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The end of cartels playing hide and seek?

The efficiency and effectiveness of the Belgian leniency programme.

ABSTRACT Leniency programmes have become an important tool for competition authorities to detect and prosecute illegal cartel conduct. However, the literature predicts ambiguous effects of the implementation of such programmes. Therefore, this study sheds some light on whether leniency increases or decreases the incentives to form cartels by analysing the Belgian leniency programme. Firstly, the paper describes the history and subsequent revisions of the leniency guidelines. Secondly, the study compares Belgian competition law enforcement with other countries. Specifically, the paper includes a comparison of the number of cartel discoveries, the investigation duration of cartel cases, the sanction policy and the number of leniency applicants in Belgium, Germany, France, the UK and the Netherlands. Lastly, a negative binomial regression model assesses the effect of leniency on the number of cartel discoveries. The results show a long-term decrease in the number of detected cartels, which points to enhanced deterrence capabilities, whilst no short-term effect of leniency is found. Hence, the paper does not indicate a significant increase in the detection rate after the introduction of leniency.

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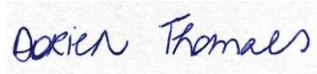
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Authorship declaration

I hereby declare and confirm that this thesis is entirely the result of my own work except where otherwise indicated. I acknowledge the supervision and guidance I have received from Prof. Dr. Christine Zulehner. This thesis is not used as part of any other examination and has not yet been published.

13/08/2019

Dorien Thomaes

A handwritten signature in blue ink that reads "Dorien Thomaes". The signature is written in a cursive style and is placed on a light-colored rectangular background.

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0 Introduction

Generally, the goal of competition policy is to protect competition in the market (European Commission, 2011). Undertakings typically attempt to prevent, restrict or distort competition by engaging in collusive agreements (Santos Nicolau, 2015). By coordinating their market behaviour, undertakings may become able to significantly increase profits. Undertakings thereby knowingly substitute a concrete cooperation for the risks arising from competition on the merits (ECJ, 1972). Most frequently, cartel conduct involves agreements on prices (Santos Nicolau, 2015). However, competition authorities may also prohibit anti-competitive behaviour such as the limitation of production, the distribution of markets or customers and the exclusion of new entry or market expansion (European Commission, 2011).

European competition policy focuses to a large extent on the protection of consumer welfare (Albæk, 2013). Cooperation between undertakings may reduce their incentive to innovate and to offer competitive prices (Santos Nicolau, 2015), since the risks of competition disappear once a collusive agreement is formed. Consequently, colluding undertakings hold the power to set higher prices, which reduces consumer surplus (Frisch, 2016).¹ Furthermore, consumer choice and quality may diminish (Belgian Competition Authority [BCA], 2015). Hence, cartel conduct may decrease consumer welfare (Frisch, 2016). Therefore, cartel activity is prohibited according to the European competition rules. Accordingly, competition authorities have as their object to detect and deter cartel behaviour (Santos Nicolau, 2015). The Belgian Competition Authority (hereafter: BCA) gives the same rationale behind its fight against cartels. In Belgium, cartels are prohibited under

¹ According to Conner and Bolotova (2006), the median overcharge amounts to 28 percent.

article IV.1 of the Code of Economic Law (hereafter: CEL), which is practically identical to article 101 of the Treaty on the Functioning of the European Union (BCA, 2015).

Collusive agreements are typically secret, which makes it difficult for competition authorities to identify such anti-competitive behaviour (BCA, 2015). In several jurisdictions, the use of screening tools was introduced. Through observing market movements, such as high or constant price levels, competition authorities may be able to detect cartel conduct (OECD, 2013). However, screening results are not sufficient evidence to prove the existence of a cartel (OECD, 2013). Therefore, competition authorities mainly depend on complaints by competitors and consumers to gather information (Brenner, 2009). Investigating and prosecuting cartels thus requires considerable resources, whilst competition authorities are generally constrained by a limited budget (Kaplow & Shavell, 1994; Motta & Polo, 2003). Consequently, the European Commission, the BCA and many other national competition authorities (hereafter: NCAs) established a leniency programme. Leniency programmes grant partial or full immunity to cartel members who report information about a cartel in which they participated and thus cooperate with the competition authority (BCA, 2015; Dijkstra & Frisch, 2018). Since cartel members themselves provide information, competition authorities may save resources, which they can now attribute to combating other types of anti-competitive behaviour, such as abuses of dominant position (Brenner, 2009).

Leniency programmes may also help to achieve deterrence of cartel formation. Before an undertaking forms or joins a cartel, it considers several factors (Santos Nicolau, 2015). According to Becker (1974), who describes optimal deterrence in a criminal setting, an individual will only decide to commit a crime when the benefits it expects to gain are higher than the costs. Becker defines the costs of committing

a crime as the multiplication of the detection probability and the severity of the punishment. Although cartel conduct is not considered a crime in most European jurisdictions, the reasoning of Becker gives an interesting insight. To deter cartel formation, competition authorities may thus either raise the expected fine or increase the detection probability. A leniency programme adds to this equation in the sense that it may enhance detection capabilities, which leads to a higher number of cartel discoveries (Brenner, 2009; Miller, 2009). However, leniency also reduces the expected fine. Consequently, leniency may induce undertakings to form or continue a cartel if the fine reduction causes the benefits resulting from the cartel to be higher than the expected fine. Therefore, critics of leniency programmes argue that granting partial or full immunity might facilitate collusion. Moreover, competition authorities are said to rely too much on leniency programmes and fail to pursue an active detection policy (Kovacic, 2016; Newman, 2016). The literature describes which effect of leniency prevails and thus whether the introduction of leniency programmes is effective in deterring cartels. Authors such as Motta and Polo (2003), Ellis and Wilson (2003) and Spagnolo (2004) discuss the ambiguous effect of leniency on the incentives to engage in a cartel and to self-report. Therefore, this study wants to shed some light on whether leniency increases or decreases the incentives to form cartels by analysing the Belgian leniency programme.

Firstly, the paper compares Belgian competition law enforcement to other countries, looking at factors such as the number of cartel discoveries, sanction policy, the number of leniency applicants and investigation duration. Specifically, the paper studies Belgian, French, German, UK and Dutch competition law enforcement. Since all these jurisdictions are based on European competition law and are thus very similar, discrepancies between the descriptive statistics can

practically only be attributed to differences in enforcement efficiency and effectiveness. The paper is one of the firsts to compare competition law enforcement regarding cartels by several NCAs.

Secondly, the paper conducts a negative binomial regression analysis. By applying the theoretical model of Miller (2009) to time series data, the study is able to conclude on the detection and deterrence capabilities of four NCAs² after the adoption of leniency programmes. The evolution of the number of cartel discoveries over time serves as an indicator of the efficiency and effectiveness of the policy. Since this paper focuses on the analysis of national leniency programmes, it mainly contributes to existing literature by providing additional cross-sectional variation. This may help to estimate and evaluate the true effect of leniency programmes on the incentives to collude and the deterrence capabilities of competition authorities after the introduction of leniency. Several authors, such as Zhou (2013) and Frisch (2016) recommend further research to analyse more national leniency policies. Frisch (2016) and Dijkstra and Frisch (2018) are the firsts to analyse a national leniency programme, namely the Dutch leniency programme. These studies are therefore the main inspiration source of this paper.

Lastly, the BCA updated the Belgian leniency policy with the 2016 Leniency Guidelines. The paper examines the changes that were implemented. Ideally, the paper would empirically examine the effectiveness of this revision. However, the time frame is too short. Nevertheless, the paper lists the modifications in a theoretical manner.

² The NCAs of Belgium, France, Germany and the Netherlands.

The paper is organised as follows. The first part of the study provides a background, summarising the content and revisions of the Belgian leniency programme and the history of the Belgian competition rules in general. Moreover, the existing literature describing the efficiency and effectiveness of leniency programmes is discussed. The second chapter reports how the data set necessary to conduct the analysis is created. Furthermore, this chapter illustrates a first part of the analysis and compares Belgian, French, German, UK and Dutch competition law enforcement by presenting several descriptive statistics. Next, the third section describes the regression model and the hypotheses of the analysis. The fourth part of the paper presents and discusses the results. Finally, the fifth chapter lists the changes the BCA implemented with the revised 2016 Leniency Guidelines. The paper concludes on the findings in Chapter 6.

1 Background and literature review

1.1 History of Belgian competition law

The first real competition legislation in Belgium was enacted in 1991. Before the introduction of the Act of 5 August 1991 on the protection of economic competition, competition law in Belgium was long neglected. The sole legislation worth mentioning is the Act of 27 May 1960 on the protection against the abuse of economic power. However, this law was strongly undervalued and generated only limited results (Roets, 2014). Furthermore, agreements between companies were only prohibited when the public interest was at risk. Nevertheless, the Act of 1960 was a large step forward, since Belgian legislation encouraged the formation of cartels starting from 1935 with the introduction of the royal decree nr. 62 (OECD, 1997; Roets, 2014).

The new regulatory framework contained three parts, covering cartels, abuses of dominant position and merger control. The fight against cartels in Belgium thus started in 1991. Two main bodies supervised by the Ministry of Economic Affairs were assigned the responsibility to oversee competition: the Competition Service (hereafter: CS) and the Competition Council (hereafter: CC). The CS investigated and noted the existence of anti-competitive practices through reports, whilst the CC was authorised to take decisions. However, relatively few decisions on restrictive practices were taken and most decisions were delayed (OECD, 1997; Roets, 2014). The CC in its annual report of 1994-1995 stated that the bodies received inadequate resources to effectively prevent and fine anti-competitive behaviour (Competition Council [CC], 2015). Nevertheless, the Amendment Act of 1999 introduced some important institutional changes regarding the CS and the

CC, partly to tackle the insufficient funds and staff (Vandermeersch, 2007). Still, the Belgian Court of Audit in its 2006 report showed that the majority of cases filed in 1998 were still under investigation (Belgian Court of Audit, 2006). Hence, the lack of resources led to suboptimal enforcement of the existing legislation regarding combatting anti-competitive behaviour (Roets, 2014).

The introduction of the two laws of 10 June 2006, coordinated by royal decree, brought an end to the ineffective Belgian competition policy (Roets, 2014). The organisational structure of the bodies responsible for overseeing competition changed completely. Moreover, the notification procedure for restrictive agreements was repealed and the possibility for undertakings to submit commitments introduced (Wijckmans, 2006; Puttemans, 2007; Vandermeersch, 2007). Lastly, the new law on the protection of economic competition of 2006 established leniency in Belgium (Roets, 2014). A last important reform of the Belgian competition regulation in 2013 placed the relevant legal basis to prohibit anti-competitive behaviour in book IV and V of the CEL. This Code also created the current integrated BCA, an autonomous body with legal personality. Since then, no significant changes to competition policy have occurred (Roets, 2014).

Looking at the history of leniency, the first record of leniency in Belgian legislation can be found in the guidelines of 30 April 2004 concerning immunity and fine reductions in cartel cases. Based on the European leniency rules, the CS developed the conditions for leniency grants. Both the CS and the CC finally agreed to prioritise the fight against restrictive practices and marked in the leniency notice that it is of greater interest to consumers to detect and prohibit anti-competitive behaviour than to fine the undertakings that helped the investigation (CC, 2004). Furthermore, the CC mentioned that some undertakings taking part in restrictive agreements are willing to cooperate with the authorities and supply

important inside information but are discouraged by the risk of high fines (CC, 2004). Therefore, the CC showed the importance of the new leniency rules.

Nevertheless, the leniency procedure contained strict conditions: the fine reduction must have been in line with the undertaking's contribution to the cartel detection. Specifically, immunity was only granted when the undertaking was the first to submit sufficient evidence which established an infringement of the competition rules that could not be proved before. Moreover, the undertaking was not allowed to have coerced other undertakings into the anti-competitive agreement. If these conditions were not fulfilled, the undertaking was eligible for a fine reduction when it provided information with considerable added value compared to the evidence the competition authority had already gathered. Three subsequent leniency applicants could obtain a reduction, ranging from 5% up to 50%. Additionally, to qualify for partial or total exemption, the general conditions for leniency must have been met: the undertaking must have continuously cooperated fully and have ended its involvement in the cartel immediately after the application (CC, 2004).

After the introduction of the European Competition Network Model Programme regarding leniency on 29 September 2006, Belgium revised its leniency rules with the "2007 Leniency Notice". Immunity to cartel fines could from now on be obtained in two ways: Type 1A and Type 1B. To qualify for a Type 1A exemption, the undertaking must have been the first to submit sufficient evidence that allowed the competition authority to carry out a targeted dawn raid which it did not yet conduct, or which was not justifiable before. The conditions for a Type 1B exemption were similar: the undertaking must have been the first to submit sufficient evidence in order to establish an infringement of the competition rules which could not be shown before. Moreover, an undertaking was only eligible for a Type 1B exemption when no other undertaking related to the restrictive practices was granted immunity

under a Type 1A exemption previous to its application. Lastly, immunity could only be granted when the undertaking did not coerce other undertakings into the anti-competitive agreement (CC, 2007). Furthermore, a Type 2 exemption was granted under the same conditions as stipulated by the leniency guidelines of 2004. Specifically, when the undertaking provided information with considerable added value compared to the evidence the competition authority had already gathered, the undertaking could be declared eligible for a fine reduction. The first leniency applicant for a partial exemption could receive a reduction ranging from 30% up to 50%. The CC could also reduce the fines for subsequent leniency applicants with 10% to 30% (CC, 2007).

Another important change was the introduction of the marker system which protects the applicant's position in the queue relative to other possible applicants for a limited period of time, for the leniency applicant to gather the necessary evidence and information (CC, 2007). This incentivises undertakings to report the restrictive practice earlier and intensifies the "race to the court" (Harrington, 2008).³

Table 1 provides a summary of the different fine reduction schemes the BCA employed according to the 2004 and 2007 leniency guidelines. Moreover, a last revision of the Belgian leniency programme took place in 2016, with the new "2016 Leniency Guidelines". Chapter 5 will discuss the adjustments made to the 2007 Leniency Notice in more detail.

³ Harrington (2008) states that leniency provides undertakings with incentives to race to the court and be the first to report the cartel to the competition authorities, since they will then be rewarded with a higher fine reduction (see Chapter 1.2).

Table 1: Summary of the 2004 and 2007 leniency guidelines

2004		2007	
Rank	Reduction	Rank	Reduction
Immunity	100%	Type 1A	100%
Partial exemption:		Type 1B	100%
- First applicant	30-50%	Type 2:	
- Second applicant	20-30%	- First applicant	30-50%
- Third applicant	5-20%	- Subsequent	10-30%

1.2 Theoretical models

The goal of leniency programmes is to deter cartel formation by detecting and thus destabilising more cartels (BCA, 2015). However, theoretical models in the literature predict various effects of leniency on the incentives to collude. Some authors argue that the introduction of a leniency programme will be effective in deterring cartel formation, whilst others predict that leniency will lead to higher cartel stability. Generally, the literature tries to describe the optimal law enforcement policy regarding leniency, taking several effects of granting fine reductions into account.

Spagnolo (2004) investigates the ability of leniency programmes to deter cartels by increasing incentives to cheat through a repeated Prisoner's Dilemma game. The author states that the optimal law enforcement policy with leniency takes two separate effects into account (Spagnolo, 2004). First, sufficiently generous leniency programmes can be exploited by cartels who may report each period and

therefore avoid the risk of being fined. Cartel members can thus use the existence of leniency to reduce the expected cost of misbehaviour, which decreases the deterrence effect of leniency programmes. On the other hand, sufficiently generous programmes can also directly increase the incentive for a cartel member to cheat and report information to the competition authorities, since the cartel member avoids a high fine. When the reduced fine is smaller than the expected fine, the value of defecting is higher, and the deterrence effect of leniency programmes increases (Spagnolo, 2004).

Spagnolo finds that an optimal leniency programme is restricted to the first confessor. For the deterrence effect to be maximised, the first cartel member that reports should receive a reward equal to the sum of all fines levied on the other cartel firms (Spagnolo, 2004). However, these “courageous” leniency programmes may not be achievable due to political and institutional constraints (Spagnolo, 2004). Nevertheless, “moderate” leniency programs may be able to deter cartel formation as well (Spagnolo, 2004). As long as there is a positive probability of being convicted, it is more profitable for a cartel member to defect and report information to the competition authorities than to only deviate from the collusive agreement (Spagnolo, 2004). Since there is still a risk of being convicted after one deviates, the cost of simultaneously reporting the cartel is lower (Spagnolo, 2004). On the contrary, Harrington and Chen (2007) find that partial leniency may enhance collusion when the probability of detection is low. Additionally, Spagnolo argues that the perceived riskiness of forming or maintaining a collusive agreement increases once a leniency programme comes into place, which may lead to deterrence.

Another contribution on the effectiveness of leniency is provided by Ellis and Wilson (2003). The authors state that cartel members are incentivised to break up

existing cartels and to self-report, since they will earn supernormal profits which exceed the profits obtained from cartel participation when they do (Ellis & Wilson, 2003). Moreover, the marginal cost of other cartel members that do not enjoy leniency increases tremendously due to fines and compliance costs (Ellis & Wilson, 2003). The defecting cartel member thus gains a competitive advantage over the other cartel members, who become direct competitors once the cartel is dissolved and Bertrand competition reoccurs (Ellis & Wilson, 2003; Frisch, 2016). Hence, the introduction of leniency programmes decreases cartel stability (Ellis & Wilson, 2003). However, Ellis and Wilson point out another (unintended) effect of leniency. The theoretical analysis shows that cartels may abuse leniency and may self-report to the competition authorities as a part of a punishment strategy when one of its members defects. Suppose that a cartel member undercuts the cartel price and is detected by the other cartel firms when a leniency programme is in place. The cartel may now punish the defector and report to the competition authorities, which leads to the defector paying the fine (Ellis & Wilson, 2003). The cartel can thus use leniency as a power tool to strengthen its stability. The study by Gray, Nguyen and Wait (2013) also highlights the potential use of leniency as a punishment device for deviating cartel members, which helps to maintain the collusive agreement.

The paper of Harrington (2008) provides further evidence on effective leniency programmes. Harrington considers three potential effects of leniency on the frequency of collusion. The first effect captures the payoff from cheating: a deviating firm profits from undercutting the collusive price whilst it simultaneously receives a fine reduction when it reports to the competition authorities. Second, cartel members may postpone using leniency to a period in which the detection probability is high. In case of a more lenient programme, the size of the fine will be lower and thus the payoff from continuing to collude increases (Harrington, 2008).

On the contrary, the “race to the courthouse effect” raises the cost of continuing to collude. Since only the first leniency applicants can be granted a fine reduction, cartel members have an incentive to be the first to report to the competition authorities (Harrington, 2008). Therefore, more leniency will lower the expected payoff from colluding and will destabilise cartels (Harrington, 2008).

According to Harrington, a leniency policy in which a high fraction of the fines is waived will certainly reduce cartel stability, since the payoff from cheating is higher than the payoff from continuing to collude (Harrington, 2008). However, when leniency is sufficiently mild, a deviating cartel member profits more from undercutting the cartel price compared to the benefits resulting from leniency and thus would not use leniency (Harrington, 2008). Therefore, the leniency policy will only be effective in destabilising cartels when the “run to the courthouse effect” outweighs the payoff from continuing to collude (Harrington, 2008). Which effect prevails, depends on the specifics of the model (Harrington, 2008).

The theoretical study by Motchenkova (2004) makes a similar distinction between more and less lenient programmes. Specifically, Motchenkova states that less lenient programmes, which grant lower fine discounts to subsequent leniency applicants or apply more strict conditions, may reduce cartel occurrence (Motchenkova, 2004). Compared to the paper of Harrington (2008), the finding of Motchenkova shows that the incentives to run to the court to be the first to apply for leniency outweigh the benefits resulting from upholding the cartel when leniency is sufficiently mild. However, the outcome changes when the leniency application is not confidential and detection probability and penalties are low (Motchenkova, 2004). The introduction of leniency programmes may in that case facilitate collusion (Motchenkova, 2004).

Motta and Polo (2003) also point out the ambiguous effect of the introduction of leniency on the incentives to collude. The authors state that leniency might lead to cartels deciding to desist from colluding and cost savings resulting from shorter investigations, which enhances welfare (Motta & Polo, 2003). However, given that leniency lowers the expected cost of misbehaviour, it might promote cartel conduct (Motta & Polo, 2003). Motta and Polo therefore describe the optimal leniency policy. The paper argues that competition authorities should only employ leniency when they have too little resources available to prevent collusion using maximum fines. In that case, granting fine discounts may serve as a second-best instrument, since the cost savings still lead to increased welfare (Motta & Polo, 2003). Furthermore, Motta and Polo show that fine reductions should be maximum and granted even when investigations are already opened to provide the right incentives to not form cartels.

Different than the previous studies, the theoretical model of Harrington and Chang (2009) does not describe the optimal leniency policy or the effect of leniency on the incentives to collude. This paper rather shows how to recognise an effective policy by looking at the impact of the introduction of leniency on cartel duration. The theoretical model of Harrington and Chang is frequently used as the basis for empirical research, as discussed in the next part of Chapter 1. The authors predict that an increase in the duration of discovered cartels shortly after the introduction of a leniency programme is due to a more effective competition policy (Harrington & Chang, 2009). The reasoning of Harrington and Chang is the following. When the adoption of a new leniency policy is more effective compared to the previous situation, the marginally stable cartels which generally tend to be of shorter duration collapse immediately (Harrington & Chang, 2009; Frisch, 2016). These cartels thus disappear from the pool of cartels to be discovered and only the more

stable cartels remain (Harrington & Chang, 2009; Frisch, 2016). Therefore, the cartels the competition authorities detect after the introduction of a leniency programme are those which generally survive longer (Harrington & Chang, 2009; Frisch, 2016). Hence, the average cartel duration rises in the short run in response to the more effective policy change (Harrington & Chang, 2009). However, the long-term effect is ambiguous (Harrington & Chang, 2009; Frisch 2016). Since the marginally stable cartels will not form in the first place, the average cartel duration increases (Harrington & Chang, 2009; Frisch, 2016). On the other hand, the initially more stable cartels collapse sooner due to the destabilising effect of leniency programmes, which decreases the average cartel duration (Harrington & Chang, 2009; Frisch, 2016). In summary, Harrington and Chang predict a double, diverging effect of leniency on cartel duration in the long run.

Conclusively, almost all studies point out that leniency programmes can be effective in destabilising and deterring cartels. However, leniency programmes may also increase cartel stability. Therefore, the literature tries to describe the optimal leniency policy which should take potential (negative) incentives to collude into account. Empirical evidence might shed light on the effectiveness of different leniency policies introduced in various jurisdictions, which could serve as an indicator of the predictive capabilities of the previously discussed theoretical models.

1.3 Empirical studies

Comparing the different empirical findings shows that the literature disagrees on the efficiency and effectiveness of leniency programmes. The topic is thus heavily debated in both the areas of theoretical and empirical research. Most empirical evidence regards the European and US leniency guidelines. Moreover, some authors show the efficiency and effectiveness of leniency through analysing cartel duration, whilst others study the evolution of the number of cartel discoveries.

Empirical studies face an important constraint of non-observability (Brenner, 2009). Data samples can never include all active cartels, since only discovered cartels can be observed (Brenner, 2009). Hence, conclusions must be drawn from limited available data. Posner (1970) states that it may be misleading to interpret an increase in the number of detected cartels as proof of an effective antitrust policy change. Discovering more cartels after the introduction of leniency could also be due to a rise in the propensity for cartel formation and a low detection probability (Posner, 1970). Therefore, empirical results will always be somewhat biased (Frisch, 2016). The theoretical models must thus develop conditions that, if satisfied, enable empirical studies to conclude on the efficiency and effectiveness of leniency programmes (Brenner, 2009).

The first empirical study on the European leniency programme is conducted by Brenner (2009). Brenner examines the efficiency and effectiveness of the European leniency guidelines adopted in 1996 based on two separate analyses. The study includes 61 prosecuted cartels falling under article 81 of the EC Treaty, or previously article 85, by the European Commission between 1990 and 2003. The first part investigates the efficiency of leniency in a broad manner. Brenner analyses to what extent the introduction of leniency induces cartel members to

reveal more cartel information. Following the reasoning of Motta and Polo (2003), leniency may increase the detection probability and may provide cartel members with incentives to self-report to the competition authorities. Cartel members revealing more information may lead to quicker prosecution procedures and thus to lower prosecution costs (Brenner, 2009). The results confirm that leniency does indeed lead to more information being revealed. Furthermore, the results show that leniency decreases the cartel investigation duration by almost one and a half years. Hence, the European leniency programme introduced in 1996 proves to be efficient (Brenner, 2009).

On the other hand, the second part examines if leniency helps destabilising cartels and deters cartel activity in the long term, and thus if leniency is effective. As mentioned above, the theoretical model of Harrington and Chang (2009) studies the relationship between the introduction of leniency and the duration of detected cartels. The model predicts an immediate rise in cartel duration, whilst the long-term effect of the leniency introduction is ambiguous (Harrington & Chang, 2009). Brenner (2009) finds a positive effect between the leniency introduction and cartel duration in the short term. However, the result is not significantly different from zero. Therefore, Brenner considers further empirical evidence regarding time series data of the number of cartel discoveries. Brenner applies the theoretical model of Miller (2009)⁴, which states that a rise in the number of cartel discoveries in the short term and a drop in the number of cartel discoveries in the long term are sufficient to establish an increase in the detection rate and a decrease in the formation rate of cartels, respectively. Brenner hypothesises that the introduction of the EU leniency programme will prove to be effective, looking at the evolution of

⁴ A detailed description of Miller's theoretical model can be found in Chapter 3.

cartel discoveries over time. However, the study does not find support for this hypothesis. Brenner suggests that the increase in cartel discoveries after the introduction of leniency might be due to an exogenous change instead.

Miller (2009) applies his own theoretical model to find empirical evidence for the effectiveness of leniency. Different than the research of Brenner (2009), Miller studies the US leniency programme adopted in 1993. The data set includes all cartel discoveries by the DOJ between 1995 and 2005. Miller finds a statistically significant increase in the number of discovered cartels immediately after the leniency introduction, therefore showing the enhanced detection capabilities of the DOJ. Moreover, the number of cartel discoveries falls below pre-lenieny levels in the long term, which provides evidence of the deterrence effect of the leniency programme. The study of Miller thus concludes that the US leniency programme of 1993 is effective.

Miller also refers to the study of Brenner (2009), stating that the results of both papers are consistent with each other. Since the European leniency programme did not include immunity to the first confessor until 2002, the insignificant results of Brenner suggest that immunity may be an important component of successful leniency programmes (Miller, 2009).

De (2010), however, finds no evidence that supports the theory of an effective leniency programme. The study analyses the European leniency programme of 1996 and includes cartels prosecuted by the European Commission during the period 1990 until 2008. Based on the theoretical model of Harrington and Chang (2009), De concludes that cartel duration does not significantly increase shortly after the introduction of leniency. Therefore, the results are not in line with those of an effective leniency programme. Nevertheless, De argues it is difficult to conclude that the leniency programme is not effective. He states that the results show that

more years under leniency and cartels born under leniency tend to be disruptive (De, 2010). Furthermore, De argues that the definition of the short term after the introduction of the leniency programme is ambiguous in an empirical context (Harrington & Chang, 2009).

In contrast to the study of De (2010), the study of Zhou (2013) finds evidence that leniency is effective. Specifically, Zhou mainly analyses the revised European leniency programme of 2002, whilst the papers discussed above study the initial European leniency guidelines of 1996. The study includes prosecuted cartels by the European Commission during the years 1985 to 2012. In line with the predictions regarding an effective leniency programme described by the theoretical model of Harrington and Chang (2009), Zhou's results show an immediate increase in the average cartel duration after the leniency programme is introduced and a decrease in the average cartel duration in the long run.

The main innovation of the revised leniency guidelines of 2002 compared to the initial guidelines is that the European Commission starting from 2002 could no longer alter the size of the fine for the first leniency applicant. Furthermore, the fine reduction scheme was adapted. Specifically, the various leniency discount factors granted to subsequent leniency applicants were lowered. As described by the literature discussing the optimal design of a leniency programme, the conditions to be granted fine reductions may have an enormous influence on the incentives which are provided to cartel members to self-report (Ellis & Wilson, 2003; Motta & Polo, 2003; Spagnolo, 2004). Hence, the dissimilarity in results between the studies of Brenner (2009), Miller (2009), De (2010) and Zhou (2013) may be explained by the focus on either the leniency guidelines of 1996 or 2002.

The paper of Choi and Kahn (2014) evaluates the Korean leniency programme. During the years 1981 and 2012, the Korea Fair Trade Commission investigated

and prosecuted 619 cartels, which are all included in the data set (Choi & Kahn, 2014). The results show a pattern in line with the prediction of the theoretical model of Harrington and Chang (2009) (Choi & Kahn, 2014). Specifically, the average cartel duration increases once the leniency programme is introduced and decreases again in the long term (Choi & Kahn, 2014). Hence, Choi and Kahn conclude that the Korean leniency programme is effective.

The most recent study regarding the effectiveness of leniency programmes is conducted by Dijkstra and Frisch (2018). The research focuses on the revised Dutch leniency guidelines of 2007 and is thus one of the first to analyse a national leniency programme. The authors call for additional cross-sectional variation to be able to more accurately estimate the effectiveness of leniency programmes (Dijkstra & Frisch, 2018). Therefore, the paper of Dijkstra and Frisch inspired the analysis carried out in this paper regarding the effectiveness of the Belgian leniency programme. The empirical findings of this paper can thus contribute to existing literature by providing additional results regarding the effectiveness of leniency programmes.

Dijkstra and Frisch apply the theoretical model of Miller (2009). Firstly, the empirical results do not show a significant change in the number of cartel discoveries after the revision of the leniency programme (Dijkstra & Frisch, 2018). Hence, Dijkstra & Frisch do not find enhanced detection capabilities of the NCA due to the new leniency guidelines in the short term. However, the authors do show that the number of detected cartels falls below initial level in the long term, which implies that the revised leniency programme leads to higher deterrence of cartels (Dijkstra & Frisch, 2018).

Recently, Harrington and Wei (2015) studied the concerns regarding the use of information on observable and detected cartels as a representative for all active

cartels in empirical research. They state that a bias may exist whenever the probability of death and discovery varies across cartels (Harrington & Wei,2015). However, when the assumption holds that all cartels are discovered with an equal probability, empirical results will be unbiased (Harrington & Wei,2015). The study by Zhou (2013) indeed assumes an equal detection probability. On the contrary, the papers of Brenner (2009) and De (2010), which study the effectiveness of leniency programmes through analysing the evolution of cartel duration, apply a theoretical model that enables the authors to conclude solely by including observed cartels. Harrington and Wei question the validity of such theoretical models regarding cartel duration and state that the empirical results may contain small bias. Nevertheless, Miller (2009) constructs his model in a way that allows to estimate the effectiveness of leniency from analysing only the number of discovered cartels. Miller studies the changes in cartel detection and formation rate and the effect on cartel discoveries. Hence, this model attacks the issue at its core and removes the risk of potential bias occurring when interpreting empirical findings (Harrington & Wei, 2015).

2 Data

2.1 Collection of data

To be able to answer the research questions described in Chapter 0, a data set covering 609 cartels discovered over the years 1994 to 2018 is created. The data set includes all cartels the NCA of Belgium and Germany detected during this period. Data regarding the NCA of the UK, the Netherlands and France, is limited to the years 2000-2018, 1999-2017 and 1996-2018, respectively.

The data set only includes actual cartels. In several cases, undertakings lodge an appeal against the NCA's decision in which an infringement of the relevant competition rules is found. Exceptionally, the court of appeal annuls the decision. Hence, the existence of a cartel is not established. These cases which have not been confirmed as cartels are excluded from the data set. On the other hand, court rulings that modify the NCA's decision do not dispute the nature of the anti-competitive behaviour but only redetermine the fine. These cases thus constitute actual cartels and are covered in the data set. A more in-depth investigation of the relevant decisions reports and following court rulings thus proves to be essential.

Summary statistics presented in the second part of Chapter 2 compare the total and average number of cartel discoveries by the different NCAs. More generally, these summary statistics study the differences in national competition law enforcement. Therefore, an analysis of the amount of fines imposed on detected cartels, the investigation duration of cartel cases and the number of leniency applicants is also included. Moreover, the number of detected cartels constitutes the main research variable in the regression model described in Chapter 3. To

complete this model, data regarding the annual budget of the NCAs, the annual GDP of the respective countries and the annual number of mergers and acquisitions (hereafter: M&A) is collected. Lastly, the data set indicates the introduction date of the initial Belgian, French, German, Dutch and UK leniency guidelines.

Specifically, data regarding Belgian competition law enforcement is gathered by consulting several sources. The annual reports provide information regarding the number of cartel discoveries, the budget, the average investigation duration and the number of leniency applicants per year. However, the number of detected cartels is only reported for the years 2000-2018. Therefore, the decision reports regarding article IV.1 CEL⁵ are analysed to find the number of detected cartels for the missing years.

According to various articles in book IV of the CEL, the NCA of Belgium can decide in four ways. First, it can issue an injunction. Second, the cartel under investigation can pledge to act in a certain way or to refrain from certain behaviour in the future. In those cases, the BCA stops the investigation and desists from establishing an infringement of the competition rules. Third, a competing firm or an individual, whose interests are harmed due to anti-competitive practices, can issue a request to the competition authority to adopt interim measures. This action allows the competition authority to suspend such behaviour. However, this is not a decision on the substance and therefore does not establish the existence of a cartel. Lastly, the competition authority can impose a pecuniary sanction. In summary, only the first and fourth decision types establish an infringement of article IV.1 CEL and are therefore included in the data set as a cartel discovery.

⁵ The relevant legal basis for illegal cartel conduct was article 2 WBEM at that time.

Additionally, the average amount of fines the BCA imposes on prohibited cartel conduct per year and per case is collected by studying all decision reports regarding cartels detected over the period 1994 to 2018. As mentioned above, the BCA is not obligated to impose a pecuniary sanction on the infringing behaviour. Moreover, the annual reports only report the NCA's budget for the years 2002 to 2018. Therefore, the missing values are estimated backwards by calculating the annual budget's exponential growth. The numbers for the period 1994 to 2001 thus constitute an estimation and do not represent the actual historical budget.

Next, the French *Autorité de la concurrence* (hereafter: ADLC) documents the number of cartel discoveries in its annual reports. However, this figure is only reported for the years 2001 to 2018. Therefore, the decision records are analysed. The ADLC provides a search engine which enables researchers to run specified queries depending on the information that they require. For this paper, the database is filtered on year and anti-competitive practices. Only the decisions in which an infringement of article L.420-1 of the Commercial Code is found are included in the data set as a cartel discovery. Simultaneously, data regarding the fines imposed on the convicted cartels is gathered. Since the annual reports only report the fine imposed by the ADLC and do not account for later modifications in appeal, around 875 decision reports by the ADLC and the courts of appeal are analysed in total (years 1996 to 2018). Furthermore, data regarding the annual budget⁶, the average investigation duration and the number of leniency applications are collected by consulting the annual reports.

⁶ Data regarding the annual budget of the years 1994 to 2001 are an estimation based on the annual budget's exponential growth.

To collect data regarding cartel enforcement by the German *Bundeskartellamt* (hereafter: BKartA), only two types of sources, which report all the necessary data, are consulted. Specifically, all activity reports ("*Tätigkeitsberichte*") issued between 1994 and 2018 are studied. Additionally, the annual reports of 2013 to 2018 are reviewed. Only statistics concerning the average investigation duration are not included in the data set, since the BKartA does not report these figures.

In the UK, the *Restrictive Practices Court* (hereafter: RPC) decided whether registered cartel agreements were allowed under the 1956 Restrictive Trade Practices Act (Parker, 2000). Since the implementation of the 1998 Competition Act (hereafter: CA) in 2000, the *Office of Fair Trading* (hereafter: OFT) was responsible to detect, investigate and prosecute illegal cartel conduct (GOV.UK, n.d.). The CA immediately included leniency guidelines. Next, the OFT transferred part of its responsibilities to the *Competition and Markets Authority* (hereafter: CMA) in 2014 (GOV.UK, n.d). Since the decision reports of the RPC are not publicly available, data regarding UK competition law enforcement only covers the years 2000 to 2018. Cartel discoveries before the introduction of the leniency programme are thus not included in the data set.

Employing the filters "*CA98 and civil cartels*" and "*CA98 – infringement Chapter I*" on the CMA's website shows all cartels prosecuted by the OFT and the CMA over the years 2000 to 2018. The corresponding fines are reported in the various decision reports, as well as the modified fines imposed by the courts of appeal. Moreover, the average investigation duration is assessed manually, by calculating the months between the opening of an investigation and the final decision by the CMA. Furthermore, the number of leniency applicants per year is provided by the CMA itself via e-mail, after a request for information was made.

Statistics regarding the Dutch *Autoriteit Consument en Markt* (hereafter: ACM) are based on the data set created by Mr. Peter Dijkstra and Mr. Jonathan Frisch for their paper published in 2017 (Dijkstra & Frisch, 2018). Moreover, the number of leniency applicants and the average investigation duration is not included in the data set, since this data is not publicly available. Furthermore, Kwink (2015) in its evaluation of the ACM reports the budget of the competition authority for the years 2001 to 2007. The OECD (2012-2018) in its recent annual reports documents the budget for the years 2011 to 2017. The missing values are estimated through the calculation of the annual budget's exponential growth.

Next, the regression model also includes the annual number of M&A. The Institute of Mergers, Acquisitions and Alliances (IMAA) provides these statistics via its website. Finally, the annual GDP of Belgium, France, Germany, the Netherlands and the UK in absolute numbers is retrieved from the database provided by the European Statistical Office, which displays the quarterly GDP of all European countries over the years 1975 to 2018.

2.2 Descriptive statistics

This section compares competition law enforcement regarding cartels of different European countries in a statistical manner. Specifically, this section first describes the number of cartels discovered over the years 1994 to 2018 by the BCA, ADLC, BKartA, CMA and ACM. Second, the average number of leniency applicants per year is illustrated. Third, this section presents the average investigation duration of cartel cases. Lastly, the fourth part of this section compares the sanction policy of the different NCAs.

**Table 2: Summary descriptive statistics
(Belgium, Germany, France, the UK and the Netherlands)**

	BE	GER	FR	UK	NL
Cartel discoveries:					
- Total	23	137	337	41	71
- Mean (year)	0.92	5.48	14.7	2.16	3.74
- Mean (year), relative to GDP	0.23	0.22	0.91	0.10	0.64
Leniency applicants (mean):					
- Year (real)	6.8	40	4.9	22.4	-
- Year, relative to GDP	1.76	1.47	0.24	1.07	-
Investigation duration (mean (case), in months)	46.4	-	21.7	37.6	-
Fines (in euro):					
- Mean (year)	33,016,358	284,488,000	377,141,048	37,995,161	-
- Mean (case)	22,010,905	51,913,868	38,823,343	13,900,668	7,192,108

Table 2 provides a first insight into the data with a summary of the descriptive statistics which will be described further in the following paragraphs. It is important to notice that data regarding the CMA is limited to the years 2000-2018. Therefore, the total number of cartel discoveries is left out. Moreover, the number of detected cartels by the ADLC for the years 1994 and 1995 is not found. The summary statistics thus do not include the number of cartel discoveries for these two years. Statistics regarding Dutch competition law enforcement for the years 1994 to 1998 are also missing. To account for differences in country size and economic activity, the average number of leniency applicants and number of cartel discoveries per

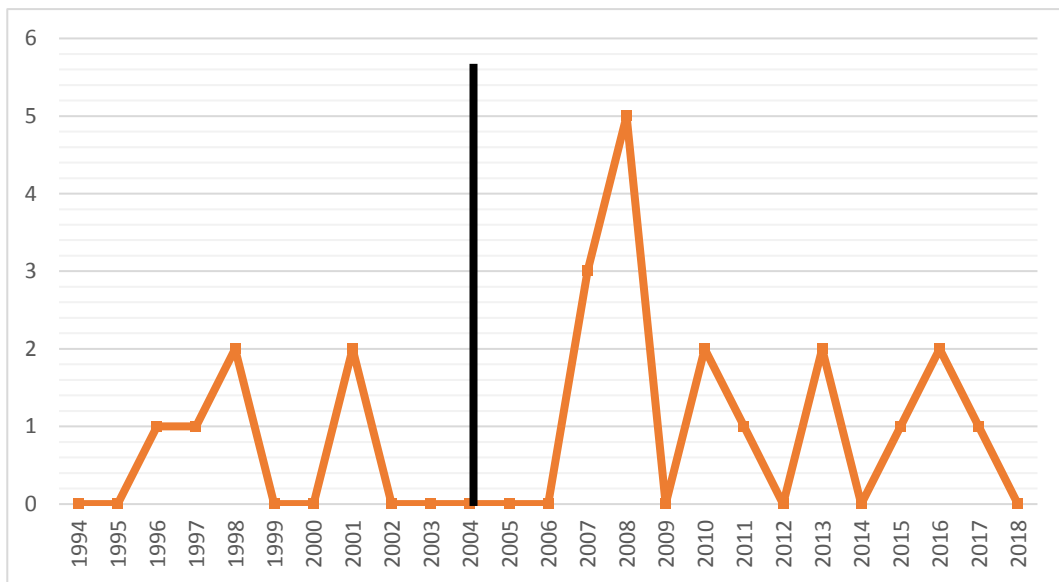
year is calculated relative to GDP. The annual GDP is thus used as a proxy for economic activity. Illustrating the data in this manner allows a better comparison of the differences in competition law enforcement. However, using the total number of active businesses as the basis for comparison would have been optimal, since this figure is directly related to the number of cartel discoveries and leniency applicants. Unfortunately, these numbers are not found.

2.2.1 Cartel discoveries

A first look at Figure 1, which plots the number of cartel discoveries by the BCA over the years 1994 to 2018, seems to reveal a similar pattern as described by the model of Miller (2009). The initial Belgian leniency programme was introduced in 2004, represented by the vertical (black) line in the graph. As shown in the summary of the descriptive statistics (Table 2), the average investigation duration amounts to 46.4 months. Hence, the first cartels which could be granted full or partial immunity are only convicted around 2008. The graph indeed shows a rise in the number of cartel discoveries around 2007 and 2008. In the long term, the number of detected cartels seems to fall again. This could be due to the enhanced deterrence capabilities of the BCA after the introduction of the leniency programme. However, a descriptive analysis does not provide sufficient evidence of the effectiveness of the Belgian leniency policy. Other factors, such as the annual GDP or the budget of the BCA might influence the observed pattern in the number of cartel discoveries as well. Consequently, the immediate increase and the long-term decrease in the number of detected cartels could be due to these other factors and not to the introduction of the leniency programme in particular. Hence, Chapter 3 includes these factors in the regression analysis to control for the observed impact of leniency on the number of cartel discoveries.

According to Figure 1, the maximum number of cartels the BCA discovered during a year amounts to 5 cartels. The graph indeed illustrates a peak in the total number of cartel discoveries in 2008. However, the mean of the number of detected cartels by the BCA per year is equal to 0.92 (Table 2), which means that the BCA on average finds approximately one cartel each year. Therefore, the year 2008 constitutes an exceptional period in terms of performance.

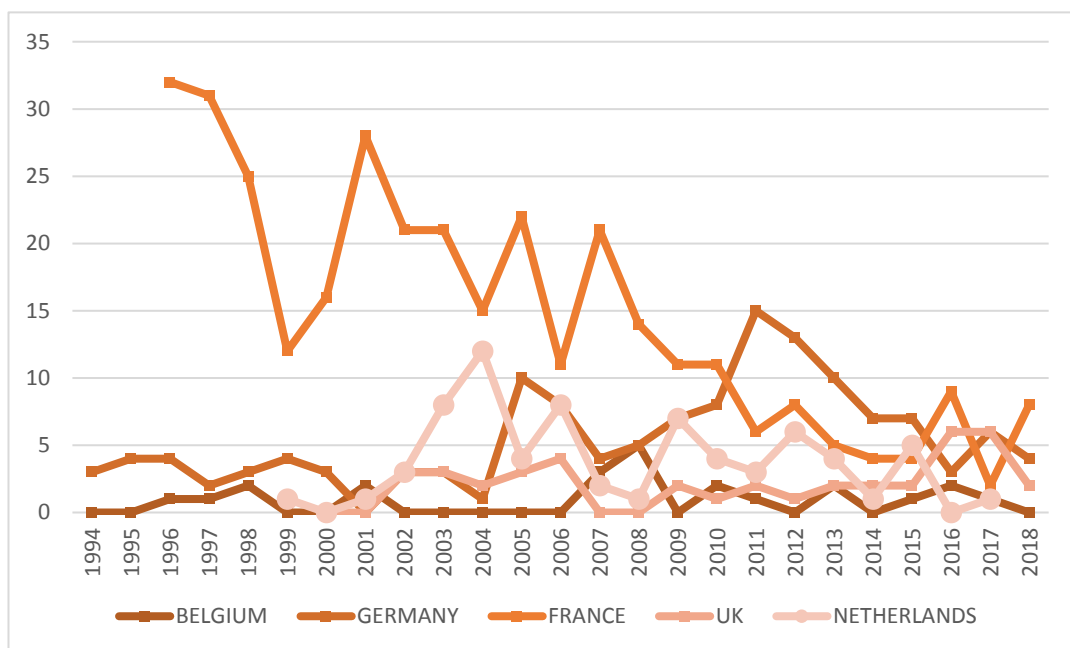
Figure 1: Cartel discoveries over the years 1994-2018 in Belgium



In comparison with the NCAs of Germany, the UK, the Netherlands and France, the mean of the number of cartel discoveries by the BCA is considerably lower (Table 2). Specifically, the BCA on average finds 0.92 cartels per year, whilst the ADLC, BKartA, ACM and CMA detect 14.7, 5.48, 3.74 and 2.16 cartels, respectively. These dissimilarities could be explained by differences in country size and economic activity. Therefore, the average number of detected cartels which controls for GDP is added as a descriptive statistic. Table 2 indicates that differences in GDP indeed influence the total number of cartel discoveries. The statistics show that the BCA and the BKartA detect approximately 0.23 cartels per

year, whilst the CMA only discovers 0.10 cartels. The ACM and the ADLC still do better, since these NCAs find 0.64 and 0.91 cartels each year. Hence, the ADLC outperforms the other competition authorities in terms of cartel discoveries per year. It is important to notice that these figures can solely be used to compare the different countries and do not represent the real number of detected cartels.

**Figure 2: Cartel discoveries over the years 1994-2018
(Belgium, Germany, France, the UK and the Netherlands)**



Next, Figure 2 demonstrates the evolution of the total number of cartel discoveries by the different NCAs over the years 1994-2018. A closer look at the graph shows that the NCAs of Belgium and the UK do not find more than six cartels per year. Moreover, the number of cartel discoveries remains relatively stable over the years. The BKartA, ACM and ADLC generally detect more cartels. However, as discussed above, this may be explained by differences in country size and economic activity. Still, the evolution of the number of detected cartels by the ADLC is remarkable. Figure 2 shows a firm decrease in total cartel discoveries over the years 1996 to 2018. This pattern seems to correspond to the deterrence effect of

leniency programmes and competition policy in general, as described by Miller (2009).

Lastly, comparing the number of cartel discoveries before and after the NCAs introduced the leniency policy might provide interesting results. Therefore, Table 3 depicts the average number of cartel discoveries before and after the introduction of the Belgian, German, French and Dutch leniency guidelines in 2004, 2000, 2001 and 2002, respectively. This table gives some insight into how the data is distributed. In Belgium, approximately 0.6 cartels were discovered each year before the introduction of the leniency programme, whilst the average number of cartel discoveries between 2004 and 2018 is equal to 1.1. The BCA's enforcement activity concerning cartels thus doubles after the introduction of the leniency programme. Similarly, the average number of detected cartels in Germany doubles in the period after the BKartA adopted the leniency guidelines. The ACM detects more than four times as many cartels after the introduction of the leniency programme as before. However, the average of the period before leniency is based on solely three observations. Furthermore, Table 3 shows that the ADLC on average only finds around half as many cartels after the introduction of the leniency programme in 2001. This pattern was already clearly depicted by Figure 2.

Table 3: Average number of cartel discoveries before and after the introduction of leniency (Belgium, Germany, France, the Netherlands)

	BE	GER	FR	NL
Before leniency	0.6	3.3	23.2	0.7
After leniency	1.1	6.2	12.3	4.3

2.2.2 Leniency applicants

Figure 3 provides a visual representation of the average number of leniency applicants per year. In Belgium, approximately 7 businesses apply for leniency each year. Similarly, the ADLC annually receives approximately 5 leniency applications. On the contrary, on average around 40 businesses submit their leniency application to the BKartA each year. The average number of leniency applicants in the UK is also considerably higher: approximately 22 business apply for leniency per year.

The findings of Figure 3 do not account for differences in country size and economic activity. Therefore, the average number of leniency applicants per year relative to GDP is added as a descriptive statistic. The calculation of the mean of the number of leniency applicants relative to GDP allows a better comparison of the various countries. However, these figures can solely be used to compare the different NCAs and do not represent the true number of leniency applications. Figure 4 depicts the results. In contrast to Figure 3, the results are much more similar. Specifically, the BCA receives 1.76 leniency applications per year, taking GDP into account. The BKartA and CMA both receive 1.47 and 1.07 applications, respectively. In France, however, only 0.24 businesses apply for leniency. This figure is considerably low in comparison and in stark contrast to the high number of cartels the ADLC detects each year.

The results may suggest that the French leniency guidelines provide less incentives to cartel members to self-report to the competition authority compared to the Belgian, German and UK programme (Ellis & Wilson, 2003; Spagnolo, 2004). A low detection probability, which may lead to lower expected costs of cartel conduct (Becker, 1974), might also explain why fewer (potential) cartel members

apply for leniency. However, Table 2 shows that the ADLC on average detects much more cartels than the other authorities included in this study. Therefore, a closer look at the content of the French leniency guidelines would be useful.

Figure 3: Average number of leniency applicants per year

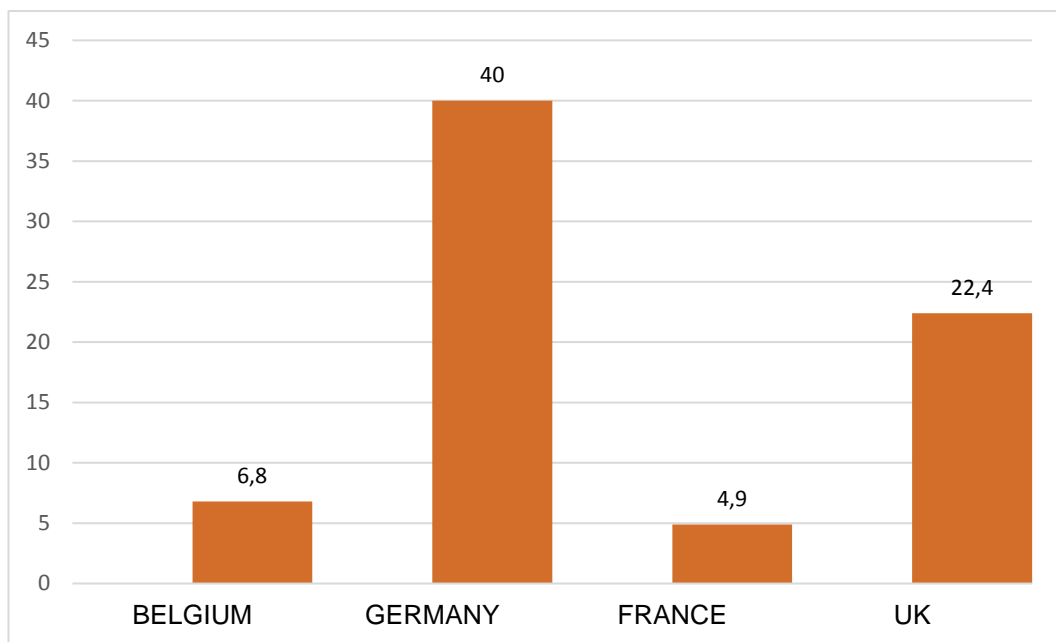
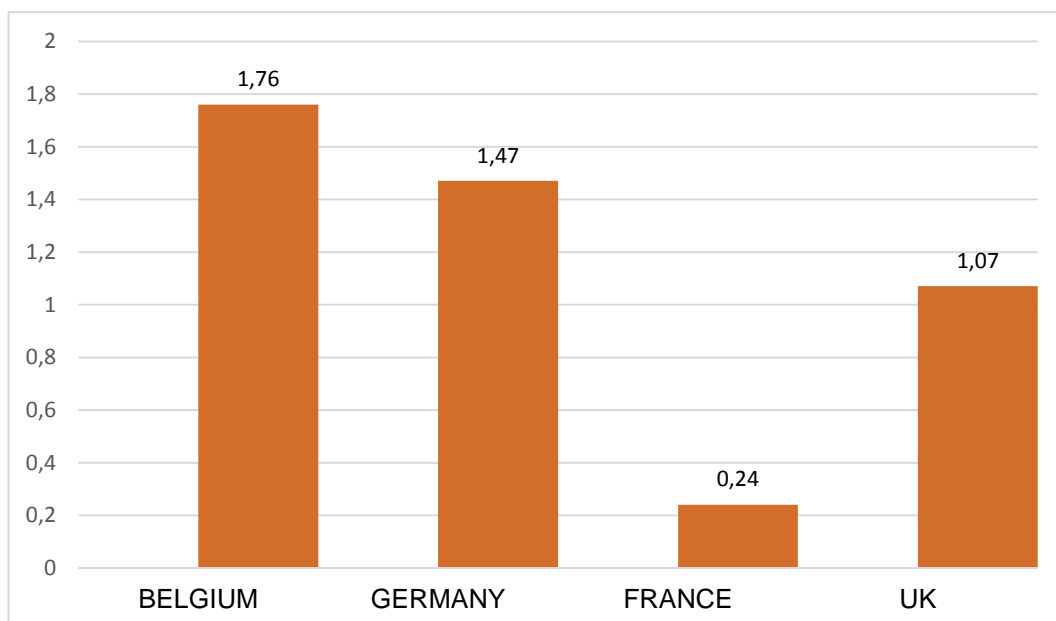


Figure 4: Average number of leniency applicants per year, relative to GDP



2.2.3 Investigation duration

The average investigation duration is defined as the time between the opening of an investigation and the infringement decision of the NCA (see Brenner (2009)). The BCA on average takes 46.6 months to conclude a cartel investigation. This figure is considerably high compared to the investigation duration of cartel cases in France. The ADLC needs around 22 months to issue its decision regarding illegal cartel conduct. In the UK, the CMA announces its decision to the parties 37.6 months after it opened the investigation.

According to Table 4, the BCA takes more than two times as long as the ADLC to finish a cartel investigation. This result shows that Belgium is less efficient and effective in handling cartel cases than France. Nevertheless, the CMA needs around 38 months to reach a decision, which is more in line with the investigation duration of cartel cases in Belgium. Therefore, the NCA of France might just be an excellent regulator or generally deals with smaller cases. Furthermore, the differences might be explained by nonoptimal competition law enforcement by the BCA and the CMA. However, data regarding investigation duration was not easily accessible. Therefore, the average investigation duration is calculated based on a limited number of observations. Table 4 includes the number of observations for every NCA.

Table 4: Average investigation duration in months

	BELGIUM	FRANCE	UK
Average investigation duration	46.4	21.7	37.6
Number of observations	7	12	15

2.2.4 Fines

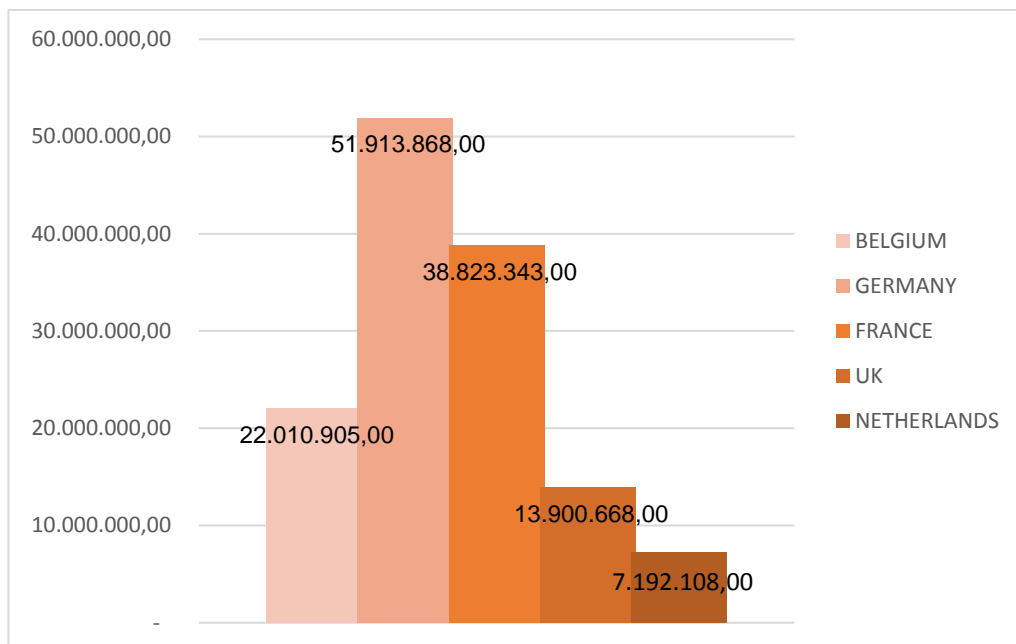
As mentioned before, NCAs are not obligated to impose a pecuniary sanction. Moreover, competition authorities hold a considerably high degree of freedom when deciding on the amount of fines to impose as long as the decision-making process is transparent, and the fine does not exceed 10% of global turnover. Hence, a comparison of the fines imposed on cartels by the BCA, ADLD, BKartA, CMA and ACM might show large differences.

Indeed, the fines the BCA and CMA impose per year are much lower than the amounts convicted cartels in Germany and France need to pay. Specifically, the BCA imposes fines amounting to approximately 33 million euros each year. However, this figure is somewhat distorted, since the *Supermarket cartel case* was ordered to pay a fine of around 174 million euros, which is very high for the BCA. The fines imposed by the CMA fall within the same range: detected cartels pay approximately 38 million euros in total per year. In contrast, the total amount of fines the ADLC on average imposes per year is ten times higher in comparison with the CMA. Similarly, the BKartA annually receives around 284.5 million euros from the cartels it convicts.

The statistics representing the average amount of fines per year imposed on cartels are to a large extent influenced by the number of cartel discoveries. If the NCA convicts more cartels, the average amount of fines will generally be higher. Therefore, Figure 5 shows the average imposed fine per case by the BCA, BKartA, ADLC, CMA and ACM. Presenting the results in this manner makes it easier to compare the pecuniary sanctions the different countries impose on illegal cartel conduct. Figure 5 clearly shows that cartels convicted in the UK and the Netherlands are condemned to pay a considerably lower fine compared to the

other countries. Per case, the CMA imposes a fine of approximately 14 million euros and the ACM around 7 million euros. Compared to the BKartA, which fines around 52 million euros per cartel case, the CMA and ACM follow a considerably milder sanction policy. Another explanation could be that the CMA and ACM generally deal with smaller cartel cases. The same reasoning can be made for the BCA, which receives approximately 22 million euros per convicted cartel case. In France, the average imposed fine on businesses that engage in a restrictive cartel agreement amounts to approximately 39 million euros. Two of the researched countries on average thus impose large fines compared to the other three countries under review. A conclusion regarding which NCA employs stricter enforcement procedures is hard to make, since several factors might explain these differences.

Figure 5: Average imposed fine per case in euro



3 Regression model

The theoretical model used in this paper to empirically analyse the efficiency and effectiveness of the Belgian leniency programme is based on the model of Miller (2009). According to this model, the effectiveness of leniency can be evaluated by regressing time series data of cartel discoveries.

The following negative binomial regression model is estimated:

$$NUM_{CARTELS} = \alpha + \beta_1 \times LENIENCY + \beta_2 \times GDP + \beta_3 \times BUDGET + \beta_4 \times MERGERS + \varepsilon$$

The dependent variable $NUM_{CARTELS}$ represents the annual number of detected cartels from 1994 to 2018. Since this is a count variable, the negative binomial regression model is the most appropriate⁷. The independent variable $LENIENCY$ is a dummy variable which equals one if leniency is in place and zero if the period foregoes the introduction of the leniency programme. Therefore, the dummy variable will equal one starting from 2004 for Belgium, 2001 for France, 2000 for Germany and 2002 for the Netherlands. Furthermore, the model includes some control variables such as the annual GDP of the countries in question (GDP), the annual resources of the NCAs ($BUDGET$) and the annual number of M&A per country ($MERGERS$).

Since analysing only Belgian data would lead to too little observations to be able to produce externally valid results, the regression also contains data from the French, German and Dutch competition authorities. In total, 91 observations are included in the sample.

⁷ Appendix 1 plots the distribution of the dependent variable in a histogram.

Figure 6 shows the possible effects of an innovation, hence the leniency programme, on the number of cartel discoveries over time. The innovation, illustrated by the vertical line, influences detection probability and deterrence capability. Panel A represents an increase in the detection rate of cartels due to the introduction of leniency, whilst holding other factors constant. The number of detected cartels rises immediately following the innovation, since the competition authority discovers more active cartels. However, the pool of active cartels to be detected shrinks, which leads to a weaker effect in the long term. Panel B similarly simulates the isolated decrease in the formation rate of cartels: the leniency programme deters cartels over time. The number of discovered cartels falls gradually, since the pool of active cartels to be detected becomes smaller due to enhanced deterrence.

Panel C and Panel D illustrate simultaneous changes in detection and formation probabilities. In Panel C, the introduction of the innovation leads to an immediate increase in the number of discovered cartels due to a rise in the detection rate. In the long term, the number of cartel discoveries falls below initial levels. The higher detection probability reduces the incentive to form cartels, which lowers the number of active cartels. The leniency programme thus proves to be effective in deterring cartels. On the other hand, Panel D shows the opposite: the innovation causes lower detection and deterrence rates. Cartel discoveries decrease immediately after leniency is introduced but rise again above initial levels in the long term due to the pool of active cartels getting larger.

Conclusively, for the leniency programme to be effective, the detection and deterrence rate should increase, which would lead to an immediate increase in the number of discovered cartels and a decrease in the number of discovered cartels below initial levels in the long term. Therefore, the regression model should follow

the convergence path of Panel C. It is thus important to test the regression model both in the short term and the long term to correctly evaluate the detection and deterrence capabilities of the NCAs before and after the innovation. Hence, the two following hypotheses will be tested to assess the effectiveness of the leniency programme:

Hypothesis 1: In the short term, the introduction of the leniency programme will increase the number of cartel discoveries due to an increase in the detection rate.

Hypothesis 2: In the long term, the introduction of the leniency programme will decrease the number of cartel discoveries below initial levels, since the decrease in the formation rate shrinks the pool of active cartels.

Only when both *Hypothesis 1* and *Hypothesis 2* can be validated, the leniency programme is effective in achieving its goal to deter cartel formation by providing efficient incentives to cheat and self-report.

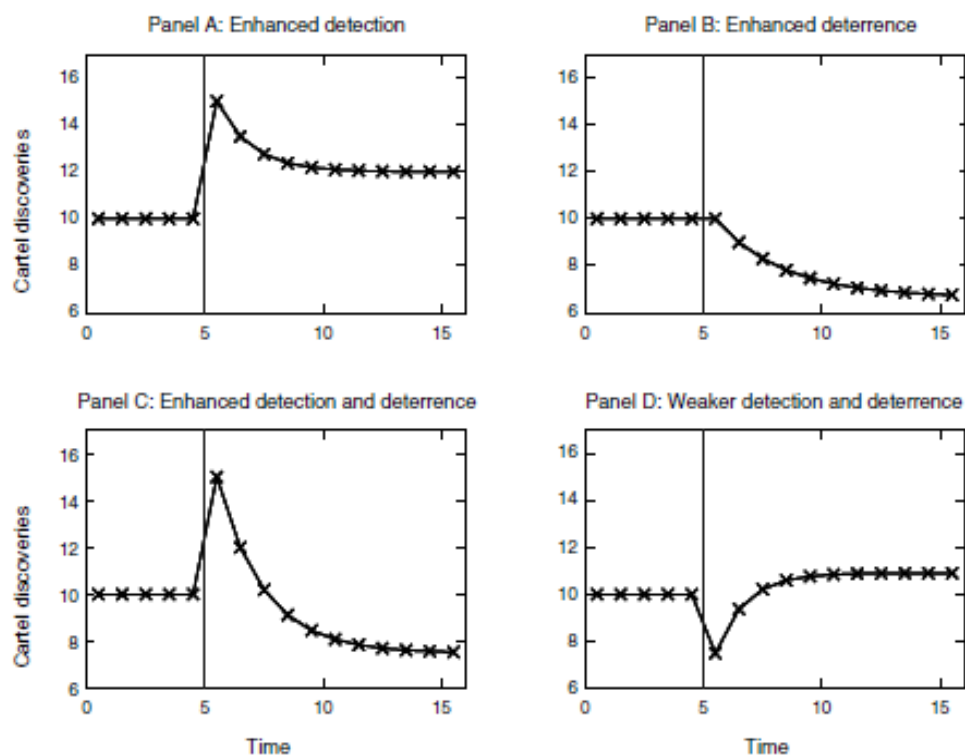


Figure 6: The evolution of the number of cartel discoveries (Source: Miller (2009))

The analysis thus comes down to studying the change in the number of cartels before and after the introduction of leniency. To do so, the model includes a dummy variable which equals one if cartel members can apply for leniency and zero otherwise. This allows the model to show whether there is a significant increase or a decrease in the number of cartel discoveries after the leniency programme is adopted. For robustness, the model includes the annual budget of the NCAs the annual GDP of all four countries and the annual number of M&A. First, the number of cartel discoveries is expected to be higher when the NCA has a higher budget to spend on cartel cases (Dijkstra & Frisch, 2018). Second, the effect of GDP on the amount of cases a competition authority can handle is ambiguous. Some authors claim that GDP and case load are procyclical (Posner, 1970), whilst others find a negative correlation between the two variables (Ghosal & Gallo, 2001; Dijkstra & Frisch, 2018). Finally, Mehra (2007) argues that a horizontal merger serves as an alternative to a cartel agreement. Therefore, the study predicts a negative relation between the number of M&A and the number of cartel discoveries.

4 Results and discussion

This chapter first considers the short-term effect of leniency on the number of cartel discoveries. Table 5 presents the results of the negative binomial regression model, split into several regressions to check for robustness. To capture the short-term effect of leniency on the detection rate of cartels, a period of five years is tested. For example, data regarding Belgian cartel discoveries is limited to the years 1994 to 2008 in this regression, since the leniency programme was introduced in 2004. As mentioned before, the NCAs need around 21 to 46 months to issue their final decision. It thus takes time to observe the effect of leniency on the number of cartel discoveries.

Column (1) shows the regression without including any control variables. The coefficient of the *LENIENCY* variable equals 0.288. This estimate indicates that the included NCAs annually detect 0.288 more cartels in the period that post-dates the leniency programme compared to the period before the leniency programme was introduced. Although this result is in line with *Hypothesis 1*, the estimated positive coefficient is not significant. Next, column (2) and (3) include controls for the annual GDP of the respective countries and the annual budget of the NCAs. Adding *GDP* to the equation does not yield a significant effect on the number of detected cartels. Nevertheless, the estimated coefficient of this control variable is significant at the 1% level and positive. Hence, this result is in line with the paper by Posner (1970), which argues that the case load is procyclical. The inclusion of the variable *BUDGET* again does not show that the introduction of leniency causes a significant increase in the number of cartel discoveries. The coefficient in itself is also insignificant. Lastly, column (4) adds all control variables to the regression model. Although all estimated coefficients remain positive, no significant effect is

found. Furthermore, the coefficient of the *LENIENCY* variable remains stable. Since regressions (1)-(4) do not find a significant increase in the number of detected cartels in the short term, the null-hypothesis cannot be rejected. Therefore, leniency does not enhance the detection capabilities of the NCAs. This result contrasts with the study by Miller (2009), which did find a significant increase in the number of detected cartels. Nevertheless, this finding is in line with the papers by Brenner (2009) and Dijkstra and Frisch (2018).

Result 1: In the short term, the introduction of the leniency programme does not significantly affect the number of cartel discoveries. Therefore, leniency does not significantly increase the detection rate.

Table 5: Negative binomial regression model (short-term effect)

	(1)	(2)	(3)	(4)
<i>LENIENCY</i>	0.288 (0.438)	0.299 (0.403)	0.208 (0.459)	0.285 (0.496)
<i>GDP</i>		1.10e-6 ** (3.69e-7)	1.15e-6** (3.91e-7)	8.71e-7 (7.64e-7)
<i>BUDGET</i>			8.21e-9 (2.05e-8)	5.18e-9 (2.18e-8)
<i>MERGERS</i>				0.0003 (0.0008)
constant	1.792*** (0.296)	0.474 (0.508)	0.354 (0.582)	0.283 (0.607)
Observations	44	43	43	43
Pseudo R ²	0.0017	0.0331	0.0337	0.0344
Prob > Chi	0.5108	0.0153	0.0364	0.0690

Note: *** p<0.001, ** p<0.01, * p<0.05

To assess the long-term effect of leniency on the deterrence capabilities of the NCAs, the regression model excludes the short-term data (five years). For example, data regarding Belgian cartel discoveries is limited to the years 1994 to 2003 and 2009 to 2018 in this regression. This allows us to capture the long-term deterrence effect of leniency, whilst excluding the short-term increase in the detection rate. Table 6 presents the results.

Table 6: Negative binomial regression model (long-term effect)

	(1)	(2)	(3)	(4)
<i>LENIENCY</i>	-0.087 (0.287)	-0.599* (0.258)	-0.719* (0.322)	-0.681* (0.321)
<i>GDP</i>		7.88e-7*** (1.52e-7)	8.25e-7*** (1.65e-7)	4.68e-7 (2.83e-7)
<i>BUDGET</i>			4.76e-9 (7.61e-9)	4.50e-9 (7.52e-9)
<i>MERGERS</i>				0.0005 (0.0003)
constant	1.792*** (0.234)	0.860** (0.270)	0.781** (0.299)	0.580 (0.324)
Observations	72	71	71	71
Pseudo R ²	0.7613	0.0595	0.0605	0.0660
Prob > Chi ²	0.0002	0.0000	0.0000	0.0000

Note: *** p<0.001, ** p<0.01, * p<0.05

As predicted, column (1) shows a negative effect of leniency on the number of cartel discoveries in the long term. However, this estimation is not significant. When controls for annual GDP and annual budget are added to the equation in column (2) and (3), the estimated coefficient of *LENIENCY* remains negative and becomes significant at the 5% significance level. Furthermore, the control variable *GDP* is

significant at the 0.1% level, indicating that GDP has a positive effect on the number of cartel discoveries. This estimation result contrasts with previous studies, including the paper of Miller (2009) and Dijkstra and Frisch (2018). Lastly, the complete regression model shows that the NCAs on average find 0.681 fewer cartels each year, which is in line with *Hypothesis 2*. The control variables become insignificant, as shown in column (4). Therefore, a relation between annual budget and detected cartels is not found. Moreover, column (4) in both Table 5 and 6 indicates that there is no effect of the number of M&A on the number of detected cartels. Conclusively, the results show a negative long-term effect of leniency on cartel discoveries, which indicates that the pool of active cartels to be detected shrinks over time.

Result 2: In the long term, the introduction of the leniency programme decreases the number of cartel discoveries below initial levels. Therefore, leniency does significantly increase deterrence capabilities.

Since the results do not support *Hypothesis 1*, the paper cannot conclude that the leniency programme of all four NCAs together is efficient and effective.

If the findings of this paper are compared with previous studies, several similarities and differences can be noticed. First, Brenner (2009) finds no evidence of enhanced detection nor deterrence capabilities, whilst this study shows a significant increase in the deterrence rate but does not report an increase in detected cartels in the short term. Second, Miller (2009) does find a short-term effect of leniency on the number of cartel discoveries. The results presented by the paper of Dijkstra and Frisch (2018), however, are completely in line with the findings of this study. Important to notice is that not all studies research the same leniency programmes. Consequently, differences in the conditions to be granted

immunity or in the fine reduction scheme may influence the results and lead to different conclusions regarding the efficiency and effectiveness of leniency. Hence, the findings depend heavily on what the research subject is. Moreover, the data set covers the years 1994 to 2018. During this period, several of the leniency programmes included in this analysis are reviewed. Therefore, the results also capture the effects of these revisions on the detection and deterrence capabilities of the NCAs. However, the paper does not analyse the impact of these revisions separately but assesses the whole period.

5 The 2016 Leniency Guidelines

Chapter 1 discussed the history of the Belgian leniency programme and the Belgian competition rules in general. As mentioned before, the last reform of the Belgian competition legislation in 2013 replaced the competition rules to book IV and V of the CEL. Thereafter, article IV.46 CEL determines the conditions under which cartels members can be exempted from fines imposed by the BCA or the Belgian courts in case an infringement of article IV.1 CEL is found. On 22 March 2016, the BCA published the new leniency guidelines in the Belgian Official Gazette, thereby replacing the last revised leniency policy of 2006-2007. According to article IV.25 CEL, the BCA can submit guidelines regarding the practical application of the competition rules. Hence, the BCA decided to renew the existing guidelines and lay down the new conditions for cartel members to be granted immunity or to be (partially) exempted from fines. Although the period to empirically analyse the effect of the 2016 revision of the Belgian leniency guidelines on the number of discovered cartels is too short, this chapter describes the changes that were made in a theoretical manner.

Since the introduction of book IV of the CEL in 2013, the BCA can sanction individuals who are not undertakings for violating the competition rules with a fine up to 10.000 euros. According to paragraph 23 of the 2016 Leniency Guidelines, individuals can only be prosecuted when an undertaking is simultaneously prosecuted for the same anti-competitive behaviour. Individuals thus fall within the scope of article IV.1 CEL. Therefore, the leniency programme should also allow individuals to apply, next to undertakings. Specifically, an individual involved in prohibited conduct can obtain immunity when the individual provides new information to the BCA and acknowledges the existence of the anti-competitive

behaviour. Furthermore, several individuals may be eligible for immunity simultaneously, even when they are not the first to report information to the competition authority. Additionally, the BCA can grant immunity to both an undertaking and individuals at the same time if all leniency applications meet the conditions.

A second important change regards the existing Type 1A immunity (LexGo, 2019). As mentioned in Chapter 1, cartel members can be granted full immunity in two situations. First, when the leniency applicant is the first to provide evidence that allows the BCA to conduct targeted investigations which it could not justify before and fulfils all other conditions, the cartel member may be eligible for a Type 1A exemption (BCA, 2016). In the 2016 Leniency Guidelines, the BCA removed the alternative condition stating that a leniency applicant can receive immunity when the competition authority did not yet conduct a targeted dawn raid on the moment it receives the reported information. Nevertheless, the leniency applicant must still provide the BCA with sufficient information to be eligible for immunity. Hence, this adjustment will only have limited consequences. However, according to Blockx and Pico (2016), the BCA must obtain a mandate from an investigating judge to conduct a targeted dawn raid. Before 2013, the competition authority received authorisation from the president of the CC. It has thus become significantly more difficult to conduct targeted investigations (Blockx & Pico, 2016). Therefore, the BCA applies stricter approval standards to Type 1A leniency applications in order to present sufficient information to the investigating judge who issues the mandate (Blockx & Pico, 2016). Second, Type 1B immunity is granted when the leniency applicant is the first to provide sufficient information which allows the competition authority to establish an infringement of article IV.1 CEL (BCA, 2016). The BCA did not apply any changes to this exemption type (LexGo, 2019).

Next, when a cartel member provides information with considerable added value compared to the evidence the competition authority already possesses, the undertaking can be declared eligible for a reduction of the fine (Type 2 immunity) (BCA, 2016). The 2016 Leniency Guidelines significantly adapted the fine reduction ranges, which are now overlapping (LexGo, 2019). Specifically, the first applicant for a Type 2 immunity may now receive a fine reduction between 30% and 50% (BCA, 2016). A reduction between 20% and 40% can be granted to the second leniency applicant who meets all conditions (BCA, 2016). Finally, the fine of any subsequent applicant may be reduced by 10% to 30% (BCA, 2016). This refined fine reduction system allows the BCA to reward applicants who filed their application later in time but who provide information of significant quality with a higher discount (LexGo, 2019). Table 7 provides an updated version of Table 1 regarding the fine reduction ranges. This table includes the last revision of the leniency guidelines in 2016.

Several changes have been made to the procedure regarding leniency applications (Blockx & Pico, 2016). Leniency applicants now formally submit their application through an appointment with the Auditor-General (BCA, 2016). This system allows the BCA to have a better overview regarding the timing of all leniency applications, since the date of the appointment determines the applicant's rank (LexGo, 2019). Furthermore, an undertaking can ask the Auditor-General, before it formally submits its application, if it is still the first who would provide the competition authority with information regarding the cartel in question (BCA, 2016). This request allows the undertaking to know whether full immunity is still available prior to its application. If so, the cartel member must immediately submit its leniency application or a request for a marker (BCA, 2016). Lastly, the BCA commits to issuing a press release stating that a dawn raid is or has taken place at a specific

undertaking whenever this is the case (BCA, 2016). Since undertakings which are subjected to a dawn raid know the competition authority is conducting an investigation, they are more likely to apply for leniency before other undertakings even become aware of this (Blockx & Pico, 2016). To mitigate this information asymmetry, the BCA implemented this guideline to give other undertakings the possibility to submit their leniency applications on time (Blockx & Pico, 2016). Further research may analyse whether these changes influence the effectiveness of the leniency programme.

Table 7: Summary of the 2004, 2007 and 2016 leniency guidelines

2004	
Rank	Reduction
Immunity	100%
Partial exemption:	
- First applicant	30-50%
- Second applicant	20-30%
- Third applicant	5-20%

2007	
Rank	Reduction
Type 1A	100%
Type 1B	100%
Type 2:	
- First applicant	30-50%
- Subsequent	10-30%

2016	
Rank	Reduction
Type 1A	100%
Type 1B	100%
Type 2:	
- First applicant	30-50%
- Second applicant	20-40%
- Subsequent	10-30%

6 Conclusion

Detecting, investigating and prosecuting illegal cartel conduct constitutes a resource intensive practice for competition authorities. Therefore, authorities rely more and more on leniency programmes, which can considerably lower the budget attributed to convicting cartels. However, the literature points out that leniency programmes may increase incentives to engage in a collusive agreement and, hence, increase cartel stability when the benefits of collusion raise due to reduced expected fines. Nevertheless, leniency programmes may increase the detection probability of cartels, which may lead to lower cartel formation in the long term. Consequently, it is important to empirically analyse which effect of leniency programmes prevails.

This paper thus studies the efficiency and effectiveness of the Belgian leniency programme. Since the goal of leniency programmes is to destabilise and to deter cartels, the paper first analyses the change in the number of cartel discoveries before and after the introduction of leniency guidelines by conducting a regression analysis. Moreover, the study descriptively compares competition law enforcement regarding cartels by several NCAs: the BCA, BKartA, CMA, ACM and ADLC. Specifically, the paper includes a comparison of the number of detected cartels, investigation duration, the number of leniency applications and sanction policy.

The results of the regression analysis show the long-term deterrence effect of leniency programmes. Since leniency reduces the incentive to form cartels, the pool of active cartels to be discovered shrinks over time. Hence, the NCAs detect fewer cartels in the long run. However, no evidence of enhanced detection capabilities is found. The results do not indicate a significant increase in the

number of cartel discoveries in the short term. Therefore, the paper cannot conclude that the leniency programme of all four⁸ NCAs together is efficient and effective. The findings are in line with the study by Dijkstra and Frisch (2018).

Furthermore, Belgium on average finds a relatively standard number of cartels each year. The ACM and ADLC outperform the BCA in this area, whilst the CMA on average detects fewer cartels. Next, the BCA receives more leniency applications compared to the other researched NCAs. However, Belgium's sanction policy regarding cartels is considerably mild, since the average amount of fines per cartel case is relatively low. Lastly, the investigation duration of cartel cases handled by the BCA is comparable to those reviewed by the CMA but considerably longer than the duration of cartel cases by the ADLC. This paper's findings let NCAs compare their competition law enforcement regarding cartels with other countries and may help evaluate certain areas. Hence, the paper can help create even more efficient and effective policymaking.

The study has several limitations. First, establishing the data set was a very intensive and complex process, since the necessary data is spread out over a considerable number of documents. Furthermore, not all necessary data is publicly available, which led to limited observations for certain research variables. The study is thus heavily constrained by the limited available data. Further research could thus, for example, compare the different NCAs based on the number of businesses instead of GDP when this data becomes available for all research subjects.

⁸ The regression analysis does not include cartel discoveries by the CMA.

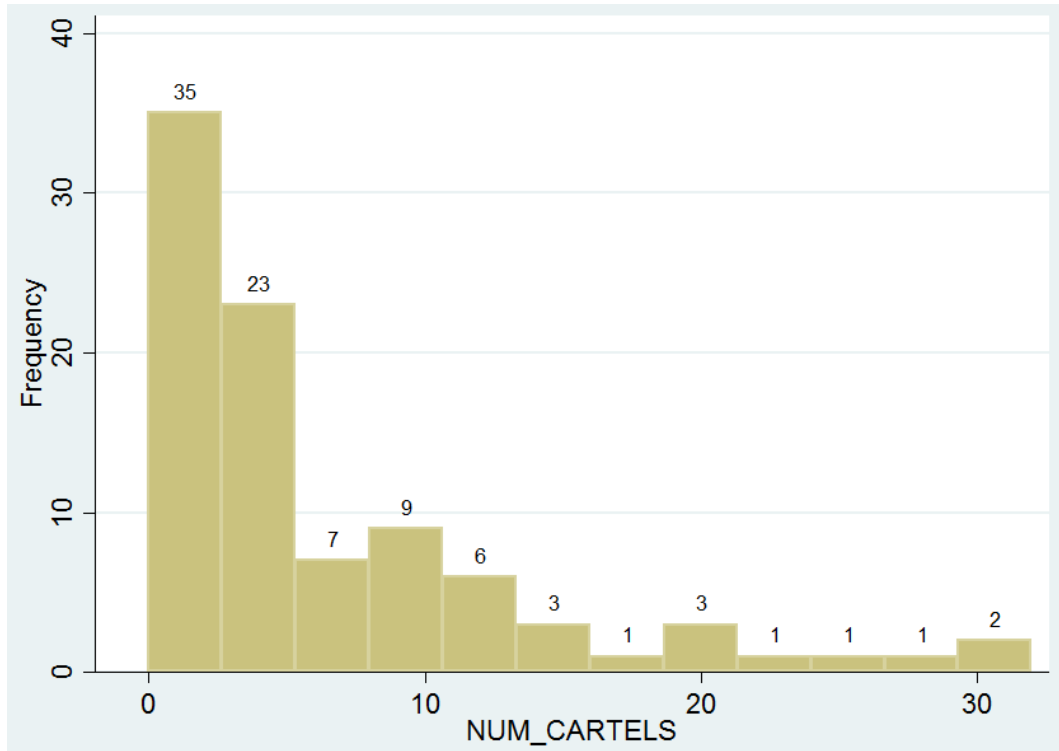
Second, Harrington and Chang (2009) argue that studying cartel discoveries does not provide sufficient information regarding the effectiveness of leniency. Specifically, the authors state that when the detection probability is sufficiently low, the introduction of leniency guidelines will indeed increase the number of detected cartels (Harrington & Chang, 2009). On the contrary, when the detection probability is high, the deterrence effect of leniency prevails, since the number of active cartels to detect is already small (Frisch, 2016). Hence, leniency will lead to fewer cartel discoveries. The interpretation of results thus depends on the initial detection probability (Harrington & Chang, 2009). Therefore, Harrington and Chang (2009) argue that assessing the effect of leniency on cartel duration provides less ambiguous results. Further research could thus study the efficiency and effectiveness of the Belgian leniency programme through assessing the effect on cartel duration.

Third, the regression analysis includes cartels detected by four NCAs. Focussing on only one NCA could provide more cross-sectional variation to compare empirical findings. Therefore, further research could empirically analyse the BCA or another NCA when there is sufficient data available later in time or through assessing quarterly data.

Lastly, NCAs revise existing leniency guidelines, which may influence detection and deterrence capabilities. Therefore, this paper's findings include the potential effects of these subsequent revisions. Hence, future research could study the change in the number of cartel discoveries or cartel duration after a revision of a leniency programme is implemented.

Appendices

Appendix 1: Histogram of the dependent variable



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