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Information Bargaining in Leniency Programs

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Abstract

This essay presents a set of reforms for the Swedish competition authority's leniency program. The leniency program is viewed as a tool for information bargaining in environments where information is unequally distributed. Within this context two different settings are explored. In the first information is complete but imperfectly distributed. In the second information is incomplete and imperfectly distributed. Each setting provides its own aspect on how reform could enhance the Swedish leniency program's influence in terms of successful cartel prosecution. An Extension of the leniency program to include cartel ringleaders and potentially more than one conspirator is proposed. Such reforms would raise overall welfare by increasing deterrence through greater total penalties and through enhancing the incentives for conspirators to convey information to the competition authority.

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1: Introduction

Antitrust policy is constantly discussed and debated. Proponents argue that efficient implementation of antitrust can decrease or even eliminate deadweight losses in addition to lessening costs associated with rent seeking for monopoly profits (Posner, 2001). Others, including the Swedish competition authority, argue further that the associated welfare redistribution from consumer to producer is something off-putting, although not an economic cost per se, and requires antitrust regulation.¹ Critics range from those who are skeptic regarding the implementation of antitrust in its current form to some who are simply not convinced with antitrust policy in general (Crandall and Winston, 2003).

Recent developments in Swedish antitrust include the addition of a leniency program to battle cartels.² The purpose of this essay is to conduct an economic analysis of the Swedish leniency program. Two questions serve as a baseline for analysis and discussion: Is the Swedish leniency program efficient in its current form? If not how could it be improved?

The point of view taken here is that the amount of information conveyed by defendants to the competition authority is the key measure for success of a leniency program. Within this information bargaining context two models will be presented. These are subsequently combined in an attempt to create a framework that is capable of demonstrating the bargaining situation incorporated in an efficient leniency program when information is imperfectly distributed.

Section 2 provides a background on leniency, the objectives of the Swedish competition authority and the legislation currently used to achieve these objectives. The section ends with two suggestions of reform to existing legislation. Section 3 introduces the models. Section 4 provides a discussion of each model and the applicability of the combined framework on Swedish leniency regulations. Section 5 concludes.

¹ For sources and further information, please refer to:

http://www.konkurrensverket.se/konkurrens/varfor_konkurrens.shtm

² By providing carrots in the form of reduced sentences for informants (KKVFS, 2006:1). For information in English, please refer to: http://www.konkurrensverket.se/eng/competition/leniency_guidelines.shtm

2: Background

2.1 Why Introduce a Leniency Program?

It may not seem completely obvious whether a leniency program can promote optimal deterrence in an economy. Two arguments suggest that cartel agreements as such will be unstable. First, there exists an incentive for each individual firm to increase the quantity it produces somewhat in order to reap extra profits (Perloff, 2004: p435-436). Second, in markets where the cartel is not the only producer, firms not in the cartel (the fringe) could simply increase output and gain market share (Posner, 2001: p62).

Research suggests that the situation, unfortunately, is not so simple. Sophisticated methods have been developed under which collusion seems possible even in situations where uncertainty persists (Ellison, 1994). Trigger pricing is one of these methods.³ Another cause for concern is that firms acting outside of a cartel often have limited capacity to react. This is due to the fact that cost of implementation, in this case represented by output increases, and time are frequently inversely related (Alchian, 1971). Therefore quick response to quantity restrictions is often too costly to be considered a realistic alternative. Moreover, most firms produce on the upward sloping part of their marginal cost curve (Posner, 2001: p63). If this were not so one would witness natural monopolies everywhere since decreasing variable costs would promote constant expansion!

The facts mentioned above speak in favor of the idea that cartels may indeed be more stable than originally assumed. Historically sticks have been used to create expected costs of collusion. In his classic paper *Crime and punishment: An Economic Approach* Gary S. Becker emphasizes the importance of raising expected penalties over the expected gain for optimal deterrence (Becker, 1968). In addition, Becker also observes that deterrence is more effectively increased by raising the probability of punishment rather than through increases in the severity thereof.

³ The Firms in a cartel may agree on a “trigger price” at which they return to the pre cartel output levels for a specified period of time. Thereby making detection of- and cheating on the cartel more difficult.

More recent research in the field of psychology and economics makes an argument for a modification of rationality assumptions (Rabin, 1998). Suggestions include that economic agents have preferences that are *time inconsistent* and depend on *hindsight bias*.⁴ Agents suffer from *loss aversion* which implies that potential losses, given a certain reference point, should affect behavior more than what would be considered rational. Firms may be assumed to act more rationally than individuals but this should not disqualify these results.⁵

The incorporation of loss aversion into antitrust theory would imply that expected penalties need not be as high as expected payoffs to ensure optimal deterrence. On the other hand, time inconsistent preferences may lead to some upward adjustment.

The probability of detection can be increased with different measures. One way is through increased monitoring by competition agencies. Increases in monitoring of firm activity raise costs for society directly and indirectly. Indirect costs are achieved through *over-deterrence* (Kobayashi, 2002).⁶ This implies that society suffers costs associated with inefficiencies in resource utilization by firms who are either afraid of being suspected for collusion or by conspiracies who devote more resources to concealing their actions. Over-deterrence issues prevail in areas where regulations are less clear. In general this implies that over-deterrence is less of a problem in battling collusion, where rules are clearly set. The opposite is true for regulation of information exchange among firms where over-deterrence is a prominent issue due to the vague rules in this area (Posner, 2001: 159-171).

⁴ Time inconsistent preferences imply that agents discount future punishment at a higher rate than what is rational. Hindsight bias implies that historical outcomes can have stronger effects on agents in forming their expected future payoffs than what would be considered rational.

⁵ Another factor that may be of interest when setting penalties is myopia. Lee and McCrary (2005) present results which suggest that individuals can be regarded as myopic when calculating their expected penalties. How this behavior affects firm activity is still rather unclear however and therefore this idea is left as a note in this text.

⁶ Over-deterrence implies that firms' behavior is adversely affected by excessive expected penalties. For example, a firm that is not infringing any regulation may spend large amounts of resources on monitoring its employees and other measures to avoid being affiliated with illegal activity and risk a trial.

An alternative approach is a leniency program that offers carrots to potential confessors. By combining sticks and carrots the goal is to achieve increased deterrence without causing over-deterrence. In order to assess the qualities and restrictions of the Swedish leniency program it will be advantageous to begin by explaining its details and objectives.

2.2 The Swedish Leniency Program

Article 28b of the Swedish Competition Act states that: Immunity may be granted to a corporation that provides information on collusion to the competition authority of a sort that the authority was not yet aware of (KKVFS 2006:1).⁷ In addition the corporation must continue to fully cooperate with the competition authority throughout the entire investigation. There are two additional requirements which are to be fulfilled if the corporation is to qualify for leniency:

1. The corporation is the first to inform the competition authority regarding its participation in a conspiracy.
2. The corporation may not have assumed a leading role in the infringement.

The competition authority has recently been subjected to criticism for its inability to successfully punish conspiracies (Wahl, 2006). The amount of cases successfully tried has been unsatisfying and when a conspiracy has been found guilty, punishment in the form of fines has been far too low to promote effective deterrence (Wahl, 2006). Fault for the latter should, however be attributed to the courts who have simply lowered the fines originally proposed by the competition authority.

Under-usage of the leniency program has been a major factor in contributing to the lack of successful punishment. The cure for increased usage as it has been laid out by Wahl can be summarized as: Simplification for increased predictability of outcomes. This in addition to higher fines should largely increase deterrence and efficiency of the system (Wahl, 2006).

⁷ For English translation of KKVFS 2006:1 please refer to:
http://www.konkurrensverket.se/eng/competition/leniency_guidelines.shtm

2.3 Suggestions of Reform

This essay will present some more radical suggestions of reform for the leniency program. Economists seek to maximize welfare through increased efficiency wherever possible. The economic perspective on this issue is therefore not so preoccupied with the justice (or fairness) issue as such, although one should not completely dismiss the significance of utility which individuals may draw from justice. Two modifications to the existing leniency program are proposed below. These suggestions are both explicitly aimed at increasing the probability of successful conviction. To be clear, increased penalties for offenders is nothing this essay, or economists in general should, refute (as long as possibilities of over-deterrence are taken into consideration). As noted earlier though, increased probability of conviction is more efficient deterrence than increased penalties.

Suggestion 1

The competition authority should extend its leniency policy to include ringleaders, who have assumed leading roles in the infringement, or other actors who are heavily involved.

Suggestion 2

The competition authority should be given the possibility of awarding leniency to more than one offender if the information that may be obtained is expected to increase the total penalty. This possibility may be used on a discretionary basis.

For these suggestions to be effective it must be shown that unfair penalties can maximize the total penalty and therefore be used as means for optimal deterrence. Furthermore it should be possible to acquire further information concessions through bargaining after initial information has been obtained. The next section presents two models that make a case in favor of these statements.

3: Two Models with Differing Assumptions Regarding Information

The concept of bargaining for information is introduced through two models. These models differ in their assumptions regarding the completeness of information. As a consequence, both models explore differing possibilities and objectives referring to the state of information among the relevant actors.

The first model presents a situation where information is unequally distributed but *complete*. Such a setting is straightforward in the sense that it implies an objective of gathering information to the extent necessary to impose successful conviction with an overall satisfying penalty.

The second model assumes unequally distributed and *incomplete* information. In this setting, actors' beliefs play a central role in determining the optimal deterrence policy. The addition of beliefs as a central element presents new challenges to reach desired objectives. This setting requires a different approach and provides an alternative angle of viewing the issue.

3.1 Bargaining in a Setting of Complete but Imperfectly Distributed Information⁸

Assume a conspiracy that involves 2 defendants, $i = \{1, 2\}$, who have been accused of collusion. There also exists a competition agency whose goal it is to maximize the total penalty facing the conspiracy. Hence, this setting includes three players. Further assumptions critical to this model can be summed up as follows:

Litigation costs are assumed to be zero. p_i denotes the *ex ante* probability of conviction and it is assumed to vary depending on the defendants role in the crime. Defendant 1 can be considered the Ringleader and therefore he faces a higher *ex ante* probability of conviction than defendant 2, i.e., $p_1 > p_2$. In addition each defendant possesses information that can increase the probability of conviction for his codefendant. This increase of probability is defined as φ_i . The defendant with the highest *ex ante* probability of conviction possesses the most of this information, i.e. $\varphi_2 > \varphi_1$.

⁸ This model is a somewhat simplified version of the model presented in Kobayashi (1992).

Deterrence is maximized by maximizing the sum of the defendants expected penalties. The game between the competition authority and the defendants is made up of two stages in which the authority first makes simultaneous plea offers to each defendant. In the second stage each defendant decides whether to accept or reject their respective offers. If a defendant accepts a plea offer, he receives a total penalty of $(p_i + \delta_i)X$, where X is the penalty imposed upon conviction and $\delta_i X$ is the plea penalty ($\delta_i \geq 0$) or the plea discount ($\delta_i \leq -\varepsilon < 0$).⁹ If an offer is rejected the outcome for each defendant will depend on the action of his codefendant. If the codefendant does not accept the plea offer either, the defendants expected penalty equals $p_i X$. If the codefendant accepts a plea bargain and testifies, the expected trial penalty for the defendant is increased to $(p_i + \varphi_i)X$. Normalizing the sentence to $X = 1$, the defendants face the penalty matrix illustrated below.¹⁰ A key difference between this game and a standard prisoner's dilemma is that the offers made by the competition authority are unconditional.¹¹

Table 1 The Penalty Matrix

		Defendant 2	
		Clam (C)	Fink (F)
Defendant 1	Clam (C)	p_1, p_2	$p_1 + \varphi_1, p_2 + \delta_2$
	Fink (F)	$p_1 + \delta_1, p_2 + \varphi_2$	$p_1 + \delta_1, p_2 + \delta_2$

In this setting the outcome is characterized by a situation in which both defendants accept the offers made by the competition authority. What should be more controversial is the

⁹ The magnitude of the plea discount is set equal to or above $\varepsilon > 0$ so as to make sure that an optimal strategy for the prosecutor exists!

¹⁰ Observe that the penalty matrix illustrates each defendant's view, which is to minimize the expected penalty he is facing. In addition, since litigation costs are 0 there is no "added penalty" for a trial conviction.

¹¹ This implies that if the defendant accepts the offer it must be honored as can be verified by the payoff structure in the matrix.

result that the ringleader is charged with a lower penalty than his conspirator in the optimum. This is due to the assumption that says that information possessed by each defendant is positively correlated to his involvement in the crime. Therefore the competition authority bargains with the most culpable defendant in order to obtain the highest amount of information. This will allow the maximum expected total penalty, although the individual penalties may be viewed as unfair. The objective is thus to prove that the expected total penalty can be maximized in an unfair setting. This proof is provided below.

To solve for the equilibrium outcome in this game backward induction is used, i.e. the final stage is considered first. The defendants react to the offers made by the authority depending on the values of δ_1 and δ_2 . These will first be considered exogenous before determining them in deriving the authority's optimal offers (δ_1^*, δ_2^*) .

Stage 2: The Defendants Game

In the defendants game there are six distinct cases to consider:

Case 1. $\delta_i < 0, \delta_j < 0$: Both defendants choose dominant strategy F .

Case 2. $\delta_i > \varphi_i, \delta_j > \varphi_j$: Both defendants choose dominant strategy C .

Case 3. $\delta_i < 0, \delta_j > \varphi_j$: Defendant i chooses dominant strategy F , defendant j chooses dominant strategy C .

Case 4. $\delta_i < 0, 0 < \delta_j < \varphi_j$: Defendant i chooses dominant strategy F , defendant j chooses best response F .

Case 5. $\delta_i > 0, 0 < \delta_j < \varphi_j$: Defendant i chooses dominant strategy C , defendant j chooses best response C .

Case 6. $0 < \delta_i < \varphi_i, 0 < \delta_j < \varphi_j$: Both C, C and F, F are pure-strategy equilibria.

The last case is unique in that it is the only case where no single pure-strategy equilibrium can be obtained through the direct or iterated elimination of strictly

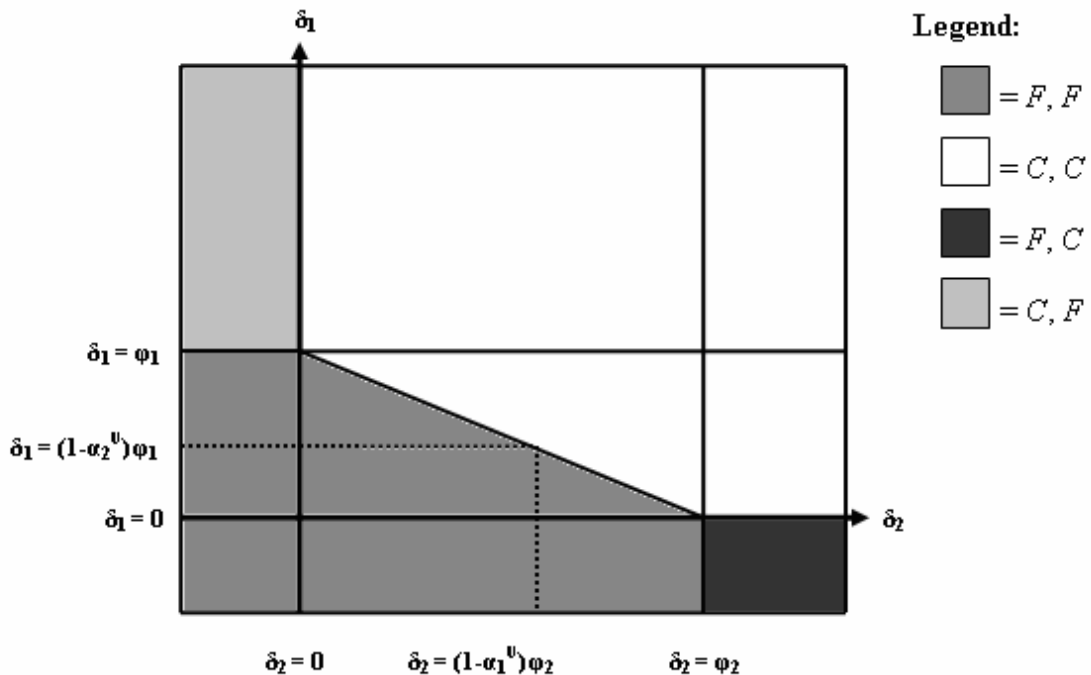
dominated strategies. In the last case there are two pure-strategy Nash equilibria, (C, C) and (F, F) .¹²

The procedure that can be used to derive a result for when which of the two pure-strategy equilibria will apply to a given set of offers is called the *linear tracing procedure* (Harsanyi and Selten, 1988). Since the result is rather intuitive the actual procedure will not be covered here.¹³ The result states that (F, F) is an equilibrium outcome when the set of offers made:

1. Impose lower penalties than previously expected on both defendants
2. Adequately offset any penalty placed on defendant j that is greater than his prior penalty with a penalty on defendant i that is lower than his prior penalty.

The outcomes are illustrated in figure 1 below. α_i^0 represents player j 's prior beliefs on the probability that player i will play strategy C .

Figure 1
Pure Strategy Equilibria



The different outcomes are dependent on the size of the penalty discount or penalty increase for each player.

¹² There also exists a mixed strategy equilibrium but it is not essential for the analysis in this paper.

¹³ The procedure is covered in the appendix to Kobayashi (1992). For completeness, please refer to Harsanyi and Selten (1988).

Stage 1: The Authority's Equilibrium Offers

To derive the optimal set of offers (δ_1^*, δ_2^*) it is necessary to first compute and then compare the maximum total penalty for each of the four second-stage equilibria: (F, F) , (C, C) , (F, C) and (C, F) .

If both plea offers are rejected, (C, C) , the total penalty will equal the *ex ante* penalties facing the individual defendants:

$$\pi^*(C, C) = p_1 + p_2 \quad (1)$$

Alternatively, the authority can pick a combination of $\delta_i > \varphi_i$ and $\delta_j < 0$. The expected penalty is maximized when the plea discount is set as close to 0 as possible ($\delta_j = -\varepsilon$). If $i = 1$ and $j = 2$, the authority's expected payoff equals

$$\pi^*(C, F) = p_1 + p_2 + \varphi_1 - \varepsilon \quad (2)$$

If $i = 2$ and $j = 1$, the authority's expected payoff will be

$$\pi^*(F, C) = p_1 + p_2 + \varphi_2 - \varepsilon \quad (3)$$

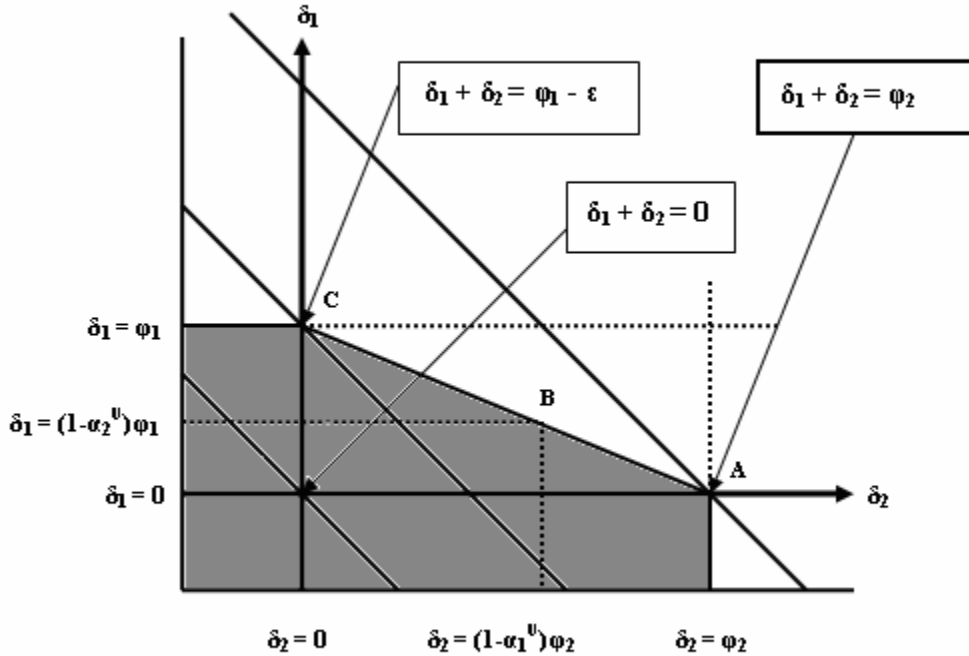
Since it is assumed that $\varphi_2 > \varphi_1 > \varepsilon$,

$$\pi^*(F, C) > \pi^*(C, F) > \pi^*(C, C).$$

The authority's preference between $\pi^*(C, F)$ and $\pi^*(F, C)$ will thus only depend on the magnitude of φ_1 versus φ_2 . Each defendant receives an offer that will depend on his relative ability to increase his codefendant's probability of conviction. In figure 2 iso-penalty lines have been added to the picture.¹⁴ These lines are linear and will have a slope of -1 in δ_1, δ_2 space. They represent the penalty tradeoff between player 1 and 2.

¹⁴ An iso-penalty line represents along which the total penalty is equal in all instances although differently distributed. It functions analogously to iso-cost lines or indifference curves.

Figure 2
Authority's Payoff:



The iso-penalty line that lies furthest to the northeast intersects point A. That the overall penalty is largest here can be verified from the figure.

The last case to be considered is when both defendants choose fink, (F, F) , as their strategy. If (F, F) is the equilibrium the prosecutor will choose (δ_1, δ_2) so as to maximize the total penalty $\delta_1 + \delta_2$ given the constraint provided by the shaded area in figure 2.

The prosecutor's optimal strategy will vary depending on which of two distinct cases applies. Case 1 is illustrated in figure 2. The boundary of the shaded area between point B and point A has a slope between zero and minus one i.e. $(1 - \alpha_2^0) \phi_1 / \alpha_1^0 \phi_2 < 1$. The highest attainable iso-penalty line passes through the point $(\delta_1^*, \delta_2^*) = (\epsilon, \phi_2 - \epsilon)$. The expected total penalty is equal to

$$\pi^*(F, F) = p_1 + p_2 + \phi_2 \quad (4)$$

That (δ_1^*, δ_2^*) is the global optimum can be checked with the previously made assumption that $\phi_2 > \phi_1 > \epsilon$ and the fact that $\pi^*(F, F) = \pi^*(F, C) + \epsilon$.

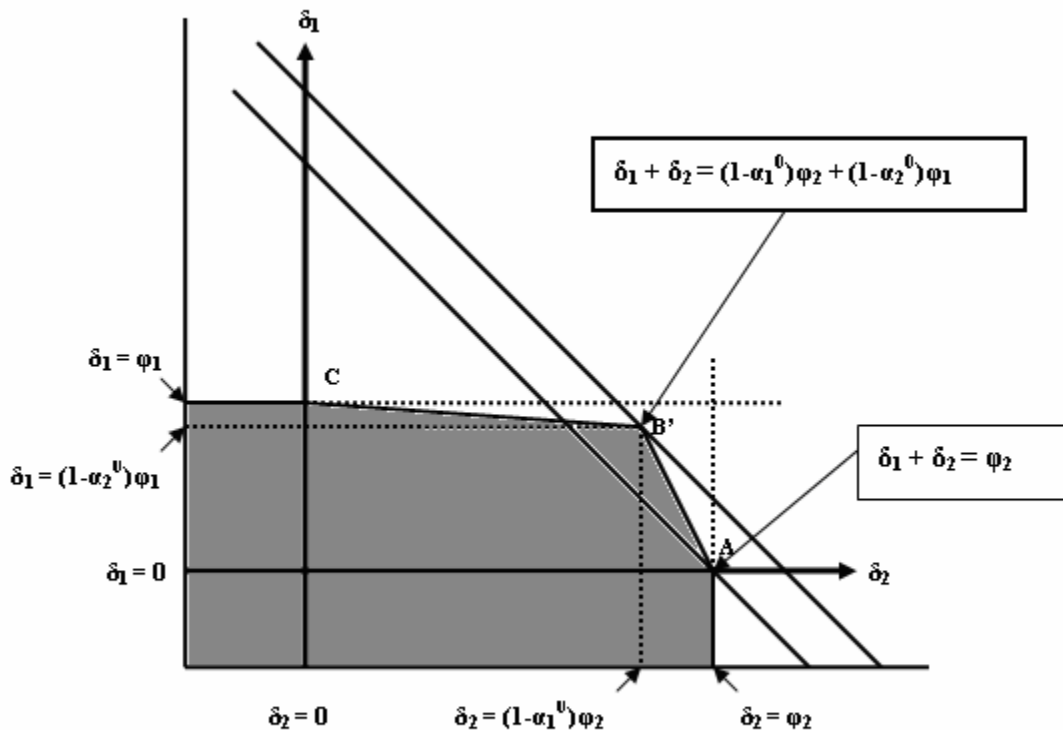
In the second case, $(1-\alpha_2^0) \varphi_1 / \alpha_1^0 \varphi_2 > 1$, the boundary of the shaded area between point B and point A is smaller than minus one. The highest attainable iso-penalty line will now be the one passing through the point $(\delta_1^*, \delta_2^*) = (1-\alpha_2^0) \varphi_1 - \varepsilon, (1-\alpha_1^0) \varphi_2 + \varepsilon$. The expected total penalty is

$$\pi^*(F, F) = p_1 + p_2 + (1-\alpha_2^0) \varphi_1 + (1-\alpha_1^0) \varphi_2 \quad (5)$$

That $(\delta_1^*, \delta_2^*) = (1-\alpha_2^0) \varphi_1 - \varepsilon, (1-\alpha_1^0) \varphi_2 + \varepsilon$ is the global optimum is verified in the same manner as for case 1 with one addition. The iso-penalty line passing through this point lies above the line that passes through $(\varepsilon, \varphi_2 - \varepsilon)$. Case 2 is illustrated in figure 3 below.

Figure 3

Authority's Payoff : Case 2



In this second case the larger slope in point B' creates a new equilibrium. The iso-penalty line passing through point B' lies further to the northeast which verifies the optimality of the new total penalty.

A Numerical Example

Assume $p_1 = .6, p_2 = .3, \varphi_1 = .2$ and $\varphi_2 = .4$. Both defendants are further assumed to have diffuse prior beliefs, i.e. $\alpha_1 = \alpha_2 = .5$. The assumptions imply that:

$(1-\alpha_2^0) \varphi_1 / \alpha_1^0 \varphi_2 = \varphi_1 / \varphi_2 = .2 / .4 = .5 < 1$. Thus, case 1 applies here and the authority's optimal offers are $(\delta_1^*, \delta_2^*) = (\varepsilon, \varphi_2 - \varepsilon) = (\varepsilon, .4 - \varepsilon)$. In equilibrium both offers will be accepted and defendant 1 will receive a lower total penalty than defendant 2. $p_1 + \delta_1 = .4 + \varepsilon < p_2 + \delta_2 - \varepsilon = .7 - \varepsilon$. Even though defendant 1 faces a higher ex ante (p_i) and ex post ($p_i + \varphi_i$) expected penalty, defendant 2 receives a higher penalty in equilibrium.

3.2 Bargaining with Incomplete- and Imperfectly Distributed Information

In situations of incomplete information a player's beliefs are central to the outcome of the game. As will be shown below, a defendant's optimal strategy will depend on his beliefs regarding the competition authority. In the game below a situation where the competition authority utilizes the beliefs of defendants to its advantage is modeled. The outcome below illustrates the case in which defendants are convinced to Fink when the competition authority needs to purchase further information.

That this game has some valuable properties may seem evident. Its emphasis on the importance of beliefs in situations of incomplete information makes it a useful complement to the model of complete information presented above. This model serves as an argument for allowing extended forms of leniency in situations where the competition authority lacks sufficient information for a successful trial. Second, it makes a case for analyzing, and trying to utilize to one's advantage, belief structures among defendants. In a repeated game setting, previous outcomes provide an important part of forming beliefs as suggested by the *hindsight bias* property.

A Perfect Bayesian Equilibrium (PBE) is defined as a complete set of actions that are optimal given each player's beliefs. These beliefs are formed through observation of actions taken by a counterpart. There are several kinds of Bayesian equilibria. Here we look for a Separating Equilibrium which will be defined and explained in process.¹⁵

¹⁵ A second prominent equilibrium, the pooling equilibrium, will not be pursued in this essay. In a pooling equilibrium the type of competition authority the defendant is facing is decided by nature since the competition authority will pool on one action regardless of its type (thereof the name pooling). The reasons for not illustrating in detail a pooling equilibrium are two. For one the separating equilibrium suffices to make a cogent case for the importance of beliefs in bargaining situations. In addition the author does not

This is a two stage game played by 2 players; the Competition Authority (A) and the Cartel Ringleader (R). The key feature is the fact that there exists imperfect information on the side of R . His reaction to A will depend on the signal he receives through observing A 's actions.

In stage one A must decide if it will make a plea offer or not. This decision rests on the information previously accumulated by A about the cartel. If A feels confident in winning a trial it may option to proceed to court immediately. On the other hand if information regarding the cartel's existence is too scarce and A feels that the expected total penalty is too low it may option to make a plea offer to R .¹⁶

In stage two R must decide whether to Clam (C) or Fink (F). His decision will be based on his expected payoffs which in turn are based on his beliefs about how much information A has accumulated. These beliefs will, as mentioned earlier, depend on the signal R receives from A . The game is illustrated in figure 1 below.

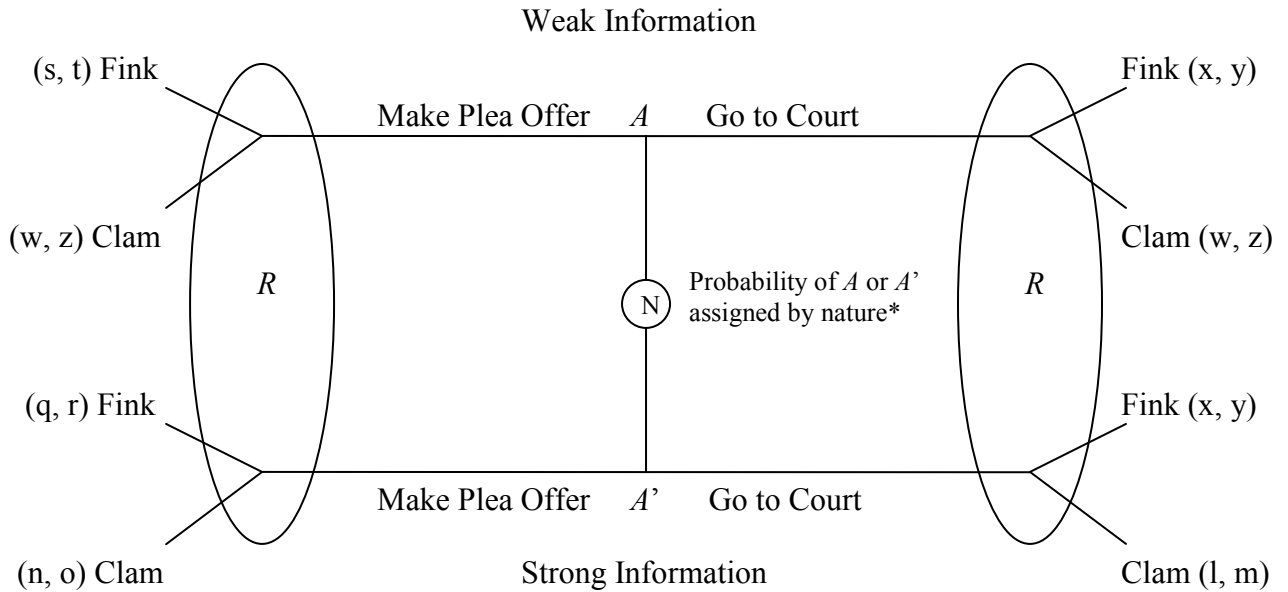
wish to present a detailed analysis regarding how nature assigns probabilities to the type of competition authority.

¹⁶ Perhaps C has gained information from a cartel member but expects that more information may increase the chances of successfully punishing the cartel.

Figure 1

Characterization of the game

Payoffs: (Competition Authority, Ringleader)



*Strictly speaking, the probability of A or A' occurring is set by nature, but this assumption is not critical in the analysis since it is the outcome in each case that is of interest.

Although the game is played by 2 players, (A, C), the game presents three, (A, A', C). This is due to the fact that the ringleader faces a competition authority that can potentially assume two different forms, (A, A'), depending on whether it has weak or strong information on the cartel's activities.

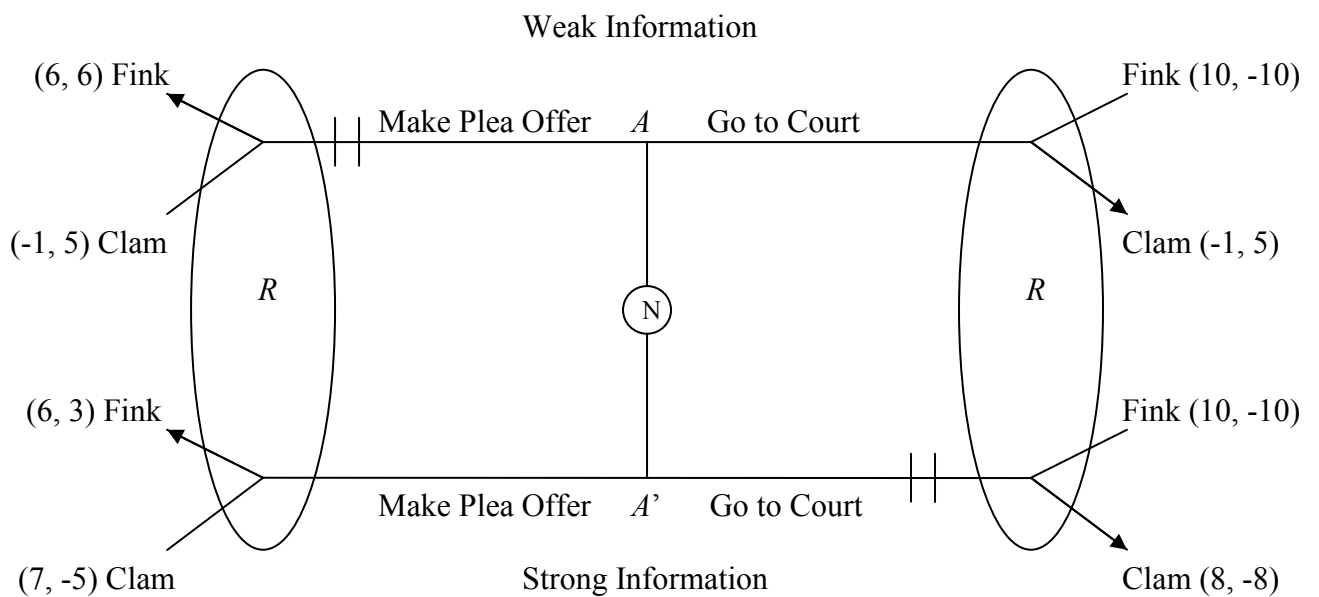
A separating equilibrium in this game is characterized as follows. Through observing an action taken by the competition authority (A or A' depending on it's state) R forms beliefs about if he is facing A or A' . In figure 1 this implies that by observing the action taken by A or A' , R determines at which point of the game he is through his beliefs about his opponent. For the equilibrium to be stable, the reaction by R should be of such a kind that none of the players can profitably deviate from their present position. This requires that the expected payoffs are formed so as to make such equilibria optimal. An important part in forming these payoffs is the strategy used by A when trying to get R to play F .

In this case the separating equilibrium should be one where R believes he is facing A when he observes the strategy *Make Plea Offer* (i.e. R receives a plea offer from A) and that he is facing A' when he observes the strategy *Go to court*. An example with payoffs is illustrated in figure 2.¹⁷

Figure 2

Example with Payoffs

Payoffs: (Competition Authority, Ringleader)



The payoffs denoted under *Clam* in response to *Make Plea Offer* can be thought of as the results of a following trial. Note that the payoffs are equal when Fink is played under *Go to court* regardless of the state of information. This is due to the fact that litigation costs are still assumed to be zero. If this had not been the case, i.e. litigation costs not equal to zero, the equilibrium would have remained stable only within a certain interval of costs associated with litigation. This should not deter the analysis however, since this interval is affected by the expected penalties also. If litigation costs are kept within a certain relation to penalties the equilibrium will thus remain stable.

Potentially there can be two types of separating equilibria in the game illustrated in figure 2. One set of strategies involves A playing *Go to court* and A' playing *Make Plea Offer*. However this set of strategies can be excluded due to the fact that it involves a strategy that is strictly dominated. Regardless of R 's reaction, A' is always better off playing *Go to*

¹⁷ How these beliefs are formed can depend on several different factors. Subjective probabilities may arise due to previous experiences (hindsight) and through observation of other games of equal or similar nature.

Court. As mentioned above the separating equilibrium in this game involves *A* playing *Make Plea Offer* and *A'* playing *Go to court* since none of these strategies are strictly dominated. When *R* observes the strategy *Make Plea Offer* his beliefs will lead him to assume that he is currently in the top left corner of the game. His best response given the payoffs would be to play *F*. Observe that *R* will always play *F* when he observes the strategy *Make Plea Offer* even if he were *A'* because he believes that he is facing *A*.¹⁸ Similarly when *R* observes *Go to Court* his beliefs lead him to assume that he is in the bottom right corner of the game where his best response is to play *C*. In order for these strategies to constitute a Perfect Bayesian Equilibrium there must be no profitable opportunity to deviate for any player given the oppositions strategies. That this is the case can be verified in figure 2.¹⁹

The PBE in the above example is constituted by the following set of strategies and beliefs:

A: *Make Plea Offer*

A': *Go to Court*

R: Play *F* if observe *Make Plea Offer*, play *C* if observe *Go to Court*.

R 's beliefs: Only type *A* plays *Make Plea Offer* and only type *A'* plays *Go to Court*.

¹⁸ In this case *R* 's decision to always play *F* when observing *Make Plea Offer* does in fact constitute a best response also when facing *A'*. This does not always have to be the case however!

¹⁹ Neither *A* nor *A'* will change his strategy given *R*'s strategies and vice versa.

4: Discussion

4.1 Analysis of Situations with Imperfectly Distributed but Complete Information

The plea bargaining model illustrates how “unfair” penalties can lead to increased deterrence through greater overall punishment. An alternative conclusion is presented by ELP (Easterbrook, Landes and Posner, 1980) who argue that the magnitude of a penalty facing an individual defendant is positively correlated to his culpability. As such their analysis contradicts Kobayashi’s but there are several important differences in the assumptions made. In the ELP model the total punishment facing the conspiracy is fixed but the individual defendant’s punishment is endogenous. Therefore, the plaintiff may settle for a small penalty with one defendant. This increases the residual penalty for the others. Settling with less culpable defendants in order to increase the penalty for the most culpable ones makes sense since this procedure maximizes the plaintiff’s expected payoff. In Kobayashi’s model however, each individual’s penalty is exogenous and nondependent of possible settlements by Co conspirators.

Kobayashi’s approach has some advantages over the one provided by ELP. The complete but imperfect information framework presented in Kobayashi is more realistic than a setting with complete and perfect information as presented in ELP. Costs associated with collusion are very rarely obtained or calculated (Wahl, 2006). Moreover, Kobayashi focuses on the crucial point of how to obtain the information required in order to most efficiently punish the conspiracy whereas ELP focus more on determining the optimal fines for efficient deterrence.

Easterbrook (1983) argues that unjust penalties reduce deterrence. In his opinion individual’s rational expectations of expected payoffs from committing a crime are decisive and thus lower penalties for heavy wrongdoers may increase their willingness to become criminals. However, antitrust issues differ since they involve conspiracies which by definition consist of more than one firm. If conspirators are scared by high penalties they will not join the conspiracy in the first place and thus increased willingness by ringleaders to form conspiracies will be offset by others unwillingness to cooperate.

Increased expected penalties for co-conspirators may cause over-deterrence through overprotective measures. These serve to lower the subjective expected probability of conviction. An example of such an action is excessive surveillance that may involve disproportionate monitoring of employees. This increases production costs and creates a welfare loss to society as long as the conspiracy is not yet discovered. Losses caused by such actions may be considerable. Kobayashi (2002) analyzes this problem. He observes that the costs from over-deterrence seem to increase with expected penalties when they exceed the optimum. A change in leniency regulations would require consideration of this issue when setting penalties.

4.2 Analysis of Situations with Incomplete and Imperfectly Distributed Information

The PBE serves to illustrate a possible setting in which the probability of successful punishment can be increased through improved possibilities of utilizing leniency as a carrot for obtaining information. Acquiring additional information on conspirators through an extended leniency policy is supported by Motta and Polo (2003). They argue that the attractiveness of accepting a leniency offer after an investigation has already commenced can be very high since the expected punishment has increased with the opening of an investigation.

As mentioned above a repeated game setting allows possibilities for the competition authority to utilize the beliefs (and the expected payoffs associated with these beliefs) formed by cartel members through hindsight bias to its advantage.

Incomplete and imperfectly distributed information on the side of the conspirators weakens the argument that “the race to the courthouse effect” will disappear under forms of extended leniency.²⁰ The effect is changed but its critical features are preserved. Since information is neither complete nor perfectly distributed, conspirators cannot be expected to know with certainty whether other members have been conveying information to the

²⁰ The original race to the courthouse effect assumes that firms will race to the courthouse since they know that only the first confessor will be awarded leniency. Thus if leniency makes it profitable for only one firm to convey information to the competition authority the conspiracy will be detected. The fact that this is common knowledge should create a race among conspirators.

competition authority or not.²¹ Thus uncertainty prevails. Moreover, the analysis by Motta and Polo (2003) presented above shows that the expected penalty increases substantially when an investigation has commenced. This implies that if conspirators become suspicious of an investigation regarding their recent activity, the race to the courthouse effect not only prevails but may become even stronger! The fact that leniency to more than one is not guaranteed if the information provided by the first firm is sufficient for the competition authority to proceed successfully against the cartel provides yet another incentive to fink early. The argument for extending leniency is further strengthened by Harrington and Chen (2005) who show that when leniency is only partially awarded there may be perverse collusion increasing effects.²²

Something that at first may seem counterintuitive is that it is not necessarily economically efficient to employ measures aimed at discovering every cartel immediately (Kobayashi, 2002). Such measures may require disproportionate expenses on the side of the competition authority. If the cartel is causing a lot of deadweight loss larger penalties become even less desirable than a higher probability of detection. This is due to the fact that the deadweight loss outweighs the expected gains in the form of penalties obtained from prosecution. In this case extended leniency may be more cost-efficient. In addition, if increasing damage to public welfare is positively correlated to increasing startup costs for a conspiracy, optimal deterrence is most efficiently achieved through early detection.²³

4.3 Swedish Leniency Regulations

Wahl (2006) says that the Swedish competition authority has not been notably successful in dealing with conspiracies. Its leniency program has employed excessive requirements for leniency in the past. This has resulted in lower than expected usage by firms. Critics such as Wahl (2006) have attributed the leniency program's lack of efficiency to the process of implementation, not the structure of the program. According to Wahl (2006)

²¹ It is assumed that conspirators will not inform other members regarding their decision to fink.

²² The incentive to deviate from a conspiracy is too low with partial leniency programs. The program is exploited to lower expected penalties instead of deterring firms from forming a conspiracy.

²³ For correlation between startup costs and cartel sizes, please refer to Posner (2001)

The Swedish competition authority has far too little power in determining the final penalties imposed on firms. The fact that penalties have constantly been lowered during trials in recent years is certain to affect firms' behavior.

Increased predictability of the Swedish leniency program has been on the list of requirements (Wahl, 2006). Predictability is good to the extent of getting firms to internalize expected payoffs rationally. On the other hand, given a situation where information is incomplete and imperfectly distributed, uncertainty exists. It may be possible to exploit firms' attitudes towards risk. Signaling can be an important part of this process.

The United States saw some major changes to its leniency program in the 1990: s. These changes included improved possibilities to award leniency to conspirators with major roles in a conspiracy. Kobayashi (2002) makes a case for the success of the modified system by observing the dramatic increase in the amount of leniency applications since these changes took effect. The models presented in this essay underline the importance of reexamining and reforming the Swedish Leniency Program. In light of US experience and recent theoretical advancements a more economic approach to antitrust in general, and the leniency program in particular, would be beneficial to Swedish welfare.

5: Conclusion

The Swedish competition authority should be given increased possibilities to pursue its goal of optimal deterrence. Awarding leniency to a ringleader may lead to a larger penalty in total. Extending leniency offers to more than one defendant as an exchange for increased information may likewise have an overall penalty increasing effect. Penalties that provide optimal deterrence given these reforms should be introduced.

In assessing the efficiency of a leniency program a key question is whether the probability of detection is high. Since the probability of detection depends on the amount of information accumulated by the competition authority, an increased emphasis on the importance of information gathering will surely increase chances of prosecution. The environment in which the competition authority acts is often characterized by incomplete and imperfectly distributed information. Modern economic theory allows more precise modeling of diverse environments. The leniency program would benefit from reforms that take into account this progress in theory.

The overall costs or benefits to society are likely to determine the existence of any system of regulations. It is difficult to say whether a modified leniency program will itself cost more to implement than the existing one. There is room for additional research in this area. The biggest cost to society however is the cost associated with the existence of cartels and other conspiracies that practice market restraining activity. The leniency program was introduced as a means to lowering these costs. If a modified version does increase the probability of conviction, its benefits will likely exceed any extra costs associated with its implementation.

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