Optimal Allocation of Cartel Fines

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Also exploring anticompetitive behaviour is Kai Fischer, who investigates the optimal means of punishing collusion in a market. As Fischer notes in the introduction, both the number of cartels detected and the fines being given as sanctions for collusion have been increasing over the past 25 years in Europe. This can be attributed to a series of new measures being implemented by competition authorities, such as heavier fines and criminal charges for collusion as well as "leniency programmes" which grant immunity to those who confess to cartel membership. However, cartelism is still a problem at both a national and international level, thus evidently more needs to be done. There are two primary avenues that competition authorities can take: increasing the severity of sanctions or increasing detection rates. Both of these options incur wider economic consequences, and thus there is a fine balancing act to be done between maximising the level of deterrence and minimising cost. In other words, competition authorities need to seek out the most cost-efficient way of deterring collusion. Using the Lagrangian multiplier method, Fischer illustrates how competition authorities can approach this problem.

I. Introduction

Due to strengthening competition pressure in the market, companies will often try to find ways to stay profitable or to even increase their profit margins. Besides legal measures (e.g. improving efficiency, segmentation within a market), some companies consider collusion. In the following essay, I focus on how a competition authority (henceforth, CA) can react to cartel formation. In doing so, there will be a description of all fine-related tools which CAs can use. Furthermore, their reciprocal influence will be analysed. Finally, a cost-efficient allocation of the CAs' tools is examined. For that, focus will be especially laid on the role of the probability of conviction.

Cartels are a particularly damaging form of anti-competitive behaviour, greatly decreasing the overall surplus in a market. To increase cartel detection rate, CAs have begun to introduce "leniency programs", whereby members of cartels can confess to collusion in exchange for full or partial immunity from fines and criminal prosecutions. In Germany (where it has been possible to "blow the whistle" since 2000) and the European Union (EU) the number of cartels detected increased sharply (see Tables 1 and 2). In addition, the size of fines for collusion has risen sharply in recent years (see Table 3). This could indicate that CAs are operating a new strategy emphasising the importance of fines instead of increasing the probability of detection. Nevertheless, this essay shows that only adopting heavier fines without increasing the probability of cartel detection is insufficient for stamping out collusion completely.

Table 1: Collusion – EU Commission Cases since 1995 (EU Commission, 2018)

Time Period	1995-1999	2000-2004	2005-2009	2010-2014	Since 2015
EU Cases	10	30	33	30	22

Table 2: Collusion – German Federal Cartel Office (FCO) Cases since 1997 (Bundeskartellamt, 2018)

Time Period	1997-2000	2001-2004	2005-2008	2009-2012	2013-2017
EU Cases	11	6	15	49	38

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Table 3: Fines declared by EU Commission and FCO since 1995 [in millions of Euro] (Bundeskartellamt, 2018; EU Commission, 2018; Statista, 2016)

Time Period	1995-1999	2000-2004	2005-2009	2010-2014	Since 2015
EU Fines	292.8	3,462.4	9,414.0	7,917.2	6,837.9
FCO Fines	308.9	821.0	1,214.4	2,133.9	399.0

II. Literature and Collusion Theory

The literature extends back to Becker (1968) who first introduced the economics of crime. He states that crime can be avoided by finding an optimal allocation of all tools executive forces have to deter. Applied to collusion, he suggests that CAs can prevent collusion by selecting a suitable strategy. The following models extend his basic framework. Camilli (2006) adds the role of price elasticities. Miller (2009) argues that - besides fines - other instruments such as structural remedies should be used to sanction collusion. There is an ongoing debate whether current fines are too high or too low to secure effective deterrence as well as a cost-minimizing allocation at the same time. Connor and Lande (2006) recommend increasing fines, whereas Kobayashi (2001) emphasises problematic aspects of potential overdeterrence. Wils (2006) and Andreoni (1991) primarily work on the relationship between fines and the probability of detection.

Since collusion is a way to increase companies' overall profit, CAs have to find means which reduce the incentive to collude. To put the incentive to zero, profits gained due to collusion have to equal the expected fine a company has to face. The expected fine $S_{overall}$ is the product of the following three factors: the fine imposed by the cartel authority if a cartel is detected (S); the probability of detection (α), i.e. the share of cartels detected in relation to the population of all cartels existing; and the probability of conviction (β) which indicates the share of detected cartels which are finally punished. On the basis of these assumptions, the final equation emerges, where π^K is the additional profit the company is earning due to collusion:

$$\pi^K = S_{overall} = \alpha\beta S$$

Similar conditions are formulated by Harrington (2014) and Kaplow (2013). In the equation, it is highlighted that a high fine is not enough to secure effective deterrence, as α and β have to have at least a minimum level. That is why both probabilities influence cartel firms' behaviour and should be chosen carefully.

Nevertheless, CAs are not able to select a certain value for both probabilities. α cannot be measured due to missing information on the overall population of cartels. β is not under the control of most CAs. Whether a cartel firm is convicted or not depends on legal circumstances, e.g. the structure of the executive or behaviour of single judges. This essay is one of the first in which there is a distinction between α and β. In the extant literature, both probabilities are usually combined as a general probability variable. But, different factors influence both of these probabilities and CAs cannot influence each of them directly. To have a detailed view on the differences in comparison to those essays where there is a single overall probability, this essay will explain the differences of the probabilities and the final effect on the optimal allocation of CAs' tools in depth.

III. Competition Authorities' Tools

As the main opponent of any cartel, CAs have to ex-ante prevent, detect and ex-post sanction collusion. In doing so, the CA can influence two parameters: the probability of detection α and the actual fine S. Both parameters cannot be influenced directly but can be changed in the medium-term. For example, α can be increased by hiring more staff at a CA. The more people there are trying to detect cartels, the higher the probability of detection. Still, the process of employing new CA agents takes time. Changing S can be done by adapting law and legal circumstances, e.g. adopting the *Bußgeldleitlinien* of the FCO. To strengthen deterrence, CAs can increase α and S, so that firms do not have an incentive

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to collude anymore. Nevertheless, CAs should act efficiently – that is, they should offer effective deterrence at a low-cost level. For a minimum cost level CAs should allocate S and α in a way that they hit the minimum of the CAs' cost functions. To be able to argue this point, the cost function of a typical CA is framed in the following sections. Increasing S has a positive effect on the overall fine $S_{overall}$. Unfortunately, to increase S causes additional costs to the wider economy. Though it does not cost CAs a lot of money to change laws to adapt S[1] , companies which do not even engage in collusion fear being accidently affected by these new high fines. They invest in prevention measures in order to not have to pay high fines. Those expenditures can be interpreted as cost caused by increasing S. The higher the value of S, the higher the costs to the wider economy will rise.

Furthermore, the more CAs increase S, the higher the marginal costs are. Outside companies first do not fear increasing fines as much. But as soon as those fines can endanger companies' financial stability, precautionary measures and related expenditures will increase:

$$\delta C/\delta S > 0, \ \delta^2 C/\delta S^2 > 0 \quad \text{(Camilli, 2006)}$$

The cost structure of α is similar. Raising α is one possible strategy to increase the degree of deterrence. Nevertheless, costs emerge. In contrast to the proportional increase in the deterrence effect by changing α

$$(\delta S_{overall}/\delta\alpha > 0, \ \delta^2 S_{overall}/\delta\alpha^2 = 0),$$

costs increase over-proportionally:

$$\delta C/\delta\alpha > 0, \ \delta^2 C/\delta\alpha^2 > 0 \quad \text{(Camilli, 2006).}$$

1 Implementing new laws could cause first-copy-cost arising once at the beginning of the usage of the new law. Later on, it does not cost anything to use those new regulations.

Marginal costs of α increase due to the declining marginal productivity of labour and other input factors. When CAs hire more employees to detect more cartels, the first agent finds more undetected cartels than the tenth does. Therefore, marginal costs for an additional unit of α rise.

Since both input factors have increasing marginal costs, the cost-efficient allocation can only be found by optimizing both tools at the same time. This is done via the use of a Lagrangian cost minimisation function, as seen in the following section. Still, the important role of β has to be taken into consideration. β is not fixed by CAs directly, so this variable cannot be used to minimize the cost function in the Lagrangian model. Still, S has influence on β, so that CAs can indirectly have an impact on the probability of conviction. If CAs cause S to rise, β is expected to fall:

$$\delta\beta/\delta S < 0 \qquad \text{(Andreoni, 1991; Snyder, 1990).}$$

Judges tend to have stronger concerns about sentencing a company if S rises, because a false conviction has more drastic consequences. Therefore, high fines would cause judges to decrease the share of convicted companies. Thus, these are additional costs of increasing S.

IV. Single-Period Optimization of the Allocation of CAs' Tools

Firstly, all tools can be defined on certain intervals. E.g. $\alpha\beta \in [0,1]$, so that S cannot lie beneath a critical value of $S^*_u = S_{overall}$. Otherwise, deterrence would not be effective anymore. If there is a maximum fine (as is the case in most countries), there are minimum values for α and β, too. It follows:

$$\alpha \in [\alpha^*_u, 1] \text{ and } S \in [S^*_u, S^*_o]$$

with α_u as a minimum probability of detection and S^*_o as the maximum fine. Analysis results show that α and S are two input factors which increase the deterrence effect of CAs' measurements. Further analysis will show which combination of both is the cost-minimizing allocation[2] . By that, the allocation which maximises consumer surplus and overall surplus should be found. In the Lagrangian function beneath we assume that CAs aim at minimizing the cost functions by adapting α and S. In addition, the effect of S on β is included in the model.

$$\min_{\alpha,S} L = C(\alpha,S) - \lambda[\alpha\beta(S)S - \pi^K] \text{ with } \delta\beta/\delta S < 0$$

$$\alpha^* = \beta S^* C_S / (C_\alpha(\beta + \beta_S S^*))$$

$$S^* = \theta\beta_S/2 + \sqrt{\theta}\sqrt{(\theta\beta_S/2 + \beta)}$$

$$\theta = \pi^K C_\alpha / (\beta^2 C_S) \text{ and}$$

$$\beta_S = \delta\beta/\delta S.$$

The stronger the effect of S in β, S and α change like this:

$$\delta\alpha^*/|\delta\beta_S| > 0 \text{ and } \delta S^*/|\delta\beta_S| < 0.$$

Due to the fact that β is endogenously influenced by S, there is an opposing effect to the increasing deterrence effect caused by an increasing S. Therefore, overall costs rise and CAs substitute from S to α. It is striking that the expected interval for α is far higher than current estimations of α are (Bryant & Eckard, 1991). This indicates that current antitrust policies are not efficient. Furthermore, in reality CAs tend to have higher fines than optimal from the theoretical point of view. This could be done to achieve cost-efficient deterrence because increasing fines can

2 In this essay, cost-minimisation is chosen as a basic assumption for an efficient CA. Public choice literature (e.g. Tollison, 1985), emphasises that in reality CAs do not act in a cost-minimizing fashion. Nevertheless, it is not gone in detail here, so that the strong assumption of cost-minimisation is made to find the theoretic efficient solution. This result can be compared to current strategies then. Otherwise, the role of all tools could not be analysed without having distortion in the results caused by further assumptions.

be seen directly, whereas increasing α and by that the effect on $S_{overall}$ cannot directly be recognized. Furthermore, the endogenous probability of conviction causes a shifting substitution relation between α and S in comparison to the case of an exogenous probability of conviction (often assumed in the literature):

$$S/\alpha = C_\alpha(\beta+\beta_S S)/C_S = C_\alpha/C_S + C_\alpha(\beta-1+\beta_S S)/C_S \qquad \text{with } \delta\beta/\delta S < 0.$$

Therefore, the exchange relationship is lower for the optimum case now. The additional component $C_\alpha(\beta-1+\beta_S S)/C_S < 0$ equals an additional cost component for S, so that overall costs rise as well.

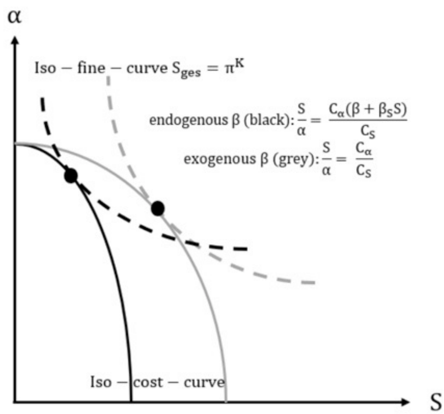

Fig. 1: Graphical Solution of Cost Minimization: exogenous and endogenous β

Iso-cost-curves (= CA's budget curve) are concave due to the second derivative. Optimal allocations are located where iso-cost-curves are tangential to iso-fine-curves. The iso-fine-curve turns inside when $|\beta_S|$ increases and the optimal allocation moves to including a higher α. Holding budget constant, that means that there is a lower overall fine for the case of an endogenous β (lower level of iso-fine-curve). The slope of the iso-fine-curves depends on β_S.

V. Implementation in Reality

This essay has a different perspective on cartel detection than is standard in the literature. It is not only focused on effective deterrence

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but on reciprocal influences among all tools and their role for a cost-efficient allocation. Nevertheless, the theoretical solution is not easy to implement in reality. For example, transparency problems can emerge. That can lead to S being used more than α because the effect of altering S can be seen easily. Furthermore, costs for S are indirectly caused and are not paid by the CAs, so adapting α could be neglected. Costs of new employees are easier to recognize and give an incentive to not change α for additional deterrence. Furthermore, the optimal allocation depends on other factors like demand elasticity and firms' behaviour. However, these are not addressed within the scope of this essay. Moreover, fines are individualised in this model, i.e. it is assumed that for each cartel case an optimal allocation can be found. Nevertheless, in reality CAs work with fine catalogues which do not allow as much flexibility in adapting fines as is assumed here.

Moreover, it is important to keep in mind that this model is a one-period model. In a multi-stage model, it is not necessary to have total deterrence, i.e. collusion is even allowed to be profitable. Firms with a high discount factor do not collude without fearing large fines (Harrington, 2014). Another potentially problematic aspect is that firms do not always behave rationally as it is assumed in this essay. It can often be the case that firms react less to an increasing α than to an increasing S because a rising α is not visible, whereas changes in S are directly visible given that they are announced by the CA. Therefore, in reality larger fines in theory could be cost-minimizing even if there are no changes in α (Bar-Ilan & Sacerdote, 2004). Additionally, it should be taken into consideration that the probability of conviction has a central effect on the optimal allocation of the CAs' tools. It depends on national circumstances how much influence a country's CA has on the probability of conviction. Therefore, it is difficult to generalise the results. Finally, in reality the budget constraint of CAs plays an important role. Consequently, in another model the budget constraint could be added as a second side constraint. Then, it would be possible to assess whether the theoretical optimal allocation is even affordable.

VI. Conclusion

The optimal design of fines for collusion requires a detailed and multi-dimensional analysis. In this essay, focus lies on efficiency and cost-minimisation. The model delivers results which suggest that CAs' current strategies have too low a probability of detection. This could cause an insufficient level of deterrence. Furthermore, most literature does not take the probability of conviction as a separate factor into consideration. The content of this essay could be improved by solving the weaknesses of the model (e.g. demand elasticity missing, strong rationality assumption) in subsequent essays. Nevertheless, it should be emphasised that fines are the basis of punishment but only one of several measurements CAs can use. Leniency programs, private damage claims, criminal sanctions and structural remedies can be employed as well. They represent potential complements to fines. Furthermore, this essay shows that only increasing fines is not cost efficient. If cartel profits rise, fines and the probability of detection both have to be adapted. Finally, it is important to keep in mind that this essay searches for cartel fines calculated on the basis of the cartel profits. But there are several countries which calculate fines in relation to firms' turnover. This could be added to an extended model as well.

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