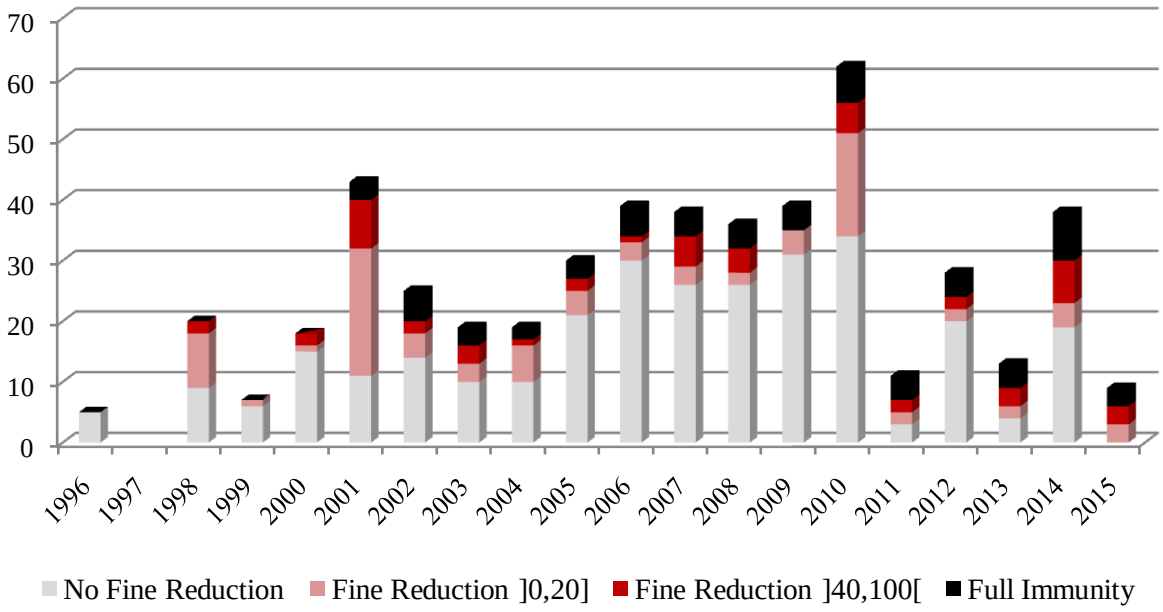


Figure 6 – Firms Convicted after the introduction of the 1996 Leniency Notice

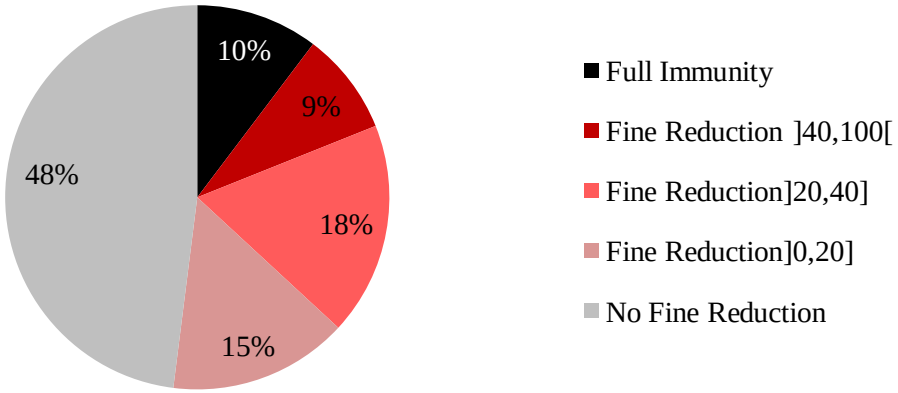


Figure 7 – Timing of the leniency application

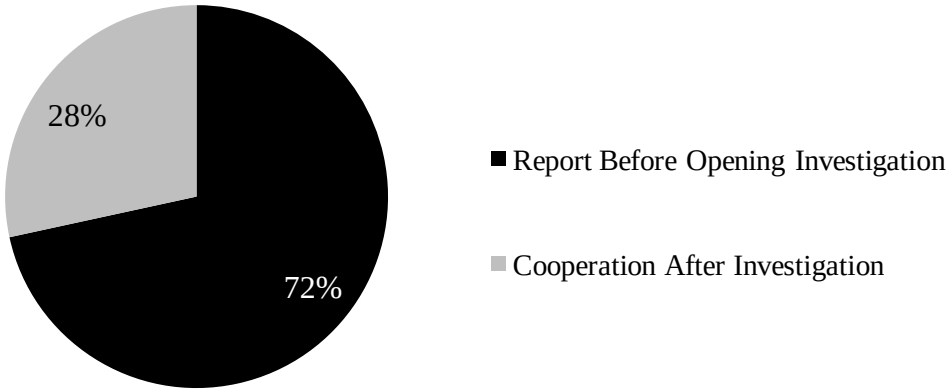


Table 3

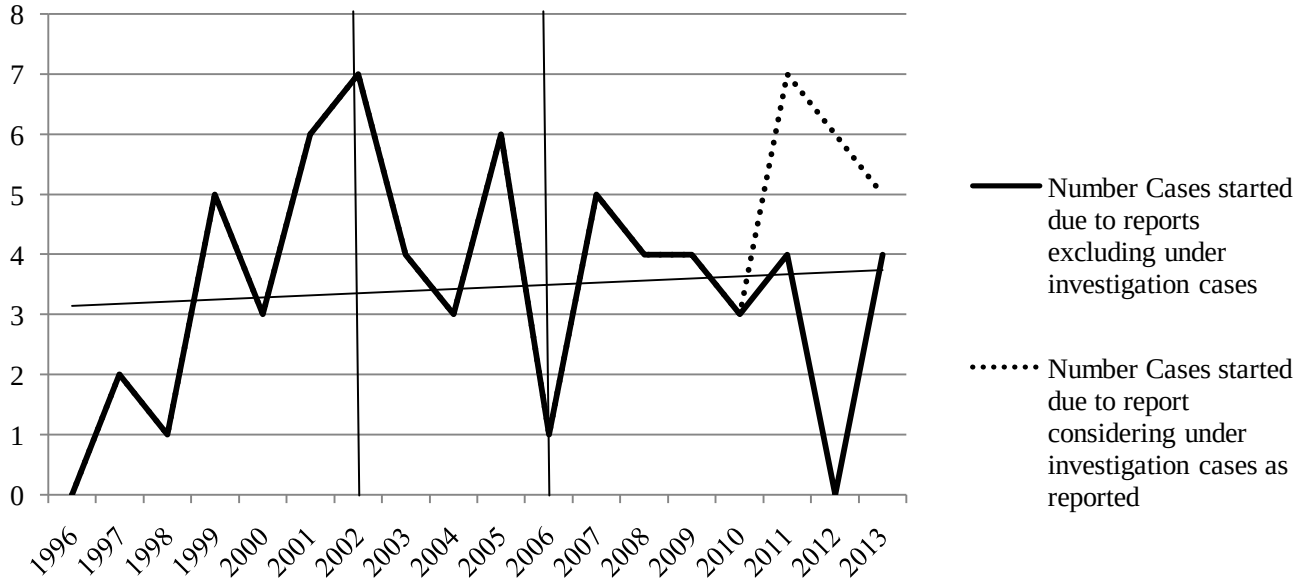
		AA initiative	
	Report Before opening Investigation	**Cooperation After Investigation**	**Without Leniency**
Cartel Size	6,3	5,7	6,4
Duration Investigation (months)	47	49	49
Duration Investigation/firm (months)	9	10	10
Fines (million €)	261,151543	209,516140	149,055300
Fines/Firm (million €)	41,101298	47,910094	42,605480
Duration Cartel (months)	100	67	58

Table 4 - Comparison of the 1996, 2002 and 2006 Leniency Notices regarding the detection method

	AA Initiative							
	Report Before Opening Investigation		Cooperation After Investigation		Without Leniency		Total	
	Number of Cases started	%	Number of Cases started	%	Number of Cases started	%	Number of Cases started	%
1996 LN	17	52	11	33	5	15	33	37
2002 LN	20	71	7	25	1	4	28	31
2006 LN	25	86	2	7	2	7	29	32
Total	62	69	20	22	8	9	90	100

Note: The cases under investigation are not included since the AA only publishes in the final decision if the investigation was started due to a leniency report or to its own initiative.

Figure 8 – Number of cartel investigations started due to firm' reports



Note: The AA only publishes in the final decision if the investigation was started due to a leniency report or to its own initiative therefore the cases under investigation are accounted using two approaches

Table 5– Comparison of the 1996, 2002 and 2006 Leniency Notices

	1996 LN	2002 LN	2006 LN
Number Cases initiated per year*	5,5	7,0	4,4
Number Cases initiated due to reports per year**	2,8	4,2	4,9
Cartel Size	6,2	7,0	5,3
Duration Investigation (months)	49	52	41
Duration Investigation/firm (months)	9,4	10,0	9,1
Fines (million €)	123,140	369,288	294,474
Fines/Firm (million €)	20,367	68,117	55,780
Duration Cartel (months)	98	94	68

* Includes the cases under investigation and the cases open by the AA initiative.
** The cases under investigation are all considered as reported cases.
Note: 2015 is not included in the calculation of the number of cases per year, since the year is not completed.

Table 6– Repeated Offenders – Number of cartel cases per firm

	Cartel Cases
Atochem/Atofina/Arkema	10
Akzo Nobel	8
Degussa	7
Mitsubishi (Electric and cable Industries)	6
Bayer	5
Toshiba	5
ABB	4
Samsung	4
Solvay	4
Shell	4
Aventis (Rhône-Poulenc)	4
BASF	4
Total	4
Hitachi/Hitachi Metals	3
Hoechst	3
Prym	3
Archer Daniels Midland (ADM)	3
Repsol	3
Asahi Glass	3
SGL	3
Du pont/ Dow	3
Eni	3
Eka Chemicals	3
Infineon	2
Philips	2
Renesas	2
Siemens	2
Fuji Electrics	2
Sumitomo Electic Industries	2
LG Electronics	2
Panasonic	2
Thyssenkrupp	2
Nippon Steel	2
Hoffman-La Roche	2
Sumitomo Chemical	2
Ajinomoto	2
Takeda Chemical	2
Coats	2
Interbrew (Inbev)	2
Groupe Danone	2
Heineken	2
Muller	2
Outokumpu	2

Deltafina	2
Chemtura	2
AC Treuhand	2
Saint-Gobain	2
Tokai Carbon	2
SAS	2
Pikington	2
Merck kga	2
Kemira	2
IMI	2
BP	2
Areva	2
Alstom	2
Chunghwa	2
FMC	2
Total repeated offenders	**58**

Table 7– Cartel cases wherein Akzo Nobel participated

Cartel	Investigation Duration	Cartel Duration	Leniency Reduction	Aggravation for recidivism
Sodium Gluconate I	1997-2001	1987-1995	20%	0%
Organic Peroxide	2000-2003	1971-1999	100%	0%
Choline Chloride	1999-2004	1992-1998	30%	0%
Monochloroacetic Acid	1999-2005	1984-1999	35%	0%
Hydrogen Peroxide	2002-2006	1994-2000	40%	0%
Sodium Chlorate	2003-2008	1994-2000	100%	0%
Heat stabilisers	2003-2009	1991-2000	0%	0%
Calcium carbide and Magnesium	2007-2009	2004-2007	100%	100%

Table 8– Cartel cases wherein Degussa participated

Cartel	Investigation Duration	Cartel Duration	Leniency Reduction	Aggravation for recidivism
Peroxygen Products	1880-1984	1961-1980	n.a	0%
Polypropylene	1983-1986	1977-1983	n.a	0%
Methionine	1999-2002	1986-1999	25%	0%
Organic Peroxide	2000-2003	1971-1999	25%	50%
Methacrylates	2002-2006	1997-2002	100%	50%
Hydrogen Peroxide	2002-2006	1994-2000	100%	50%
Calcium carbide and Magnesium	2007-2009	2004-2007	20%	50%

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