The Effectiveness of Corporate Leniency Programs

A proposal for experimental research

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Abstract

The introduction of corporate leniency programs is a recent development in competition policy. Corporate leniency programs provide fine reductions to cartel participants that report their collusive behaviour to the antitrust authority. The leniency programs aim to reduce collusive activities. However, theoretical studies indicate that corporate leniency programs may have pro-collusive effects as well as anti-collusive effects. Most theoretical studies argue that a courageous leniency program is the optimal leniency program. An experimental study is proposed to test this theoretical claim. The experimental study of Hinloopen and Soetevent (2008) is extended with a courageous leniency program experiment.

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1. Introduction

On November 12, 2008, the European Commission imposed a record-breaking fine of €
1,383,896,000 on four manufactures of car glass.[1] The European Commission found Asahi
Glass Company, Pilkington, Saint-Gobain and Soliver guilty of cartel infringement. The four
car glass manufactures formed an agreement on prices and market allocation between 1998
and 2003. This violates the European Commission Treaty and European Economic Area
Agreements on anticompetitive behaviour. The cartel members jointly controlled almost 90%
of the European car glass market. Due to the large size of the market – the market was worth
over more than € 2 billion during the last year of the cartel – and the significance of this case,
the fines imposed by the European Commission were extremely high. Not only is the total
fine of € 1,383,896,000 the largest fine ever imposed on a single cartel, the single fine of €
896,000,000 on Saint-Gobain is the highest fine ever imposed by the European Commission
on an individual firm for cartel infringement.[2]

This verdict demonstrates the increasing determination of the European Commission to ban
collusive behaviour. An interesting aspect of this particular case is the fine reduction given to
Asahi Glass Company. The European Commission received an anonymous tip-off about the
possible cartel activities of the four car glass manufacturers, which led to the cartel
investigation by the European Commission. During the cartel investigation Asahi Glass
Company provided the European Commission with additional information on the cartel
activities. The additional information helped the European Commission to successfully
penalise the cartel members. Asahi Glass Company received a 50% fine reduction because of
its cooperation with the European Commission during the cartel investigation. The fine
reduction is part of the European Commission's leniency program. Corporate leniency
programs are a relatively new development in the field of competition policy. Leniency
programs offer fine reductions to cartel members when they provide significant information
about the cartel to the antitrust authorities. In the last 20 years leniency programs have
become an important instrument of antitrust authorities and many countries have implemented
some type of leniency program. Due to the increasing importance of leniency programs, there
has been an on-going discussion about the optimal design of a leniency program. However,

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[1] Full European Commission press release can be found at the following website:
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1685&format=HTML&aged=1&language=EN
&guiLanguage=en
[2] See the following website for the official statistics:
http://ec.europa.eu/competition/cartels/overview/faqs_en.html

the first question that should be asked is whether or not corporate leniency programs are indeed effective in deterring collusive behaviour. Only when leniency programs are effective in deterring collusive behaviour, one should think about the optimal design of a leniency program.

This paper will examine several current theories on the effectiveness of corporate leniency programs. The theoretical literature review will show that corporate leniency programs may have pro-collusive effects, however, these effects will be offset by anti-collusive effects. The theoretical researchers do not agree on the optimal design of corporate leniency programs. Experimental research may help to provide a better understanding of the effect of corporate leniency programs on collusive behaviour. The main goal of this paper is to introduce a proposal for experimental research on the effectiveness of corporate leniency programs. The proposed experiment will improve our understanding of the effectiveness of corporate leniency programs. The design of current corporate leniency programs may be improved after conducting the proposed experiment.

This paper is organised as follows. First of all, the next section will discuss the economic theory behind competition and collusion as well as the fundamental principles of corporate leniency programs. The third section contains a detailed discussion of existing literature on the effectiveness of leniency programs. Theoretical and experimental research results will be discussed. In section four a proposal for future experimental research will be presented. Finally, section five will conclude.

2. Antitrust policy

In this section a few important concepts of collusion and competition theory and competition policy will be explained. Furthermore, the fundamental principles of corporate leniency programs will be discussed. This is necessary for the understanding of the detailed literature review in section three.

2.1. Collusion and competition theory

"People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices."

– Adam Smith, 1776 –

The phenomenon of collusion has a long history. Already in 1776 Adam Smith wrote about collusive behaviour in his famous work *The Wealth of Nations*. In this day and age, collusive behaviour is still an important topic of discussion. Since collusive activity is always anticompetitive and it usually distorts social welfare, collusive behaviour is not allowed in many countries. Collusion can be defined as a behavioural agreement between two or more firms in order to imitate a monopoly situation. When all parties agree to limit total output, to increase prices or to divide the market, the monopoly outcome can be realised. The cartel members will maximize their profits at the cost of social welfare (Lande & Marvel, 2000). Because cartel members have the intention to reduce competition, antitrust authorities define cartel activity as a type of organized crime (Spagnolo, 2005; Spagnolo 2008). For collusion to be successful, cartel members have to overcome three major challenges. First of all, the cartel members must agree on price and output levels. Secondly, firms must find a way to monitor the behaviour of all involved parties in order to prevent the cartel members from cheating on the agreement. In other words, the cartel participants develop a way to enforce the mutual agreement. Finally, cartel members will have to prevent non-cartel members from entering the market (Levenstein & Suslow, 2006).

The decrease in market competition due to cartel activities results in a reduction of social welfare. By setting the price above its competitive level, the cartel members increase their own profits at the expense of the consumers. One can say that cartels exert market power just like monopolistic firms. But not only do cartel members create market power by increasing the price level, they may also produce inefficiencies in product allocation. Cartel members may decrease their output level in order to increase the market price level. The cartel may also

shield its inefficient participants and this may result in higher average production costs (Leslie, 2006). In the end, the cartel causes a reallocation of wealth from the consumers to the producers. However, the productive inefficiency of cartel members causes that the loss of wealth for consumers exceeds the gain in wealth for producers. This reduction in total welfare is known as the "dead weight loss to society" (Fletcher, 2005).

2.2. Competition policy

In order to protect market competition, most countries have introduced competition laws that prohibit collusive behaviour. However, there is some discussion among researchers about the design of competition laws. Some economists believe that cartels have a very unstable nature. They argue that colluding firms have high incentives to cheat on the other cartel members. There is no need for an active competition policy, because the cartel will not survive (Stigler, 1964). Yet, in reality many countries have an active competition policy. In order to design a proper competition policy, it is important that countries examine the factors that influence the stability of a collusive agreement. One could think of factors like market concentration, product differentiation, entry and exit barriers (Levenstein & Suslow, 2006).

The formal competition laws do not stop firms from behaving anti-competitive. Many countries have set up an antitrust authority to help enforce the competition laws. The antitrust authority investigate whether or not firms violate the competition laws. However, in most cases the antitrust authorities have large difficulties detecting collusion. The illegal collusive agreements are often established behind closed doors. Therefore it is difficult for the antitrust authorities to proof collusive behaviour. Corporate leniency programs, a relatively recent development in competition policy, have been introduced to overcome the problem of collusion detection.

2.3. Corporate leniency programs

Corporate leniency programs allow a cartel participant to receive partial or full fine reductions if the cartel participant cooperates with the antitrust authority. Cartel participants that provide information about the cartel before the antitrust authority has started an investigation will be allowed to receive leniency. Cartel participants that provide additional information which reduces the duration of the investigation will also be able to receive leniency. The introduction of corporate leniency programs has increased the number of successful prosecutions of cartels (Aubert, Rey, & Kovacic, 2006).

Cartel participants will only report the collusive activities to the antitrust authority if they have significant incentives to do so. Corporate leniency programs are based on the concept of game theory. Game theory makes use of an abstract model in order to study how rational people make strategic decisions. By only providing a fine reduction to the first self-reporting firm, corporate leniency programs can be seen as a particular game known as the Prisoner's Dilemma (Motta 2004). Corporate leniency programs work rather simple. The antitrust authority provides a partial or a full fine reduction to the first cartel participant that comes forward with significant information about the existing cartel. The antitrust authority then uses this information to successfully punish the cartel members. The leniency procedure gives the antitrust authority information about the collusive activities which the antitrust authority would not have obtained otherwise (Aubert et. Al, 2003). Also, the corporate leniency program reduces collusive behaviour among firms that recognize the higher risk of cheating on the other cartel members in the presence of the corporate leniency programs (Spagnolo, 2008).

The main challenge of corporate leniency programs is getting the first cartel participant to provide information to the antitrust authority. As stated before, the corporate leniency programs reduce cartel formation by increasing the risk that a cartel participant will be reported by one of its cartel members. Often the self-reporting cartel participant has access to a significant amount of information and that may increase the speed of the prosecution process. One can conclude that the corporate leniency programs destabilise trust among cartel participants, which is one of the most important elements in a cartel formation. A combination of high fines and a corporate leniency program helps to increase the distrust between cartel participants. First of all, it gives cartel participants an incentive to cooperate with the antitrust authority while decreasing the costs of reporting. Secondly, it raises the costs of not reporting when another cartel member does cheat (Leslie, 2006). A cartel member is said to cheat when it decides to report the cartel to the antitrust authorities. This will lead to the breakdown of the cartel. A corporate leniency program should give enough incentives to cheat on other cartel members as this would lead to an unstable and unsustainable cartel (Spagnolo, 2008). By introducing a corporate leniency program in the collusion game, the risk element that comes along with the leniency program creates a situation that is similar to a Prisoner's Dilemma situation where not cheating on other cartel members is not a desirable outcome.

The cartel deterrence theory is one of the basic fundamentals of corporate leniency programs. The theory states that a firm will only participate in a cartel if the firm's profits will be higher

when participating in a cartel compared to the firm's profits when not participating in cartel (Motta, 2004). Therefore antitrust authorities should introduce corporate leniency programs in such a way that firms will choose to stay out of a cartel.

One way to examine whether a leniency scheme reaches this objective is to analyse the decision the firm faces. There are three main variables that affect a firm's decision whether or not to join a collusive agreement. First of all, the probability of discovery and prosecution of the collusive behaviour (p). Second, the level of punishment (P). Finally, the expected future gains for a firm when it is part of a cartel (EG). If the expected punishment (p*P) exceeds the expected gains from joining the cartel (EG), a rational firm will not become a member of the cartel. So as long as p*P > EG, then there will be no collusive agreements. Therefore the antitrust authorities should try to increase the probability of cartel discovery and prosecution and the height of fines in order to maximize cartel deterrence.

The antitrust authority can use two mechanisms for cartel deterrence. The first mechanism is the ex-ante deterrence mechanism. This mechanism concentrates on the prevention of collusive behaviour. The second mechanism is the ex-post deterrence mechanism. This mechanism focuses on sanctions imposed after firms show collusive activities. From a society-perspective, the ex-ante deterrence mechanism would be the most favourable option out of the two, as it prevents social welfare destruction from collusive practices and it avoids high costs of the cartel prosecution process (Motta & Polo, 2000; Spagnolo, 2008). However, one could argue that the ex-ante deterrence mechanism on itself would not work in practice. First of all, it requires the antitrust authority to extensively monitor firms, which make it an extremely expensive way of cartel deterrence. It is not efficient as the investigations focus on a much wider group of firms instead of only those firms that are willing to engage in cartel formations. Furthermore, the ex-ante deterrence mechanism does not stop the cartels that already exists. Therefore it might be more effective to set up an ex-post deterrence mechanism. An ex-post deterrence mechanism might be able to stop already existing cartels and it could significantly lower the investigation costs as the group under investigation can be limited to only the firms that are willing to engage in cartel activity. Also, the ex-post deterrence mechanism may work in an ex-ante way. The successful detection and prosecution of previous cartels may stop firms from forming cartels in the future.

One can conclude that each mechanism has advantages and disadvantages for cartel deterrence. Therefore, in reality most antitrust authorities developed corporate leniency

programs that are a combination of the two mechanisms. If one considers the equation on the previous page, a corporate leniency program tries to increase the probability of discovery and prosecution of the collusive behaviour (p) by identifying more cartels and thereby increasing the expected punishment (p*P). A higher expected punishment would deter current and future cartel activity. However, corporate leniency programs may also have pro-collusive effects. Providing leniency would reduce the fines (P) for the cartel participant that is the first to come forward. A reduction in the expected fines would negatively affect the deterrence effect of corporate leniency programs (Motta & Polo, 2003). Still, according to Spagnolo (2008), this pro-collusive effect is usually dominated by the higher probability of discovery and prosecution of the collusive behaviour. One can conclude that a corporate leniency programs which includes both ex-ante and ex-post deterrence mechanism, leads to the deterrence of current collusive behaviour and to the prevention of future cartel activity.

3. Literature review

In the previous section the economic theory behind collusion was discussed. The economic theory explained why collusion should not be allowed. Corporate leniency programs have an increasing importance in the deterrence and prevention of collusive activities. Therefore previous research concentrated on the design of the optimal corporate leniency program. Existing research papers consists of theoretical, empirical, and experimental research on corporate leniency programs. This section will give an overview of a selection of these existing research papers.

3.1. Theoretical and empirical research

Most of the existing literature on corporate leniency programs has a theoretical focus. All existing theoretical models take a mathematical form, however they do differ significantly. The differences between the optimal leniency models are mainly caused by the assumptions and characteristics of each model. The models have different assumptions about the type of leniency, ex-ante and ex-post deterrence mechanisms, and the number of firms eligible for leniency. The existing theoretical literature will be discussed based on these different assumptions. The existing empirical literature on corporate leniency programs is very limited and therefore included in the discussion of the theoretical literature.

3.1.1. Partially reduced fines

Under the partially reduced fine leniency program, self-reporting cartel members will be granted a partial reduction in the amount of fines they have to pay for violating the competition law. There has not been much research on the effectiveness of partial leniency programs. A study by Chen and Harrington (2007) is one of the few that did include the effect of partial leniency programs on cartel formation. According to Chen and Harrington (2007), partial leniency programs can have a pro-collusive effect. They argued as follows. Given that the probability of detection is small, a cheating firm might desire to make no use of the partial corporate leniency program. A firm is said to cheat when it deviates from the collusive agreement, for example by undercutting the price. However, Chen and Harrington (2007) assume that it is also allowed to apply for leniency in the periods after one of the cartel members cheats. When the cheating firm expects the other cartel members to apply for leniency after the deviation period, the cheating firm is likely to make use of the partial corporate leniency program during the period it cheats. This way the cheating firm is

guaranteed to get partial leniency, while if the cheating firm waits till after the deviation period then the probability of receiving partial leniency is much smaller. This argument suggests that a cheating firm may apply for partial leniency even when the firm would prefer to make no use of the partial leniency program. The existence of the partial corporate leniency program increases the expected fine for the cheating firm and therefore it lowers the firm's payoff to cheating. According to Chen and Harrington (2007), the partial corporate leniency program reduces the attractiveness of cheating and therefore the leniency program increases the stability of a cartel. Motta and Polo (2003) also found a pro-collusive effect of partial corporate leniency programs. However, their argument differs significantly with the argument of Chen and Harrington (2007). The difference is mainly due to the fact that Chen and Harrington (2007) focus on the stability of established cartels, whereas Motta and Polo (2003) focus more on incentives to start cartels. Motta and Polo (2003) argued that by partially reducing fines, the expected cost of collusive behaviour for a self-reporting firm is lowered. The decrease in expected cost is an incentive for self-reporting firms to engage in collusive behaviour. Given that the antitrust authority have sufficient monetary resources, Motta and Polo (2003) conclude that corporate leniency programs should not be implemented because of this pro-collusive effect.

However, it may be more realistic to assume that antitrust authorities face a limited budget. When antitrust authorities have limited financial resources, Motta and Polo (2003) recommend to introduce a corporate leniency program that includes partial or full fine reductions. They argue that fine reductions will stimulate cartel participants to inform the antitrust authorities about the anticompetitive activities. The self-reporting cartel participant will provide the antitrust authorities with significant information, that the antitrust authorities would not have received otherwise. This will decrease the duration of the antitrust authorities' investigation process, resulting in lower investigation costs for the antitrust authorities. This argument is supported by the findings of Innes (1999). Innes (1999) focused on activities that harm the environment. He found that, the sooner the damaging activities are discovered and ended, the damages may be partly or fully undone and therefore the social harm will be limited. Even though the specific results of the study by Innes (1999) have nothing to do with anticompetitive behaviour, they can be used to argue in favour of corporate leniency programs. One can conclude that partial leniency programs are favourable if investigation costs are saved and/or if an early discovery of cartel activities is beneficial for society as a whole.

Based on the existing literature, it is difficult to draw a conclusion about the effectiveness of partial leniency programs. The results of theoretical studies on partial leniency programs are rather ambiguous. In some situations partial leniency programs may increase the attractiveness of anticompetitive behaviour, but this need not always be the case. One may conclude that partial leniency programs do not guarantee a reduction in anticompetitive behaviour.

3.1.2. Fully reduced fines

Under the fully reduced fine leniency program, self-reporting cartel members will be rewarded with a full reduction in the amount of fines they would have to pay for behaving anticompetitive. Motta and Polo (2003) were among the first researchers to theoretically study the effectiveness of corporate leniency programs. Given that the antitrust authorities have limited financial resources, a full leniency program is preferred over a partial leniency program according to Motta and Polo (2003). By self-reporting, a firm would lose with certainty the future gains that the firm would have earned if the cartel was not discovered. Therefore Motta and Polo (2003) argue that self-reporting might reduce the future gains of cartel members that come forward to the antitrust authorities. Firms would only decide to self-report when the reduction in fines is generous enough to compensate for their forgone future gains. Therefore a full leniency program would convince more firms to self-report compared to a partial leniency program. Spagnolo (2005) agreed that full leniency programs can be used effectively for the reduction in collusive behaviour. The study by Spagnolo (2005) showed three cartel deterrence effects of partial and full leniency programs. The first effect is the "protection from fines" effect. This effect exists when the reduced fine under the leniency program is lower than the expected fine of a cheating cartel member that does not inform the antitrust authorities. By setting the expected payoff of a cheating and self-reporting cartel member above the expected payoff of a cartel member that just cheats, a cartel member has a higher incentive to inform the antitrust authorities. The second effect is the "protection from punishment" effect. This effect exists when a cartel is continued for more than one period. It is also assumed that cartel members who are repeatedly caught by the antitrust authorities, are punished harder than the cartel members that are caught for the first time. So when a cartel is reported to the antitrust authorities, the future fines will increase meaning that the expected gains from the cartel are reduced. According to Spagnolo (2005), the third deterrence effect of a full leniency program is the increase in riskiness of collusive behaviour. Trust is one of the main necessities for a successful cartel. By introducing a full leniency program the risk of

other cartel members reporting the collusive behaviour to the antitrust authorities increases. This may harm the trust among cartel members and hence destabilising the cartel.

Brenner (2005) empirically studied the effect of corporate leniency programs in competition policy. He focused on the efficiency of the European Union's moderate corporate leniency program, which was introduced in 1996. To be more precise, he studied the effects of the European Union's leniency program on the number of leniency applications, the size of fines, and the duration of cartel investigations. Based on his regression analysis, Brenner (2005) concluded that the corporate leniency program increased the number of leniency applications. This is in line with the conclusions of Motta and Polo (2003) and Spagnolo (2005). However, Brenner (2005) did not find significant effects of the European Union's leniency program on the duration of cartel investigations. This last result conflicts with Motta and Polo (2003). As stated before, Motta and Polo (2003) believed that a partial or full leniency program will reduce the duration of cartel investigations.

Based on the existing literature, one can state that fully reduced fine leniency programs may indeed help to reduce collusive behaviour. The full leniency program is preferred over the partial leniency program as a method of cartel deterrence according to the theoretical literature.

3.1.3. Positive rewards

Under the positive reward leniency program, self-reporting cartel members will be rewarded with a positive payment. This type of leniency program is also referred to as the courageous leniency program whereas the partially and fully reduced fine leniency programs are considered to be moderate leniency programs. Even though Spagnolo (2005) stated that moderate corporate leniency programs can have an effective deterrence effect, he concluded that the optimal corporate leniency program would be a courageous leniency program with high rewards for the self-reporting cartel members and high fines for the wrongdoers that do not inform the antitrust authorities. The rewards and fines need to be sufficiently high, otherwise the leniency program may not affect the cartel activity. If a cartel was formed before the implementation of the corporate leniency program, it means that expected profits from the cartel formation were positive. Under the moderate corporate leniency program, a self-reporting cartel member would expect a net loss from reporting the cartel to the antitrust authorities because the firm has forgone future gains from the cartel. So a moderate corporate leniency program may not be effective in deterring cartels. By setting the rewards and fines at

significant high level, the cartel members have a higher incentive to inform the antitrust authorities. According to Spagnolo (2005) a courageous corporate leniency program can be self-financing, when the total sum of fines paid by the wrongdoers covers the positive reward received by the self-reporting cartel member. The fines paid by the wrongdoers are transferred to the self-reporting cartel member. According to Spagnolo (2005) this will lead to full cartel deterrence at no social cost given that the fines are set at their maximum level.

Aubert et al. (2003) also found that courageous leniency programs are the optimal leniency program. The study of Aubert et al. (2003) focussed on moderate and courageous leniency programs for firms and individual persons. They concluded that a courageous leniency program for both, employees and firms, would be a strong instrument for a reduction in cartel activity. According to Aubert et al. (2003) the positive reward is necessary to persuade a cartel member to report the collusive activities to the antitrust authorities. The positive reward needs to compensate for the forgone expected benefits of the collusion compared to the expected benefits of the situation with no collusion. A way to deter collusion even more effectively is by introducing a courageous leniency program for individual employees of the colluding firms (Aubert et al., 2003). When the employees are rewarded by the antitrust authorities for providing information about the collusive activities, firms needs to bribe their employees in order to protect the cartel. Bribing the employees increases the cost of collusion for the firms. It makes collusive behaviour less attractive and hence it destabilises the cartel.

One can conclude that the courageous leniency program is an effective mechanism for reducing collusive behaviour. When one compares the courageous leniency program with the moderate leniency programs, the existing theoretical literature shows that the courageous leniency program would be the best mechanism for reducing collusive activities.

3.1.4. Ex-ante leniency programs versus ex-post leniency programs

As stated previously, an ex-ante leniency program focuses on the prevention of anticompetitive behaviour. Ex-ante leniency programs only allow leniency to self-reporting before the antitrust authorities started an investigation on the cartel activities. An ex-post leniency program focuses on the deterrence of anticompetitive behaviour. Ex-post leniency programs allow leniency to self-reporting cartel participants even after the antitrust authorities have started their investigation on anticompetitive behaviour of those particular cartel participants. Spagnolo (2000) focused on the ex-ante corporate leniency programs. He argued that ex-ante corporate leniency programs will destabilise cartels by increasing the risk that one

of the cartel members informs the antitrust authorities about the collusive activities. Aubert et al. (2003) also support the ex-ante mechanism. In their study the ex-post leniency programs is defined slightly different compared to the definition stated in the beginning of this section. Aubert et al. (2003) define the ex-post leniency program as a leniency program where firms can apply for leniency after the antitrust authority has finished its investigation. According to Aubert et al. (2003) firms reporting to the antitrust authority after it has successfully investigated a cartel is rather useless. Once the antitrust authority has successfully finished its investigation, any additional information does not significantly add value to the antitrust authority's investigation as the investigation is already completed. They also find that self-reports after the antitrust authority has unsuccessfully finished its investigation is more costly than self-reports before the antitrust authority has finished its investigation. When firms decide to come forward after the antitrust authority has completed an unsuccessful investigation, the antitrust authority may have to start a second investigation based on the new information provided by self-reporting firms. This type of process leads to unnecessary investigation costs compared to the situation where firms self-report before the antitrust authority has started an investigation.

However, not all studies prefer ex-ante leniency programs over ex-post leniency programs. According to Motta and Polo (2003) ex-post leniency programs are more effective for deterring collusive behaviour than ex-ante leniency programs. They argue that the probability of detection and prosecution increases as soon as the antitrust authority starts an investigation. Due to this higher probability, cartel participants have a higher incentive to come forward to the antitrust authorities. This may lead to lower investigation costs for the antitrust authorities and it may harm the trust among the cartel members. Therefore Motta and Polo (2003) argue that ex-post leniency programs should be preferred over ex-ante leniency programs.

The existing literature shows rather ambiguous results. Some studies favour ex-ante leniency programs over ex-post leniency programs (Spagnolo, 2005; Aubert et al., 2003), while others prefer ex-post leniency programs over ex-ante leniency programs (Motta and Polo, 2003). Therefore it is unclear whether the optimal corporate leniency program should have an ex-ante or an ex-post mechanism.

3.1.5. Single firm leniency versus multiple firms leniency

Another policy element that may affect the cartel deterrence effectiveness of leniency programs is number of firms eligible for leniency. If leniency programs only grant leniency to

the first self-reporting firm instead of all self-reporting firms, the effectiveness of leniency programs may be improved or vice versa. Spagnolo (2005) is in favour of a corporate leniency program that only grants leniency to the first self-reporting cartel participant. Spagnolo (2005) argues that if more self-reporting cartel members would be allowed to receive leniency, the corporate leniency program is more likely to be exploited. Every single period the cartel members would agree to collude and systematically report to the antitrust authorities. All the cartel members would be able to receive a reduction in the amount of fines they have to pay for violating the competition law. The exploitation of the corporate leniency program increases the value of the cartel and decreases the deterrence effect of the corporate leniency program (Spagnolo, 2005). Therefore Spagnolo (2005) concludes that antitrust authorities should only grant leniency to the firm that is the first to report.

Furthermore, by only allowing the first self-reporting cartel member to enjoy leniency, the risk that comes with joining the cartel is increased. The eligibility of only one cartel member may significantly harm the trust among cartel members as self-reporting becomes a credible threat. The reduction in trust increases the likelihood of cartel members rushing to antitrust authorities (Spagnolo, 2005). One can conclude that by only granting leniency to the first self-reporting firm, the so-called "race to report" can be created (Spagnolo, 2005). If more firms would have the possibility to receive leniency, firms would not race to the antitrust authority. According to Spagnolo (2005) the cartel participants would most likely play a waiting game, where collusive firms would only self-report if first another cartel member decides to come forward. This argument is in line with the views of the US Department of Justice. Officials of the US Department of Justice believe that only the first self-reporting firm should be granted leniency in order to protect the effectiveness of the corporate leniency program. Their view is supported by the significant increase in the number of leniency applications made by self-reporting firms after the European Commission introduced a policy that only grants full leniency to the first cartel member that comes forward before an investigation is started (Spagnolo 2005).

The papers, that address the discussion about the maximum number of firms eligible for leniency, favour leniency programs that only grant leniency to the first self-reporting firm. Therefore, one can conclude that the optimal leniency program only provides leniency to the first self-reporting firm.

3.2 Limitations of theoretical and empirical research

One can conclude that there is theoretical and empirical support for the cartel deterrence effect of corporate leniency programs. The existing theoretical literature shows that corporate leniency programs can decrease the cartel stability and encourage collusive firms to come forward to the antitrust authority. However, the findings described in the existing literature should not be accepted that easily. First of all, a corporate leniency program consists of many different elements, like the type of leniency and the number of eligible firms. Each theoretical model has its own assumptions about every single element. In each paper an optimal leniency program is based on a combination of assumptions. The exact effect of a certain element on the cartel deterrence effect of a corporate leniency program is difficult to determine, as it may be affected by the assumptions about other elements. Therefore it is hard to construct an optimal leniency program which is based on the results of theoretical research.

One should also take into account the study limitations in the case of empirical studies on corporate leniency program. The problem with empirical studies on corporate leniency programs is that only a small number of the existing cartels can be observed. Since cartel activity usually happens behind closed doors, the cartel samples of empirical studies are only drawn from a group of detected cartels. Therefore the sample may not be a good reflection of the actual cartel population as it will include a bias towards detected cartels (Brenner, 2005). Furthermore, the exact effects of corporate leniency programs are extremely difficult to measure. One cannot prove that the number of cartels reduces as the number of existing cartels is unknown due to the secretive nature of cartels (Spagnolo, 2008). Even though many countries face a significant increase in the number of successful cartel prosecutions after introducing a corporate leniency program (Aubert et al. 2003), no one can conclude that the introduction of a corporate leniency program has reduced cartel activity. An increase in the number of cartel prosecutions could, for example, be explained by an increase in cartel activity due to improved market integration within the European Union in the beginning of the 1990's (Brenner, 2005) or by the pro-collusive effects of corporate leniency programs as explained by Motta and Polo (2003). Another explanation for an increase in cartel prosecutions can be an increase in fines at the moment of introduction of the corporate leniency program. The increase in fines may trigger firms to come forward, where firms would not have reported their collusive activities if the corporate leniency program was introduced without an increase in fines.

Due to the limitations of the theoretical and empirical research, one cannot exactly determine what the optimal corporate leniency program should look like. Therefore it might be best to study the optimal leniency program by using experimental research.

3.3 Experimental research

We have seen that the theoretical literature has no direct answer to the optimal corporate leniency program. Furthermore, empirical analysis of cartel deterrence effects may be unreliable due to the non-observability of cartel activities. Anticompetitive behaviour is difficult to observe in natural markets, as firms try to hide collusive behaviour from the antitrust authority. Therefore, the effect of corporate leniency programs on cartel activity seems to be an interesting topic for experimental analysis. Experimental analysis in a laboratory allows for control of all variables. One will be able to study the exact effect of one variable on a dependent variable while controlling for the influences of other variables. In the case of corporate leniency programs, one can study the exact effect of a leniency program element on the cartel deterrence effect of the leniency program. This can provide significant information necessary for the creation of the optimal corporate leniency program. In this following section a number of existing experimental research papers will be discussed.

Apesteguia, Dufwenberg, and Selten (2007) were among the first to experimentally study the effectiveness of corporate leniency programs. Apesteguia et al. (2007) introduced a one-shot homogeneous Bertrand pricing game, on which they based their experimental games. The game goes as follows. The game starts with three firms that simultaneously have to choose a price between 91 and 100. The firm with the lowest price will make a profit, while the firms choosing a higher price will earn nothing. The profit will be equal to the difference between the chosen price and the cost of production, which is set at 90. Based on this simple game Apesteguia et al. (2007) created four different games; Standard, Leniency, Bonus and Ideal respectively. Each game reflects a particular competition policy. The Standard game reflects the situation previous to the introduction of a leniency program. The game consists of three stages. In the first stage subjects have to decide whether or not they want to communicate with the other two subjects. A cartel is formed when all three subjects decide to communicate. In the second stage each subject will choose a price in the range of 91-100. The third stage is only reached if a cartel was formed in the first stage. In the third stage subjects have to decide whether or not to report the collusive behaviour to the antitrust authorities. If a cartel is reported, all firms will face a fine of 10% of their revenue. The Standard game and Leniency

game are identical in the first two stages, but they differ in the reporting phase. Self-reporting firms receive a partial or full fine reduction in the Leniency game. If only one firm chooses to report the cartel, it will receive full leniency while the non-reporting firms face a 10% revenue fine. If two firms choose to report the cartel, they will both face a 5% revenue fine while the non-reporting firm has to pay a 10% revenue fine. The Bonus game resembles the Leniency game except that self-reporting firms have a chance to receive a bonus next to the fine reduction. If only one firm reports the cartel, it will receive full leniency and it will collect the 10% revenue fines paid by the non-reporting firms. If there are two self-reporters, both firms have to pay a 5% revenue fine. However, each self-reporter receives half of the 10% revenue fine paid by the non-reporting firm. When all firms decide to report the cartel, all three firms will face a 6.67% revenue fine and they will not receive any bonus. The Ideal game reflects the situation where communication is just not possible. Since collusion only exists after firms communicate, collusion is impossible in the Ideal game. This game only consists of the price decision stage, where each subject has to decide on the price. In the experiments of Apesteguia et al. (2007) each game was played by about twelve groups of three subjects. Based on their experiments, Apesteguia et al. (2007) conclude that moderate leniency programs reduce prices to the competitive price level. They also find a lower percentage of cartel formations in the Leniency game than in the other three games. However, the experiment results did not support the use of courageous leniency programs. Apesteguia et al. (2007) conclude that more cartels were established in the Bonus game than in the other games played.

An experimental study by Hinloopen and Soetevent (2008) focussed on the effectiveness of corporate leniency programs in relation to cartel formation, cartel duration, and cartel recidivism. Hinloopen and Soetevent (2008) based their experimental design on the study of Apesteguia et al. (2007). However, the two studies have significant differences. First of all, the games of Apesteguia et al. (2007) ended after one period, whereas in the study of Hinloopen and Soetevent (2008) the games continued for at least 20 periods. When the games last for only one period, the positive effects of a leniency program may be exaggerated as there are no costs of reporting. The bias towards the positive effect is reduced by repeating the games. Furthermore, Hinloopen and Soetevent (2008) considered the order in which firms report. By providing the first self-reporter the largest fine reduction, they allowed for a so-called race to report. In contrast, Apesteguia et al. (2007) provided the same amount of leniency to each self-reporting firm. The level of communication also differs in the two

studies. The communication between subjects in the study by Hinloopen and Soetevent (2008) was much more restricted than in the study by Apesteguia et al. (2007). Hinloopen and Soetevent (2008) allowed their subjects to communicate only about prices and the maximum communication time was one minute. Apesteguia et al. (2007) permitted their subjects to discuss anything except their identity and the subjects had ten minutes to communicate. Another difference is related to the probability of detection. In the study by Apesteguia et al. (2007) it was assumed that cartels will only be detected when a firm decides to report it. Hinloopen and Soetevent (2008) implemented a detection probability in their games. If there is an antitrust authority, there will be a positive probability that a cartel is detected, regardless of whether the cartel was reported or not. Finally, Hinloopen and Soetevent (2008) only took into account moderate leniency programs, while Apesteguia et al. (2007) focussed on both, courageous and moderate, leniency programs. Like Apesteguia et al. (2007), Hinloopen and Soetevent (2008) constructed a framework of four competition policy games. The experimental games are the Benchmark game, the Communication game, the Antitrust game, and the Leniency game. Hinloopen and Soetevent (2008) start with the Benchmark game and by adding a new element to each game they ultimately reach the Leniency game. This way the experiment results can be linked to the specific elements of a leniency program. The Benchmark game resembles the Ideal game of Apesteguia et al. (2007) as subjects are not allowed to communicate in the Benchmark game. A cartel is formed once all three subjects decide to communicate, therefore it is impossible to form a cartel in the Benchmark game. In the Communication game the three subjects are allowed to communicate about prices and hence form a cartel. The detection probability is zero in the Communication game and firms do not have the option to report collusive behaviour, hence the cartel will be formed at no cost. The Antitrust game is identical to the Communication game, however, cartels now face a 15% detection probability. If a cartel is detected, all subjects will face a 10% revenue fine. In the Antitrust game, subjects do not have the opportunity to report the cartel to the antitrust authorities. The reporting option is added in the Leniency game. In contrast to Apesteguia et al. (2007), Hinloopen and Soetevent (2008) based their leniency scheme on the order of reporting. The first self-reporting firm will receive full leniency and the second reporting firm will only have to pay half of the 10% revenue fine. The last self-reporting firm will not receive leniency and therefore has to pay the full 10% revenue fine. If a cartel is not reported by one or more of its members, the firms still face the 15% detection probability. Hinloopen and Soetevent (2008) conclude that a leniency program significantly destabilises cartels. Their experiments show that non-communicating subjects become more persistent and the cartel

defection rate increases once a leniency program is introduced. This might indicate that the trust among subjects is reduced due to the introduction of the leniency program. Finally, Hinloopen and Soetevent (2008) do not find a relation between leniency and cartel recidivism. This means that leniency programs do not keep anticompetitive firms from forming a new cartel after they have been fined for collusive behaviour.

One of the most recent studies on the effectiveness of corporate leniency programs is a study by Dijkstra, Haan and Schoonbeek (2011). Dijkstra et al. (2011) based their experimental design on the study of Hinloopen and Soetevent (2008). However, the two studies have a few significant differences. First of all, the experimental games of Dijkstra et al. (2011) were played by groups of two participants, while the groups in Hinloopen and Soetevent (2008) consisted of three participants. Furthermore, just like Apesteguia et al. (2007), Dijkstra et al. (2011) did not restrict the communication between participants. Finally, Dijkstra et al. (2011) permitted subjects to report a cartel and receive leniency after the antitrust authority had started an investigation. This assumption is in line with the theory of Motta and Polo (2003), yet previous experimental studies, like Hinloopen and Soetevent (2008), did not provide leniency after an investigation was started. Dijkstra et al. (2011) believe that by providing leniency after an investigation has started, the experiments will be a better reflection of reality. Dijkstra et al. (2011) conclude that leniency programs indeed reduce the number of cartel formations. Furthermore, they find that a small number of in-depth cartel investigations leads to fewer cartels compared to a large number of superficial cartel investigations. Dijkstra et al. (2011) also conclude that leniency programs have no effect on cartel recidivism, which is in line with the results of Hinloopen and Soetevent (2008).

There are a few experimental studies that did not base their experiments on the studies by Apesteguia et al. (2007) and Hinloopen and Soetevent (2008). One of these studies is conducted by Hamaguchi and Kawagoe (2005). Hamaguchi and Kawagoe (2005) study the effectiveness of different leniency programs while controlling for the number of cartel participants and the number of cartel participants eligible for leniency. In this study it is assumed that cartels have been formed before the antitrust authority announces the introduction of a leniency program. There are two different leniency programs considered by Hamaguchi and Kawagoe (2005). One leniency program only provides leniency to the first self-reporting firm, while the other leniency program grants leniency to all self-reporting firms. Hamaguchi and Kawagoe (2005) force participants to form a cartel at the beginning of the experiment and each cartel consists of either two or seven participants. Once the cartels

are formed, each participants will be informed about the probability of investigation by the antitrust authority. Finally, each participant has to decide whether or not to report the collusive behaviour to the antitrust authority. Hamaguchi and Kawagoe (2005) find that cartel deterrence is positively related to the number of cartel participants. An increase in the number of cartel participants leads to an increase in cartel deterrence. They also conclude that limiting the number of self-reporting firms eligible for leniency does not lead to a so-called race to report. However, the study by Hamaguchi and Kawagoe (2005) has substantial limitations. First of all, the experiment participants were forced to form a cartel. The participants were not allowed to choose whether or not they wanted to join a cartel. Hence, the results can only be used to determine the ex-post deterrence effect of leniency programs. Furthermore, the experiment of Hamaguchi and Kawagoe (2005) is restricted to situations where leniency programs were present. If they had applied the experiment to situations where leniency programs were absent, the results of both experiments could be compared. By comparing the results of both situations, one could determine the effectiveness of corporate leniency programs more accurately. Due to these significant limitations, the results of the study by Hamaguchi and Kawagoe (2005) should be taken with a grain of salt.

Feltovich and Hamaguchi (2010) experimentally studied the effectiveness of moderate leniency programs. They compared a partial leniency program and a full leniency program with the situation where there is no leniency program. This was done by means of repeated duopoly games. In each game participants first had to choose a low, middle or high price. A cartel was formed when both participants chose a high price. If the game included one of the two leniency programs, the participants had to decide whether or not to report the collusive behaviour to the antitrust authority. If a participant decided to report the cartel, it would receive a partial or full fine reduction. If both participants did not report the cartel, there was a small probability that the antitrust authority would detect the cartel. Feltovich and Hamaguchi (2010) find that participants are more likely to form a cartel when one of the moderate leniency programs is in force. Furthermore, they find that both moderate leniency programs reduce the probability of cartel members undercutting the cartel price. Hence, moderate leniency programs increase the stability of a cartel. However, by allowing participants to report a cartel to the antitrust authority, both moderate leniency programs also reduce the stability of a cartel. According to Feltovich and Hamaguchi (2010), the positive and negative effects of moderate leniency programs on cartel stability offset each other. Therefore they conclude that moderate leniency programs have an insignificant effect on cartel stability. This

result is in line with the theory of Motta and Polo (2003), as Motta and Polo (2003) believed that moderate leniency programs could have pro-collusive and anti-collusive effects.

Based on the discussed experimental studies, one may conclude that introducing a corporate leniency program can indeed be an effective way of reducing collusive activities. Most experimental papers found that the introduction of a corporate leniency program negatively influences the formation of cartels. However, the existing experimental literature is rather limited, because experimental research on the effectiveness of corporate leniency programs started only about 10 years ago. Therefore there is still a lot of room for further research. In the next section, a proposal for further research will be discussed. An extension of the experimental design of Hinloopen and Soetevent (2005) will be proposed in order to study the effectiveness of a courageous leniency program.

4. A proposal for experimental research

This section will contain a proposal for future experimental research on the effectiveness of corporate leniency programs. The antitrust authorities would like to implement a corporate leniency program that effectively and efficiently reduces collusive behaviour. Therefore it is important to study different types of corporate leniency programs. Aubert et al. (2003) and Spagnolo (2005) argued that a courageous leniency program would be the optimal leniency program. However, the claims of Aubert et al. (2003) and Spagnolo (2005) are based solely on theoretical studies. The robustness of theoretical studies can be tested by using other forms of research. Therefore the effectiveness of leniency programs should be studied through empirical or experimental research. Due to the unobservable nature of collusive behaviour, it is difficult to empirically test the optimal leniency program theory of Aubert et al. (2003) and Spagnolo (2005). A good alternative would be an experimental study. Up till now there has not been much experimental research on the effectiveness of courageous leniency programs. Hinloopen and Soetevent (2008) conducted the most complete experimental study on the effectiveness of corporate leniency programs. Many different elements of corporate leniency programs were taken into account by Hinloopen and Soetevent (2005), however they did not include a courageous leniency program in their experiment. Hence, an extension of the study by Hinloopen and Soetevent (2008) is proposed. In this section the experimental study of Hinloopen and Soetevent (2008) will be extended with a courageous leniency program experiment. First, a framework of five different games will be introduced. Finally, the procedure of the proposed experiment will be discussed.

4.1. Framework of games

The participants of the experiment will repeatedly play a modified version of the Bertrand pricing game. The Bertrand pricing game was introduced by Apesteguia et al. (2005). This experiment includes five different version of the pricing game: Benchmark, Communication, Antitrust, Moderate Leniency and Courageous Leniency. The first three games are similar to the games played in the experiment of Hinloopen and Soetevent (2008). The games will be repeated in this experiment, because this study has different assumptions about communication and the selection of participants compared to the study of Hinloopen and Soetevent (2008). The difference in assumptions might significantly alter the outcome of the experiment. The five games will be discussed in order of simplicity, starting with the most basic game.

4.1.1. Benchmark

Out of the five games played in this experiment, the Benchmark game is the most simple game. The Benchmark game captures a situation where there is no communication, no antitrust law and no leniency program. The other four games contain one or more of these elements. By comparing the results of the Benchmark game with the results of the other games, one can determine the partial effects of the different elements on the effectiveness of corporate leniency programs.

The Benchmark game consists of only one stage. Each of the three participants has to choose a price out of the range 101-110. The lowest price chosen will be the new market price. One needs the cost of production in order to determine the participants' profit. In this experiment, the cost of production is fixed at 100 for simplicity reasons. The participant with the lowest price will earn a profit equal to the chosen price minus the cost of production. If several participants choose the lowest price, the profit should be divided equally among those participants. The participants that choose a higher price will earn a profit of zero. It is assumed that communication is the start of a cartel. As stated before, the three participants are not allowed to communicate with each other in the Benchmark game. Hence, no cartel will be formed in the Benchmark game.

4.1.2. Communication

The Communication game is similar to the Benchmark game, except that participants are allowed to communicate with each other. It is assumed that participants need to communicate to form a cartel. If participants do not communicate, then it is highly unlikely that the participants choose the same price. Hinloopen and Soetevent (2008) only allowed restricted communication among the participants. Participants were only allowed to discuss prices. However, it is impossible to control the communication between firms outside a laboratory. A good representation of the real world is preferred in this experiment. Therefore, the communication in this experiment is not restricted, except that participants are not allowed to state their identity.

The Communication game consists of two stages. In the first stage, all participants have to decide whether or not they want to communicate with the other two participants. Once all three participants agree to communicate, a cartel will be formed. In the second stage, each participant has to choose a price out of the range 101-110. This stage is identical to the

Benchmark game. There is no antitrust policy in the Communication game. This means that participants cannot be fined for collusive behaviour. When the results of the Communication game are compared to the results of the Benchmark game, one can determine the partial effect of communication on cartel formation.

4.1.3. Antitrust

The Antitrust game resembles the Communication game, except that there is an antitrust law in force. Cartel participants can be fined for their collusive activities. Apesteguia et al. (2007) assumed that cartels were only detected if participants decided to report the cartel. However, this is not in line with reality. Communication creates evidence for the antitrust authority. According to Aubert et al. (2003), firms often keep the evidence that was generated because of communication. Even without firms reporting their collusive activities, the antitrust authority may find notes and other documents related to the collusive agreement. Hence, the participants face a detection probability in the Antitrust game. Ormosi (2011) found that the cartel detection probability is somewhere between the 10% and 20%. Based on these numbers, the detection probability is set at 15%.

The Antitrust game consists of three stages. In the first stage of the game, the participants have to decide whether or not to communicate with the other participants. If all participants are willing to communicate, then a cartel is created. In the second stage of the game, each participant has to choose a price between 101 and 110. Up till this point, the Antitrust game is identical to the Communication game. However, the Antitrust game has one final stage. In the last stage of the game, the participants' profits might be reduced. The 15% detection probability makes it possible that cartel participants may have to pay a fine at the end of the game. The fine will be equal to 10% of the participants' current revenue. The height of the fine is based on the current European Commission Treaty. The European Commission imposes fines up to 10% of a cartel member's revenue.[3] The experiment participants do not have the opportunity to report the cartel, so they will not receive any form of leniency.

4.1.4. Moderate Leniency

The Moderate Leniency game resembles the Antitrust game, except for the self-reporting option of cartel members. Cartel members can report their collusive behaviour to the antitrust

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[3] See the official website of the European Union:
http://ec.europa.eu/competition/cartels/overview/faqs_en.html

authority. If a cartel member reports the cartel, it may receive a fine reduction in return. However, the fine reduction will depend on the order of reporting. According to Spagnolo (2005), the leniency programs that only grant leniency to the first self-reporting firm are more effective than the leniency programs that provide leniency to all self-reporting firms. Furthermore, Motta and Polo (2003) and Spagnolo (2005) preferred full fine reductions over partial fine reductions. The leniency scheme in this experiment will be based on these theoretical conclusions. The first self-reporting participant will receive full leniency, while the second self-reporting participant and the last self-reporting participant will not receive leniency and thus both will face a 10% revenue fine. This leniency scheme differs from the leniency scheme in the experiment of Hinloopen and Soetevent (2008) as Hinloopen and Soetevent (2008) also provided a fine reduction to the second self-reporting participant.

The Moderate Leniency game contains four stages. In the first stage, each participant will have to decide whether or not to communicate with other participants. A cartel is established if all three participants want to communicate. In the next stage, each participant has to decide on a price between 101 and 110. The third stage and the fourth stage of the Moderate Leniency game only exist if participants have formed a cartel in the first stage. In the third stage, the participants have to decide whether or not to report the cartel to the antitrust authority. When a participant decides to report the cartel, it will face a reporting cost. The reporting cost covers the time used to gather useful information, the use of legal services and other costs that are related to reporting collusive behaviour. The effect of moderate leniency programs on the reporting of cartels would be overstated, if participants are able to report the cartel at no cost. For simplicity reasons, the cost of reporting is set at 1. In the fourth stage of the game, the participants' profits might be altered. If the cartel was reported in the third stage, all three participants' profits will be reduced with the reporting cost or the 10% revenue fine. When all three participants decided to not report the cartel, they face a 15% detection probability, just like in the Antitrust game. Even if the participants do not report the cartel, they might have to pay a fine for behaving anticompetitive.

4.1.5. Courageous Leniency

The Courageous Leniency game slightly differs from the Moderate Leniency game. In the Courageous Leniency game, the first self-reporting participant will not only be granted full leniency, but it will also receive the total amount of fines paid by the other two participants.

According to Spagnolo (2005), if the fines paid by the cartel offenders are transferred to the first self-reporting firm, a courageous leniency program may lead to total cartel deterrence.

The Courageous Leniency game exists out of four stages. In the first stage, each participant has to decide whether or not to communicate with the other two participants. If all three participants are willing to communicate, a cartel is formed. In the next stage of the game, each participant has to choose a price between 101 and 110. The third and fourth stage of the Courageous Leniency game only exist if a cartel was established in the first stage. In the third stage, the participants have to decide if they want to report the cartel to the antitrust authority. Just like in the Moderate Leniency game, the process of reporting comes with a costs of 1. When a self-reporting participant is the first to report the cartel, it will receive full leniency plus the fines paid by the other participants in the fourth stage of the game. The other participants will face a reduction in profits as they have to pay a 10% revenue fine. If all three participants do not report the cartel to the antitrust authority, the participants may have to pay a 10% revenue fine due to the 15% detection probability.

The framework of games that was discussed in this part can be seen as the theoretical side of the experiment. In the next part, the focus will shift towards the practical side of the experiment. The experimental procedure will be discussed in detail.

4.2. Procedure of experiments

The experiment will take place in the experimental laboratory of the Erasmus University Rotterdam. Each game is played for at least 15 rounds. If the games were played only once, reporting a cartel would have no negative effect on future cartel agreements. Therefore, the cartel deterrence effect of corporate leniency programs would be exaggerated if the games were only played once. The games are repeatedly played in order to avoid the bias towards the positive effects of a corporate leniency program. Each game is played by 12 groups, where each group consists of 3 participants. Each group will play one of the five games. It is important to get as many experiment results as possible. The results will be more reliable if the number of groups is relatively high. For this setting, one would need 180 participants. It is not very likely that one will find more than 180 participants for an experiment like this. Therefore the maximum number of groups per game is set at 12. It will be a challenge to find 180 participants that fit the target group of corporate leniency programs. One of the shortcomings of the existing experimental literature is that the participants are drawn from a pool of university students. Since university students are not the target group of corporate

leniency programs, the external validity of the experimental results may be harmed. In order to overcome this shortcoming, the subjects in this experiment will be drawn from a pool of business people. Business people are more likely to engage in cartel activities and therefore they are included in the experiment. However, it will be very difficult to find 180 business people who would be willing to participate in the experiment. One could try to find participants through the alumni society of the university. Another option would be to organise a conference to attract the future experiment participants to the university. The experiment could even be part of the particular conference. The participants are guaranteed to receive €5.00 if they participate in the experiment.

Before entering the laboratory, all participants will be placed in a classroom. The participants will receive a written set of instructions. Furthermore, the experiment will be explained to the participants and the participants have the opportunity to ask questions about the experiment. Once everything is clear to the participants, each participant will be randomly assigned to a computer. In order to make sure that all participants have completely understood the experiment, they first have to make a test about the rules of the experiment. Once all participants have successfully finished the test, the participants will play five practice games. This is done in order to familiarise the participants with playing the game. In the practice game the participants form different groups compared to the groups in the actual experiment. After the practice rounds, the experiment officially starts. All games, except the Benchmark game, start with the communication phase. All participants in the communication phase have to decide whether or not they want to have a virtual meeting with their two other group members. If all group members decide to communicate, a communication screen will pop-up on their computer screen. The participants have one minute to communicate, because Hinloopen and Soetevent (2008) found that most groups do not need more than one minute to reach an agreement. After the communication period is completed, the price decision stage starts. Each participant will have to choose a price in the range of 101-110. The participants that play the Benchmark game will now also have to choose their price. Once all price decisions have been made, the participants will receive information about the price decisions of their group members and about their own profits. After this stage, the round is finished for the benchmark groups, the communication groups, the antitrust groups and all other groups that did not form a cartel. The moderate leniency groups and the courageous leniency groups that formed a cartel in the beginning of the round will enter the last stage of the round. In the last stage of the round, the subjects will have to simultaneously decide whether or not they

want to report the cartel to the antitrust authorities. On their screen there will be two buttons. On one of the buttons it says *Report* and on the other button it says *Do Not Report*. Both buttons are shown, so that the participants are fully aware of the decision they make. After the report stage, all participants will learn the report decisions of its group members. The game continuous for at least 14 more rounds. In the end of the game, each participant will receive information about its total earnings in the game. If the participant has positive earnings, the participant will receive the total earnings in cash, just like the €5.00 participant fee. If the participant has negative earnings, the participant will only receive the €5.00 that was guaranteed at the beginning of the experiment. The experiment is finished as soon as each participant has received it earnings.

5. Conclusion

Before the introduction of corporate leniency programs, it was extremely difficult for antitrust authorities to detect anticompetitive activities. Since the introduction of corporate leniency programs, the number of successful cartel prosecutions has increased all around the world. However, one cannot simply assume that the increase in the number of cartel prosecutions is caused by the introduction of the corporate leniency programs. One would need to study the effectiveness of corporate leniency programs. In this study the effectiveness of corporate leniency programs was studied by means of a detailed literature review. The existing theoretical literature suggested that, even though corporate leniency programs may have pro-collusive effects, corporate leniency programs can be an effective instrument for cartel reductions. However, theoretical researcher do not agree about the design of the optimal corporate leniency program. Therefore, we shifted our focus towards other types of research. We found that empirical research is not preferred, because of the secretive nature of anticompetitive activities. A good alternative was found in experimental research. The existing experimental studies on the effectiveness of corporate leniency programs showed that corporate leniency programs indeed reduce collusive behaviour. However, most experimental studies did not include courageous leniency programs in their model, while most theoretical studies argue that a courageous leniency program is the optimal leniency program. Hence, an experimental study is proposed to test this theoretical claim. The proposal contains an extension of the experimental study of Hinloopen and Soetevent (2008). The study of Hinloopen and Soetevent (2008) is extended with a courageous leniency program experiment. The existing corporate leniency programs, in for example the USA and Europe, only include partial and full fine reductions. The proposed study may have a significant impact on the improvement of the current corporate leniency programs, if it turns out that the courageous leniency program is indeed the most effective corporate leniency program.

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