The Role of Economics in Cartel Detection in Europe [*]

Hans W. Friederiszick[†] and Frank P. Maier-Rigaud[‡]

This is a working paper version, for the final version please see:

D. Schmidtchen, M. Albert and S. Voigt (eds.), The More Economic Approach in European Competition Law, Mohr Siebeck, Tübingen (forthcoming, 2007).

[*] We thank Svend Albæk, Rainer Becker, Joe Harrington, Massimo Motta, Marc Pirrung, Lars-Hendrik Röller, Pierluigi Sabbattini, Andreas Seip, Maarten Pieter Schinkel and participants at the ACLE Forensic Economics conference in Amsterdam, the European Competition Network Chief Economist meeting, the 25th Conference on Political Economy in Saarbrücken and our colleagues from DG Competition. The views expressed are those of the authors and not of the European Commission.

[†] European Commission, Directorate General Competition, Chief Economist Team, Brussels, Belgium. Since October 2006 his new affiliation is the European School of Management and Technology (ESMT), Berlin.

[‡] European Commission, Directorate General Competition, Directorate A, Policy and Strategic Support, Brussels, Belgium; Department of Economics, University of Bonn and Max Planck Institute for Research on Collective Goods, Bonn, Germany.

1. Introduction

In the wake of the successful implementation of leniency programs in and across the EU other instruments of cartel detection have become less prominent. In the period from 2002[1] to the end of 2005, the Commission adopted 30 statements of objections, a necessary procedural step before taking a decision in cartel cases, roughly 2/3 of which were based on leniency applications. While accepting the contribution of leniency in pursuing the overarching objective of antitrust policy in the context of cartels - deterrence and desistence of collusive agreements – the following article argues in favour of a more balanced tool set for cartel detection including economic methods.

The paper is structured in the following way. Section 2 provides an introduction to the nature of collusion and the role of economics. Section 3 discusses the legal basis and the enforcement instruments available to the Commission for fighting cartels. Section 4 discusses the interdependency and the individual advantages of leniency and ex officio cartel detection. Section 5 puts forward the main challenges any economic methodology to trigger ex officio inspections has to deal with. Section 6 discusses the two main methods for cartel detection – top down and bottom up approaches. Section 7 concludes.

2. The Economics of Collusion

From an economic point of view collusion describes a situation where market prices are close to monopoly prices despite an oligopolistic market structure. In contrast to unilateral conduct that also may allow prices to rise significantly above the competitive price level in an oligopolistic environment, collusion rests on the dynamic interaction between firms: firms condition their future behaviour in the market on the current behaviour of competitors. For instance, firms may revert to 'cut throat competition' for some period in the future in reaction to a competitor's deviation from collusive price levels. This type of dynamic interaction allows firms to maintain prices at levels close to monopoly prices and significantly above what unilateral conduct alone would allow.

Consider a simple symmetric duopoly situation where the two firms i and j can choose to either compete or collude. Table 1 presents the situation in a typical 2-firm matrix game in normal form where the first value in brackets represents the payoff of firm i and the second the payoff of firm

[1] In 2002 the Commission Notice on Immunity from Fines and Reduction of Fines in Cartel Cases, OJ C45/3, 19.02. 2002, went into force replacing the first leniency program instituted by the Commission in 1996. In the six years in which the first leniency program applied, the Commission received more than 80 applications, while the number of applications has since 2002 risen to 165 in less than four years. See p. 56 in European Commission (2006).

j. If profits are ranked in the following way: a > b > c > d and 2b > a + d > 2c the game is a classic prisoner's dilemma (PD) game. [2]

Table 1: General 2×2 prisoner's dilemma game in normal form.

	Collude	**Compete**
Collude	(b,b)	(d,a)
Compete	(a,d)	(c,c)

In a simple one period setting, collusion does not constitute a Nash equilibrium and rational firms will therefore never collude under perfect information. Two firms will only collude if the cartel internal incentive constraint is not violated, that is if the (expected) profits of collusion are higher than the (expected) profits of defection, $\pi_{col} \geq \pi_{def}$. By assumption the incentive constraint is violated in the one shot game: the defection profit in the one shot case, a, is larger than b representing profits under collusion. Hence, firms will fall back to the unilateral output or price levels and the competitive equilibrium emerges.[3] Introducing time into the game, i.e. periods are indexed by $t \in \{0,1,2,...,T\}$, other outcomes may become equilibrium outcomes.

One possibility is to transform the one shot game into a supergame by infinitely repeating the stage game depicted in Table 1 (Formally $T \to \infty$). In the simplest scenario without discounting of future payoffs, the folk theorem applies, indicating that an infinite number of strategies can be supported as equilibria.[4] Introducing a discount factor, $\delta \in (0,1)$, collusion remains a sustainable strategy if firms find it more profitable. Formally, the incentive constraints are $\sum_{t=0}^{\infty} \delta^t b = \frac{1}{1-\delta} b \geq a + \sum_{t=1}^{\infty} \delta^t c = a + \frac{\delta}{1-\delta} c$, i.e. expected profits of collusion (left hand side of the inequality) are greater than expected profits of defection (right side of the inequality).[5] In the absence of competition law enforcement, this incentive constraint describes the logic of cartel

[2] The second condition is of some relevance to the further discussion since it assures that collusion remains the most attractive strategy for both players in a repeated context and a strategy alternating between collude/compete and compete/collude does not result in higher profits (See Rappoport and Chammah (1966)).

[3] Note that Cournot (where strategies are in quantities) or Bertrand (where strategies are in prices) games can be reduced to a prisoner's dilemma game by restricting the set of players and actions to two. For example, in such a setting 2b would correspond to the monopoly profit feasible under the assumption of quantity, respective price, competition. For the purpose of this paper it is therefore unnecessary to extend the analysis to complex scenarios as all the points can also be made based on a symmetric PD game. Note, however, that a structural dynamic approach may allow to describe the emergence and breakdown of cartels.

[4] See Rubinstein (1979) for a commonly cited proof of the folk theorem.

[5] For the case of a Cournot oligopoly, Friedman (1971) has shown that a grim trigger strategy, i.e. choose the collusive output until one firm deviates and produce the competitive output thereafter, although not renegotiation proof, allows to sustain collusion for a range of discount factors. Note that this type of Nash reversion is typically not optimal with continuous strategy spaces and an arbitrary restriction of punishment to Nash reversion may be problematic (Kühn, 2005).

dynamics.[6] Holding profits, i.e. market conditions, constant it is possible to solve for the critical discount factor for which the incentives to cooperate equals the incentives to defect, that is $\delta^* = \frac{a-b}{a-c}$. If $\delta \geq \delta^*$, i.e. the future is relatively important, collusion is stable. Collusion is stable because the threat to revert to the one shot Nash equilibrium is credible and does not allow any firm to profitably deviate while the collusive outcome is more profitable for both firms.[7]

Although the duopoly scenario outlined above is rather basic and the models are more complicated with *n* firms, larger strategy spaces (i.e. more than a binary choice set) or uncertainty, game theory as such cannot be considered to be particularly helpful for the empirical problem of cartel detection. It allows identifying the possibly infinite amount of collusive equilibria but remains silent about the process of equilibrium selection and how firms actually coordinate.[8]

As a result, economic theory can at best help to distinguish between competitive and collusive equilibria and provide some general considerations under what conditions collusion is more likely to arise.[9] Since some of these considerations will be taken up in the section discussing different approaches for triggering inspections using economic indicators, they are not discussed here.[10]

It may, however, be important to point out at this stage that despite contrary theoretical predictions collusion has been continuously found and sustained for long periods of time in the experimental laboratory.[11] Although it is outside the scope of this paper to discuss this literature,

[6] Note that this implies that leniency may still trigger applications even in the absence of detection. The reason for this is that market conditions may change the incentives for collusion and firms will apply for leniency in order to get a head start in the ensuing competition.

[7] A second possibility to allow collusion as a potential equilibrium in the PD game is to have the game end in finite but stochastic time by introducing a probability of termination. In that case, the probability of the game ending is 1, while the final period remains unknown. Such a situation is equivalent to a supergame with lower discount factor, i.e. $\delta = \rho\delta$, where $\rho \in (0,1)$ is the probability of continuation. For games that end in finite but non-stochastic time, Luce and Raiffa (1957) have shown that the only subgame perfect equilibrium is both firms competing in all periods. Applying the logic of backward induction, the unique Nash-equilibrium outcome of the finitely repeated PD game under perfect information is again the one in which both firms compete in every single period (see e.g. Binmore 1992 or Osborne and Rubinstein 1994).

[8] See Mehta (2005) or Cabral (2005) who notes that subgame perfection may not even be the right equilibrium concept.

[9] In addition to the explicit factors to be mentioned below, the literature has also pointed to more subtle coordinating devices (Scherer and Ross 1990) that do not require any explicit coordination between firms. The concept of salient strategies, termed focal points is an example (see Schelling, 1960).

[10] For overviews of the theoretical literature on collusion, see for instance Tirole (1988), Shapiro (1989), Motta (2004), Feuerstein (2005), or Ivaldi et al. (2006).

[11] See Holt (1995) for an overview, or for instance the classic theoretical paper by Selten (1973) and experimental follow up studies by Huck et al. (2004) analyzing the role the number of firms plays for sustaining collusion. See also Beckenkamp et al. (2007) and the comprehensive overview by Engel (2006).

experimental methods may allow a more thorough understanding of what actually is conducive to collusion and what is not.[12]

If one wants to derive economic criteria to detect collusion, a relevant insight is that tacit and explicit collusion rest on the same economic principles. The notion of explicit collusion refers to what is legally considered to be a cartel, i.e. a situation where firms directly interact to establish collusion. Tacit collusion in contrast describes a situation where the firms can establish supra-competitive prices without direct interaction. If cartel members can not write enforceable contracts, the incentive to defect exists equally in both scenarios.

The equivalence of the underlying economics of tacit and explicit collusion means that the criteria established in the context of merger control to identify tacit collusion provide a meaningful framework also for the detection of explicit collusion. More specifically, the following factors have been established in the merger control context to be of relevance. Firms have (i) to reach terms of coordination, (ii) to monitor compliance, (iii) to threaten timely retaliation and (iv) to limit the reactions by outsiders.[13]

The drawback of the fact that the same economic incentives arise under the two different forms of collusion is that economic indicators are of limited value for distinguishing between the two. This is one of the reasons why economists tend to reject the idea of *prosecuting* cartels on economic grounds only.[14]

The following section introduces the enforcement instruments available to the Commission and their legal basis.

3. Enforcement Instruments under EC law

In the practice of the European Commission, cartel detection based on inspections at the premises of firms plays a crucial role. Surprise inspections are by far the most effective and sometimes the

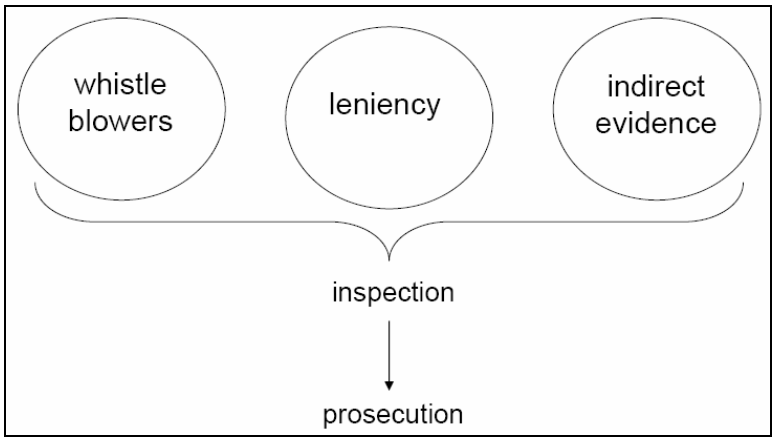
[12] Note that this is also of crucial importance with respect to collective dominance, where a focus on game theoretical concepts in particular with respect to what can be considered a credible punishment mechanism, may be too narrow for a real world competition assessment.

[13] See CFI in case Airto urs plc v Commission, T-342/99, §62 or Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings, OJ C31, 05.02.2004, §41.

[14] Motta (2005:187) and Kühn (2001:175), for instance argue against prosecuting tacit collusion under Art.81 of the Treaty. They provide some examples where it is not possible to distinguish between explicit or tacit collusion based on economic criteria. In addition, both make the point that a case built on economic criteria only will not meet the standard of proof for prosecuting an alleged cartel. Note, however, that Motta is also mentioning a case where it was considered possible to presume explicit collusion despite missing direct evidence. In the Dystuffs case the degree of price parallelism reached a level that – as was argued - could only be explained by direct communication. In general mainstream economics has little to say on tacit collusion and Kühn (2005:208) notes: "The literature has made virtually no progress on dealing with the issue of tacit collusion. However, this is a crucial issue that needs to be resolved for policy purposes, especially in the context of coordinated effects analysis in merger cases."

only means of obtaining the necessary evidence for sanctioning a cartel. Given the generally secret nature of evidence, no real alternative investigative tools currently exist on the European level. The efforts to enforce competition policy in the area of cartels thus crucially hinge on the capability of the Commission to trigger and carry out successful inspections based on a formal decision where the companies concerned are under a legal obligation to submit to the investigation. The legal basis for inspections is found in Regulation 1/2003[15] that specifically grants the Commission the power to "conduct all necessary inspections of undertakings and associations of undertakings" (Art. 20(1)). The firm concerned can challenge the lawfulness of a Commission decision ordering an unannounced inspection (exclusively) before the Court of Justice. A national court may not call into question the necessity for the inspection nor demand that it be provided with the information in the Commission's file.

Figure 1: Instruments for cartel detection



The initial evidence prompting the Commission to adopt an inspection decision is often provided by cartel members in the context of a leniency application but it may also stem from whistle blowers, that is, former employees. While leniency applicants and whistle blowers can provide the Commission with direct insights or even documents about the functioning of the alleged cartel (witness testimony, meeting notes, correspondence etc.), complainants, such as competitors or customers of the alleged cartel, provide more indirect evidence on the existence of a cartel (see Figure 1). It is clear that the Commission is not entitled to "fishing expeditions", i.e. to launch intrusive investigative measures in an unfocused attempt in the hope of finding some evidence of

[15] Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty, OJ L1, 04.01.2003, p.1. Inspection powers are in particular laid down by Art. 20, Art. 21 for inspection of other than business premises and Art. 22 for investigations carried out by Member States at the request of the Commission.

cartel activity. There is, however, no reason why more indirect evidence of cartel activity should not be capable of creating a sufficient degree of suspicion to justify an inspection by the Commission.[16] For instance, customers may observe clear signs of collusive behaviour and report these to the Commission. Also indirect and circumstantial evidence based on a sector inquiry[17] or a market screen, i.e. the active assessment of markets by a competition authority according to predefined economic criteria, cannot a priori be ruled out as a potential source for an objectively founded suspicion of a specific cartel. Particularly bottom up approaches analyzing one specific market in detail (the approach proposed in this paper, Harrington 2005, Nera 2004:176-217) as opposed to more aggregate top down analyses that screen several sectors (Grout and Sonderegger 2005, Nera 2004) are promising in this respect.

EC law does not contain any explicit rule on the exact level of suspicion the Commission needs to have for a decision ordering surprise investigations to be lawful. It would go beyond the scope of the present paper to undertake a comprehensive analysis of this complex legal issue. Nonetheless, some indications can be drawn from Regulation 1/2003 and the case law of the Court of Justice that provide a good first approximation of the degree of information an economic methodology would have to generate to allow the Commission to adopt a decision ordering surprise investigations.

According to Art. 20(4) of Regulation 1/2003, inspection decisions must explain the *subject-matter* and the *purpose* of the inspection, i.e. indicate the presumed facts to be investigated.[18] The suspicion of cartel activity must therefore be sufficiently specific as to enable the Commission to name (i) the behaviour in question, (ii) the competition rules violated and (iii) the (groups of) products or services concerned. Clearly an economic methodology can generate that information and is therefore at least as good as complaints.[19]

Although Art. 20(8) directly relates only to the scrutiny by national courts in certain specific situations, it is clear from this provision and from general principles of Community law[20] that the investigation decision and any coercive measures envisaged must not be “arbitrary”. The Court of

[16] Even in the final decision imposing a fine on cartel members, the Commission can use indirect forms of evidence to meet the required standard of proof. The Commission is therefore, a fortiori, clearly able to rely on indirect evidence to demonstrate the objective foundation of an *initial* suspicion justifying an inspection decision.

[17] The Commission undertook inspections in May and December 2006 relying on customer responses in the context of the energy sector inquiry.

[18] See ECJ in case C-227/92P Hoechst AG v Commission [1999], §41, in case C-94/00 Roquette Frères SA v Directeur général de la concurrence, de la consommation et de la répression des fraudes [2002], §47 and §48 and in case 136/79 National Panasonic (UK) Limited v Commission [1980], §26 and §27.

[19] In fact information from whistle blowers and complaints but also information generated in the context of a leniency program is often incomplete and may be subject to strategic distortions. An economic methodology, in contrast, can only be based on an assessment of that type of information.

Justice clarified that this is the case when "the Commission is in possession of information and evidence providing *reasonable grounds for suspecting* infringement of competition rules by the undertaking concerned" (emphasis added). [21] From this follows, first, that the Court appears to apply a standard of "reasonable suspicion" as condition for the Commission to adopt an Art. 20(4) investigation decision. This standard is likely to be fulfilled where the information available to the Commission is such that any reasonable person would believe, at the time when the decision was taken, that an infringement of competition rules is a serious possibility. Second, the quoted passage also emphasises that the information available to the Commission must be sufficiently precise to allow the identification of each specific firm to be subjected to an inspection ("the undertaking concerned"). Again, bottom up methodologies clearly have the potential to satisfy these two criteria.

The Court of Justice also pointed out at various occasions that inspections, as any other investigatory measure under Regulation 1/2003 (the previous Regulation 17), have to be "necessary"[22] and must not be "disproportionate"[23]. These two requirements refer primarily to the choice of the appropriate investigative measure and only indirectly to the degree of information required in order to justify an inspection decision. The requirements are therefore independent of how the initial information was generated.

Properly conducted bottom up market screens clearly have the potential to be as effective in meeting the burden of proof as more traditional sources of information and may sometimes even be superior to the latter. The important role of ex officio cartel screens for competition policy and the interrelationship of this economics based instrument with other enforcement tools, in particular the leniency program, is discussed in the next section.

---

[20] Cf. Hoechst, §19: "the need for [protection against arbitrary or disproportionate intervention] must be recognized as a general principle of Community law".

[21] Roquette Frères (referred to above), §54 and §61; in French: "l'existence d'indices suffisamment sérieux permettant de suspecter une infraction aux règles de concurrence par l'entreprise concernée"; in German: "ernsthafte Indizien vorliegen, die für den Verdacht eines Verstoßes gegen die Wettbewerbsregeln durch das betroffene Unternehmen ausreichen".

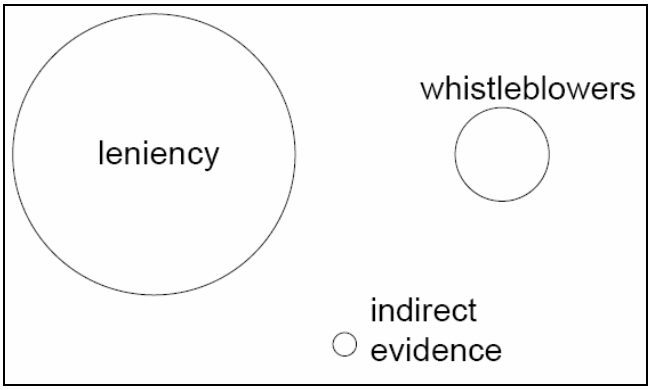
[22] Necessity in this context means that the relationship between the information sought and the alleged infringement must be such that the Commission can reasonably suppose, at the time of the investigative measure, that the evidence sought will help it to determine whether the suspected infringement has taken place; cf. ECJ in case C-36/92P Samenwerkende Elektriciteits-Produktiebedrijven (SEP) NV v Commission [1994] ECR I-1911, §21 referring to the opinion of Advocate-General Jacobs.

[23] The safeguard against disproportionate investigative measures requires the Commission to consider the impact of the measure in the light of the objective pursued, namely the enforcement of competition rules in the public interest. The ECJ held that an inspection decision that is aimed solely at enabling the Commission to collect the necessary information to appraise whether the Treaty has been infringed is not contrary to the principle of proportionality (cf. Case 136/79 National Panasonic (UK) Limited v Commission [1980] ECR page 2033, §§ 28-30; see also case C-94/00 Roquette Frères, §77). Especially with respect to coercive measures that have recourse to the law-enforcement authorities of the Member States, the assessment of proportionality should take into account, *inter alia*, the seriousness of the suspected infringement, the nature of the involvement of the undertaking concerned and the importance of the evidence sought (Roquette Frères, referred to above, §79).

4. Elements of an Ideal Cartel Policy

The overarching objective of antitrust policy is deterrence and desistence. By influencing factors of internal and external cartel stability[24] cartel policy can render the formation of cartels unattractive (deterrence) or can trigger the break-up of existing cartels (desistence). Consider the incentive constraint for collusion discussed in section 2 in the context of the infinitely repeated duopoly game. For a given market structure (i.e. profits remain as denoted in the game), discount factor and effectiveness of antitrust enforcement, collusion is either stable or not in a particular industry. From that perspective, an ideal cartel policy modifies the incentive structure of individual firms in such a way that collusion is no longer sustainable. Such a policy suppresses the existence of cartels immediately in the wake of its implementation. Due to its immediate effect on market cartelization, deterrence and desistence limit the harm to consumers to a minimum. In addition, it minimizes the resource requirements of a competition authority as cartel prosecution, which often binds a significant amount of resources of the authority, becomes irrelevant in equilibrium.[25]

Figure 2: Leniency biased cartel policy



In light of the success of the leniency programs in triggering applications, one may ask whether cartel authorities should not refrain from applying and developing pro-active detection tools such as market screens based on economic criteria even if they can generate sufficient indirect evidence to trigger inspections. Figure 2 provides a schematic overview of the current policy that

[24] Note that there exists an extensive theoretical literature spanning from research on collusive stability as in Green and Porter (1984) to models dealing with leniency as for instance Motta and Polo (1999, 2003) or the recent more general paper by Buccirossi and Spagnolo (2006). For an experimental analysis of leniency see Apesteguia et al. (2007).

[25] In practice, desistence under leniency may, however, have resource consequences, as the authority has to deal with the leniency applications and the follow-up.

is mainly based on leniency and to a limited extent on whistle blowers and complainants, while instruments based on indirect evidence generated by an economic methodology are underdeveloped.

In the following, four arguments are put forward in favour of a policy of pro-active cartel detection. First, it is argued that if full deterrence can not be achieved, for instance due to ineffective instruments, resource constraints of the competition authority or uncertainty[26] in the market, pro-active cartel detection becomes the only tool available to detect cartels outside the reach of the competition authority. Second, it is argued that in some instances leniency is little more than terminal care for cartels, limiting the consumer benefits of cartel detection in those instances. Third, it is established that pro-active cartel detection also adds to cartel deterrence. Finally, it is argued that cartel detection and leniency programs exhibit strong complementarities with respect to cartel deterrence.

With respect to the first argument recall that an ideal cartel policy allows 100% cartel deterrence. If, however, cartel policy is subject to constraints in manipulating the expected profits of collusion and/or defection, i.e. fines cannot be set to infinity or leniency can not provide full reductions or rewards, cartels may still be observed.[27]

In such a second best world, detection based on a pro-active cartel policy becomes the *only* instrument[28] that allows combating cartels outside the logic of the cartel dynamics described by the incentive constraint introduced in section 2. For any given imperfect fining and leniency policy, a subset of markets exists within which the incentive constraint to collude is non-binding. In such a world, the only remaining possibility for prosecution is a pro-active detection policy as provided for instance by the type of market screen methodologies outlined in the next section.

Regarding the second argument note that cartels that are not deterred by a particular competition policy are characterized by a non-binding incentive constraint. A change in, for instance, the leniency policy or exogenous market factors, may entail the break down of the cartel. Prosecuting latently instable cartels, i.e. cartels with a low margin between expected collusive and expected defection profits, indicate low consumer benefits linked to cartel desistence and can therefore not

[26] Note for instance that the notion of "over-deterrent fine" only makes sense in a context with uncertainty about what constitutes an infringement and what does not. In the absence of such uncertainty, a fine F_i is either deterrent or not. Typically F*, the optimal fine level, is chosen such that F* = net cartel profit (or net consumer harm) × inverse of the detection probability, but any $F_i > F^*$ i.e. $F_i \to \infty$ provides "optimal" deterrence. With such a fine no infringement is committed in equilibrium and consequently no fine is ever paid.

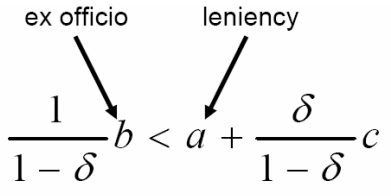
[27] Further, probably more important constraints relate to the possibly boundedly rational nature of cartelists and uncertainty in the market.

[28] Although technically complainants and whistle blowers also belong in this category, these means of triggering an inspection can hardly be considered pro-active instruments as they are beyond the control of the authority.

be considered an enforcement priority.[29] In addition, there seems to be an inherent bias in leniency cartel cases in the sense that cases based on leniency are cartels close to their imminent break-up point:[30] if market conditions change in a way that renders some cartels unstable, there exists a motivation for firms to embellish the ensuing competition by applying for leniency and guaranteeing a reduction in fine for themselves. Clearly, this results in questionable leniency cases, since cartel break-up would have been imminent. In that sense, there is a risk that leniency is little more than terminal care for cartels.

As regards the third argument it has to be pointed out that deterrence and desistence can be reached through several instruments, including pro-active cartel detection. Consider again the incentive constraint determining the internal cartel stability and assume that the constraint is just non-binding for some industry (that is collusion is marginally sustainable).

Figure 3: slack reducing effect of ex officio investigations and leniency



The incentive constraint is violated when either the expected profits of collusion (left side of the incentive constraint) are reduced or when expected defection profits (right side of the incentive constraint) are increased. The former can be achieved by an increase in the detection probability and/or an increase in the fine, the latter by reducing the fine or awarding a reward within a leniency program.[31] Although not necessarily equivalent,[32] collusion can thus be discouraged

[29] Note that with high discount factors future (competitive) profits become important, rendering the one time deviation profit less relevant. In that sense, the incentive constraint is then close to a direct comparison of collusive versus competitive profits. Furthermore, detecting cartels with a high margin between expected collusive and expected defection profits may be considered a priority as the slack in the incentive constraint can be leveraged into adjacent markets. See Bernheim and Whinston (1990).

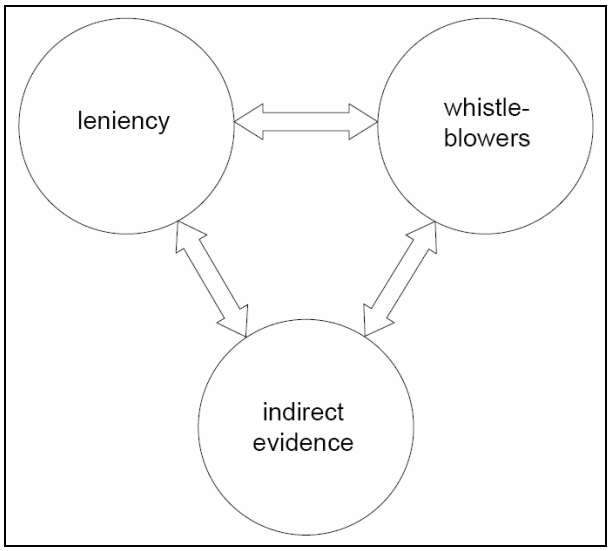
[30] It seems also rather plausible that these will not be recently started cartels but rather cartels in the ending phase given that cartel startup typically involves some fixed costs, rendering cartel formation only profitable if expected collusive profits are substantially above expected defection profits. See Stephan (2006) for an empirical evaluation of the 1996 leniency notice and Goppelsroeder et al. (2007) for a theoretical analysis at what stage of the cartel lifecycle applications for leniency occur.

[31] This holds under the assumption that defection will in some instances result in prosecution and therefore imposition of fines.

either via higher fines and higher detection probability, lowering the expected collusive profits, or via fine reductions or rewards to the defecting firm increasing the expected profits of defection based on leniency. The level of deterrence is therefore a function of fines, detection probability and leniency. From that perspective, any instrument capable of deterrence should play a vital role in the enforcement practice of a competition authority.[33]

Finally, it can be argued that pro-active cartel detection, besides its intrinsic importance, is also relevant as a complement to leniency. The effectiveness of instruments used to trigger inspections is interrelated in the sense that increased detection via ex officio procedures or solid evidence based on complainants or whistle blowers reinforces deterrence and desistence. Economic market screens, in turn have an encouraging effect on complainants and whistle blowers because even cases initially exhibiting weak evidence can be followed up.

Figure 4: Ideal cartel policy



From this perspective it is important to reinforce existing cartel policy by establishing a second leg of enforcement allowing the active detection of cartels outside the logic of the cartel dynamics as described by the incentive constraint. Only with inspections triggered ex officio can the set of cartels in the immediate reach of a competition authority be increased beyond

[32] It is outside the scope of this paper to discuss the likely asymmetric effects of these policies on for instance the resources of a competition authority. Clearly instruments are unlikely to be equally feasible and effective under more realistic conditions.

[33] An analogy can be drawn to the optimisation problem of a multi-plant firm. A firm that exhibits several plants producing the same product but with different (increasing) marginal cost technologies can produce the same output with lower total cost by optimizing the allocation of inputs between the plants: in optimum, the marginal cost of production are equal in all plants. Interpreting the probability of detecting a cartel as 'output', the individual policy instruments as 'plants' and the competition authority's resources as 'input' shows that employing multiple

traditional deterrence and desistence. Figure 4 shows how a more balanced cartel policy could put the weights on different instruments.

5. Towards an Economic Methodology for Initiating Ex Officio Investigations – Four Principles

Accepting the need to strengthen inspections triggered ex officio, the question arises what methodology to choose.[34] Four principles can be identified with which any reasonably robust economic methodology has to comply.

First of all, the methodology should obviously have the potential to detect and thereby deter cartels. Note, however, that within the legal environment in Europe (see section 3) a methodology based purely on random selection – like investigating a random sample of industries each year – would not meet the legal standard despite some power in cartel detection. For that reason any methodology pursued should be capable of selecting markets that are cartelized substantially more often than a simple random device would. In particular it has to limit the probability of false positives, i.e. of inspections triggered without provable cartel detection outcome, to meet the legal burden and to maximize the deterrence effect of the methodology.

Second, any methodology applied by a competition authority should not be easy to circumvent. This is true both for each individual indicator and for the overall methodology. Several direct implications follow from that principle. For instance, a methodology that depends on a single indicator, e.g. some measure of price variation at industry level, is more vulnerable than a methodology relying on several indicators. Furthermore, a rather automated methodology produces a more predictable outcome, compared to a methodology that leaves some room for discretion in interpreting individual indicators. Another implication of this principle is that the methodology should to a reasonable extent be kept secret in order to render circumvention more difficult.

Third, the methodology has to take into account the capabilities and resources of a competition authority on the one hand and the reliability of (public) market information on the other hand. Complex economic analysis binds resources and requires large case teams both with economic and industry know-how. A methodology that requires permanent market monitoring and in-depth industry knowledge may simply overstretch a competition authority's capacities.

---

instruments typically forms part of an optimal resource allocation plan for a competition authority in the absence of corner solutions.

Forth, a methodology has to take into account the limitations of publicly available information.

Obviously, several trade-offs exist between those different principles. We will briefly discuss some of the most relevant ones in the following. One trade-off exists between the amount of data required for the methodology to be applied and resource requirements. A more careful data inquiry for publicly available information will significantly increase the resource requirements of a specific methodology. More in general, the marginal information provided by an additional individual indicator has to be balanced with the cost of information gathering necessary to apply the indicator.

Another trade-off exists between secrecy and detection power of a methodology. Keeping the methodology secret may limit the potential for strategic circumvention by cartelist, but may have negative effects on the deterrence effect of the methodology, which is the central objective of any cartel policy. Communicating to the industry that the competition authority is actively pursuing a cartel detection policy and that it is well aware of economic tools available to support such a policy will clearly contribute to cartel deterrence. One may also argue that secrecy of the methodology will limit its quality due to limited discourse with experts on the merits of the methodology itself. More importantly given the need to justify an inspection (or to justify a non-inspection decision for instance vis-à-vis complainants) it is simply not feasibility to keep a methodology secret.[35] Hence, the methodology should be designed in a way that assures its functionality even when public.

Finally, one may want to point out that a highly automated methodology may reduce resource requirements of the competition authority, but will limit the detection power of the methodology – simple indicators are often misleading – and may be circumvented easily.

In sum, the design of a methodology for triggering ex officio cartel inspections has to be tailored to several opposing objectives and restrictions. Any methodology has to compromise between these different goals. In the following we will discuss the advantages and disadvantages of the main methods put forward in the literature for cartel detection on economic grounds.

[34] In the following the term methodology is understood to comprise a structured set of individual indicators and a rule triggering inspections ex officio based on these criteria.

[35] Re-engineering the method applied from observable past inspection decisions is also limiting the feasibility of keeping it secret.

6. Methods of Cartel Detection – Top Down vs. Bottom Up Approaches

In principle two main approaches for cartel detection based on economic criteria can be identified in the literature, top down and bottom up approaches. Top down approaches screen several sectors in order to identify industries prone to collusion. An example of such a top-down approach can be found in a study carried out by Grout and Sonderegger (2005) for the OFT.[36] Grout and Sonderegger use the incidence of cartels detected by EC and US competition authorities as a measure of cartelization of an industry and try to explain the level of cartelization by various industry specific variables (such as industry turnover, cost measures, concentration measures, measures of entry barriers or volatility measures) via regression analysis.[37] The regression analysis allows the authors to derive a probability of collusion for industries that have not been suspected of collusion in the past, thereby providing a tool for competition authorities to focus their enforcement priorities.

While providing helpful insights, top down methods are often affected by four severe shortcomings. First, the level of aggregation is generally too high to identify specific antitrust markets and, in addition, industry classifications do not match antitrust markets. Top down methods thereby do not allow identifying a specific market for cartel inspection, but can only indicate broad sectors.

Second, an empirical analysis across various sectors requires well-defined, "automated" screens. In principle, those screens can be re-engineered if the general approach is known by industry experts or economic consultants allowing to design cartels in a way to shield them against detection.

Third, the relationship between economic factors and the probability of collusion is often not linear, e.g. the probability for explicit collusion is maximized for an intermediate level of transparency.[38] Furthermore, different combinations of various economic factors may have different effects, e.g. a high level of price parallelism in a highly concentrated industry may be considered as indicator for a higher probability of collusion while price parallelism in a highly fragmented market matches the theoretical prediction of the behaviour of competitive firms.

[36] Other examples are Nera (2004) or Lorenz (2005).
[37] The regression analysis is based on three digit (SIC) industry classification; the measure of cartelization is the number of detected cartels in individual industries since 1990 (for EC) and since 1994 (for US) until 2005. Various regression methods are applied (OLS, Logit, Probit). See Annex B of the study for further details.
[38] See Grout and Sonderegger (2005:71-73) for a discussion of this point.

Fourth, by relying on past cartel detection to derive indicators for detection of cartel activity in other industries, results are possibly affected by a selection bias: those cartels detected in the past are unlikely to provide a representative sample of all active cartels. Such a methodology will bias the enforcement priorities to industries comparable to those in which cartel activity was detected in the past.[39]

Unlike top down approaches that are applied to a wide range of sectors or markets, the bottom up approach focuses on a particular sector or market.[40] Bottom up approaches thereby do not rely on consistent cross-sector data; they can adopt a more flexible set of criteria and are therefore less vulnerable to strategic behaviour; they can at least partially address the issues of non-linearity of individual factors by a more case-based approach and they are less affected by the selection bias as theoretical considerations can more easily be taken into account. Obviously, bottom up methods have their own problems – most importantly the limited availability of public market data and the resource requirements for implementing such an approach.

Overall top down methods have only a limited power and are ill-suited to meet the legal burden of justifying inspections of a particular firm in a specific antitrust market (see section 3 for the legal standard required). They can provide some general guidance, limited though by their inherent bias towards market structures traditionally considered suspicious of collusion.[41]

7. Conclusion

An economic methodology has never been used by the Commission to justify inspections. In this paper we have argued that pro-active economic methods are part of an ideal enforcement policy and can be considered a complement to existing, more passive tools of cartel detection:

First, triggering successful inspections based on an economic methodology is the only tool available to detect cartels outside the reach of the competition authority if full deterrence can not be achieved for institutional or regulatory reasons. Second, in some instances leniency is little more than terminal care for cartels, limiting the consumer benefits of cartel detection in those

[39] We have argued before that cartel inspections based on leniency applications, which currently are the main detection instrument, will result in the detection of latently instable cartels. Hence, an empirical analysis based on this past experience will simply mirror the properties of these latently instable cartels and may therefore mislead the efforts of antitrust enforcers.

[40] See NERA (2004: 176-217) and Friederiszick and Maier-Rigaud (2007) for an attempt along these lines.

[41] Grout and Sonderegger (2005) identify for instance 'telecommunication', 'manufacture of aircraft and spacecraft' and 'manufacturing of grain mill products, starches and starch products' as three of the sectors most probable for collusion but where yet cartels have not been detected (see p.8 for a complete ranking). A simple screening based on Herfindahl-Indices would have potentially lead to comparable rankings; the broadness of the classification 'telecommunications' shows the coarseness of the methodology.

instances. Third, cartel detection based on economic methods also adds to cartel deterrence. Finally, cartel detection based on economic methods and leniency programs exhibit strong complementarities with respect to cartel deterrence.

The problems inherent in using economic analysis for triggering inspections have, however, to be considered. In particular we identified four principles any economic methodology must comply with in order to be a valuable tool in cartel detection: It must have the potential to detect and thereby deter cartels; it should not be easy to circumvent; it has to take into account the capabilities and resources of a competition authority and has to consider the limited public information available.

Despite these challenges, we have argued that ex officio cartel screens are a necessary element in modern cartel detection. Bottom up approaches, in particular, can be structured in a way to meet the legal standards for triggering inspections ex officio while keeping the methodology sufficiently light with respect to resource requirements. The development of such a methodology is a promising first step towards an ideal cartel enforcement policy that if implemented will hopefully be capable of striking the balance between leniency, whistle blower, complaint and ex officio induced cases and also streamline the way cartel cases are dealt with.

References

Apesteguia, J., Dufwenberg, M. and R. Selten (2007): Blowing the Whistle, *Economic Theory*, forthcoming.

Beckenkamp, M., Hennig-Schmidt, H. and F. P. Maier-Rigaud (2007): Cooperation in Symmetric and Asymmetric Prisoner's Dilemma Games - Experimental Evidence, Max Planck Institute, Bonn.

Bernheim, D. and M. D. Whinston (1990): Multimarket Contact and Collusive Behaviour, *Rand Journal of Economics*, 21, 1-26.

Binmore, K. (1992): *Fun and Games. A Text on Game Theory*, Lexington, MA: Heath.

Buccirossi, P., and G. Spagnolo (2006): Leniency Policies and Illegal Transactions, *Journal of Public Economics*, 90, 1281-1297.

Cabral, L. M. B. (2005): Collusion Theory: Where to Go Next? *Journal of Industry, Competition and Trade*, 5, 199-206.

Engel, C. (2006): Wettbewerb als sozial erwünschtes Dilemma. in: C. Engel and W. Möschel (eds.): *Recht und spontane Ordnung. Festschrift für Ernst-Joachim Mestmäcker zum 80. Geburtstag*. Baden-Baden: Nomos-Verlag, 155-198.

European Commission (2006): *Report on Competition Policy 2005*, available at http://ec.europa.eu/comm/competition/annual_reports/2005/en.pdf.

Feuerstein, S. (2005): Collusion in Industrial Economics – A Survey, *Journal of Industry, Competition and Trade*, 5, 163-198.

Friederiszick, H. W. and F. P. Maier-Rigaud (2007): Triggering inspections ex-officio: moving beyond a passive EU cartel policy, *Journal of Competition Law and Economics*, forthcoming.

Friedman, J. W. (1971): A Non-cooperative Equilibrium for Supergames, *Review of Economic Studies*, 28, 1-12.

Goppelsroeder, M., Schinkel, M. P., and J. Tuingstra (2007): Corporate Leniency Programs in the Cartel Lifecycle: 'Cleaning out the Closet', working paper.

Green, E. J. and R. H. Porter (1984): Non-cooperative Collusion under Imperfect Price Information, *Econometrica*, 52, 87-100.

Grout, P. A. and S. Sonderegger (2005): Predicting Cartels. Economic discussion paper 773, OFT.

Harrington, J. E. (2005): Detecting Cartels. Forthcoming in: *Advances in the Economics of Competition Law*, Paolo Buccirossi (ed.), MIT Press.

Holt, C. A. (1995): Industrial Organization: A Survey of Laboratory Research, in: Kagel, J. H. and Roth, A. E. (eds) *Handbook of Experimental Economics*, 349-443.

Huck, S., Normann, H.-T., and J. Oechssler (2004): Two are Few and Four are Many: Number Effects in Experimental Oligopolies, *Journal of Economic Behavior and Organization*, 53, 435-446.

Ivaldi, M., Jullien, B., Rey, P., Seabright, P. and J. Tirole (2006): The Economics of Horizontal Mergers: Unilateral and Coordinated effects, 158 pp, Luxembourg.

Kühn, K.-U. (2001): Fighting Collusion by Regulating Communication between Firms. *Economic Policy*, 16, 32, 167-204.

Kühn, K.-U. (2005) Collusion Theory in Search of Robust Themes: A Comment on Switgard Feuerstein's Survey, *Journal of Industry, Competition and Trade*, 5, 207-215.

Lorenz, Ch. (2005): Screening markets for cartel detection - collusive marker in the CFD cartel-audit, Industrial Organization 0511003, EconWPA

Luce, R. D. and H. Raiffa (1957): *Games and Decisions - Introduction and Critical Survey*. John Wiley and Sons.

Mehta, K. (2005): Comments on Switgard Feuerstein's "Collusion in Industrial Economics – A Survey", *Journal of Industry, Competition and Trade*, 5, 217-222.

Motta, M. (2004): *Competition Policy: Theory and Practice*. Cambridge University Press.

Motta, M. and M. Polo (1999): Leniency Programs and Competition Policy. European University Institute, Florence, mimeo.

Motta, M. and M. Polo (2003): Leniency Programs and Cartel prosecution. *International Journal of Industrial Organization*, 21, 347-97.

Nera (2004): Empirical Indicators for Market Investigations, Economic discussion paper 749, OFT.

OECD (2006): Roundtable on Prosecuting Cartels without Direct Evidence of Agreement, DAF/COMP/GF(2006)3, 17 Jan 2006, Paris.

Osborne, M. and A. Rubinstein (1994): *A Course in Game Theory*, MIT Press.

Rappoport, A. and A. M. Chammah (1966): *Prisoner's Dilemma*. Ann Arbor: University of Michigan Press.

Riley, A. (2005): Beyond leniency: Enhancing Enforcement in EC Antitrust Law, *World Competition*, 28(3), 377-400.

Rubinstein, A. (1979): Equilibrium in Supergames with the Overtaking Criterion, *Journal of Economic Theory*, 21, 1-9.

Schelling, T. (1960): *The Strategy of Conflict*, Harvard University Press.

Scherer, F. M., and D. Ross (1990): *Industrial Market Structure and Economic Performance*, 3rd edition, Houghton Mifflin Company .

Selten, R. (1973): A Simple Model of Imperfect Competition where Four are Few and Six are Many, *International Journal of Game Theory*, 2, 141-201.

Shapiro, C. (1989): Theories of Oligopolistic Behaviour, in Schmalensee, R. and Willig R. D. (eds) *Handbook of Industrial Organization*, 1, 329-414.

Stephan, A. (2006): An Empirical Assessment of the 1996 Leniency Notice, CCP Working Paper 05-10.

Tirole, J. (1988): *The Theory of Industrial Organization*, Cambridge, Massachusetts, MIT Press.