CHAPTER 5

Instruments for Cartel Deterrence, and Conflicts of Interests

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5.1. Introduction

The different instruments that an antitrust authority can use to deter collusion can have diverse impacts on interest groups. Many of these instruments can be characterized as either a 'stick' (as fines and jail sentences in case of conviction) or a 'carrot' (as a fine exemption in case evidence is provided by the firm to the antitrust intervention). Such carrots help obtain evidence on existing cartels, thereby deterring some potential collusive activities, and are made necessary by the rarity of freely provided information. While some instruments act at the corporate level, others may target individuals. Their effect on taxpayers, shareholders, or employees, can differ strongly, while their effect on consumers can be roughly approximated by their deterrent power. Identifying these effects helps assess the potential adverse effects of some instruments and understand the reluctance to use some that seem quite effective.

This chapter argues that information on existing cartels is unlikely to be often provided for free by economic parties. One should therefore design programs so as to induce the revelation of this information (the 'carrot' component of antitrust intervention), as with Leniency Programs. Leniency Programs aim at increased cartel deterrence by granting corporate and individual amnesty when a firm denounces its participation in an as yet undetected cartel. It has been shown that one could potentially obtain more information with the use of a whistleblowing program, that are less constrained instruments than Leniency Programs since they grant bounties to informants. Individual (rather than corporate) whistleblowing programs allows maximizing revenues compared to a corporate program. They however have more subtle effects with respect to intra-firm agency problems. The issue of incentives for managers and high executives deserves particular attention. Managerial incentives may indeed be affected in an adverse way by otherwise quite effective policies, leading to suboptimal effort choices from managers, as we will see in a simple setting in which the punishments that shareholders can impose on managers are bounded.

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Agency problems between shareholders and managers may be exacerbated or lessened according to the instruments used by the antitrust authority. Managers can choose the market conduct of the firm jointly with their (costly) effort to increase profits. A sharp penalty on managers in case of proven collusion obviously makes it more difficult to convince them to collude, while inducing a competitive behavior together with a high effort becomes easier. And a bounty when managers report information on collusive agreements may lead to the break-up of the agreement. Both instruments are therefore a priori effective collusion deterrents. A concern has often been expressed that bounties might give managers incentives to collude (in order to later report information to the antitrust authority) even when shareholders wanted the firm to compete; inducing competition would thus become more costly. The optimal reaction of shareholders should however be taken into account, together with the anticipation by managers that their counterparts in competing firms have similar incentives to their own in equilibrium. We will see that individual and whistleblowing programs directed at managers may give rise to a different type of adverse effects, with respect to effort incentives.

This chapter is organized as follows: after summarizing the tools used in different countries to deter cartels, it argues that information will not often be provided freely, which justifies using Leniency and whistleblowing programs to induce reports. The possibility of rewarding individuals, and particularly employees of the concerned firms, raises the issue of potential conflicts between managers' and shareholders' interests. We analyze this issue in a very simple model that highlights that collusion can be used by managers as a way to save on costly effort. Leniency and individual fines are shown to be complementary in this setting. A main concern that has arisen with respect to bounties programs is whether the prospect of bounties can give incentives to the manager to collude in order to later report, when shareholders would have wished the firm to act competitively. We will see that a 'reasonable' bounty does not give rise to such adverse incentives. But the existence of a leniency program can adversely affect incentives, not with respect to market conduct, but with respect to effort choices. It may be that efficient competition, that could be obtained thanks to the threat of individual fines, is no longer feasible. It is then helpful to restrict leniency to the first reporting employee.

Note that the model we use will allow us to get some insights as to the economic efficiency of various instruments, with respect to effort and market conduct incentives. But the choice of instruments by antitrust authorities is likely to also depend on political feasibility.[1] Parties are known to exert forceful lobbying during antitrust investigations as well—the most notable example probably

[1] The literature on the political economy of trade policy (e.g., Mayer, 1984; Grossman and Helpman, 1994; Yang, 1995) has studied how tariffs could be chosen by governments trading off the benefits offered by lobbies and rent-seekers with loss in consumers welfare and potential political costs. The political economy of regulation has also been extensively studied since the seminal works of Stigler (**?**), Peltzman (1976) and Becker (1983). Conversely, the role of interest groups in antitrust policy-making has received less attention (McChesney, 1991; McChesney and Shughart,

being the AT&T divestiture in 1984. And the budget allocated to the antitrust authority depends on political factors. We will not investigate these issues here, but will stress in Section 5.3 that some other interest groups than colluding firms may sometimes be reluctant to put an end to collusion.

Stick and carrot instruments

Although fines for price-fixing and other types of cartel behavior have been increased in the United States and the European Union (see Section 5.2), many analysts believe that these fines are still too low to deter cartels. Cartels indeed continue to form and operate in a significant number of industries (Connor, **?**, 2004; Levinstein and Suslow, 2004). One of the solutions considered is imposing criminal sanctions on individuals participating in price-fixing agreements (Wils, 2005), as is already done for instance in the United States, or more recently the U.K., Ireland or Estonia (with its first criminal judgment in 2004).

A second direction for increasing cartel deterrence is using a 'carrot', instead of a 'stick'. National competition agencies have achieved notable successes in prosecuting cartels thanks to the adoption, or to the revision, of Leniency Programs. Such programs, as the ones set up in the United States in 1993 and in the European Union in 1996, grant amnesty to the first firm that reports information on a cartel not yet under investigation.[2] The 'stick' and the 'carrot' approaches can of course be complementary: According to Hammond (2000) and Spratling (1999), one of the major reasons of the success of the U.S. Leniency Program is the fear of imprisonment for corporate officials, that complements a 'race to the courtroom' to obtain leniency. And the increase in fines makes leniency more attractive.

Up to now, no Leniency Program offers positive rewards, rather than simply reduced fines. Private parties may obtain treble damages in the United States, but most private actions follow criminal prosecution, and do therefore allow unveiling existing cartels. Offering positive rewards to informants (not only victims of the cartel) is independently suggested by Spagnolo (2003) and Aubert et al. (2005). In a different context, the U.S. Civil False Claims Act rewards individuals who inform the government of fraud in procurement contracts by a substantial share of the fines collected—an amount sufficient to compensate employees for the stream of foregone future wages (Kovacic, 1996; Tokar, 2000).[3]

1995). Rowley and Rathbone (2004) note that the Chicago School, famous for denouncing the costs of a regulation driven by lobbying, has not criticized antitrust policy in the same way. Regulation may indeed be more easily subject to pressure at it is a long-lasting intervention, with better identified winners/losers.

[2] See Harding and Joshua (2003), Kobayashi (2001), and Spratling (2001).

[3] For a total number of 4,294 cases filed by September 2003, the Department of Defense and the Department of Health and Human Services have respectively recovered $ 1,592,513,253 (with $ 291,031,106 for informants), and $ 5,177,682,597 (with $ 851,646,391 for informants).

It does not seem to have given rise to large adverse effects. Kovacic (2001) offers a legal perspective on how the Civil False Claims Act approach could be adapted for use by antitrust authorities in prosecuting cartels.

Despite the relative success of the Civil False Claims Act, there exists a reluctance to use similar bounty mechanisms for fighting cartels. This reluctance stems apparently mostly from ethical issues and from a fear of adverse effects on firms' incentives. Managers or other high-level executives are often in a position to take decisions as to the firm's conduct, possibly against the recommendations of shareholders. The latter may be prevented from running a collusive agreement if their managers cannot be induced not to deviate from it. But one may fear that the managers temporarily collude in order to obtain bounties in the future, even though shareholders recommended fair competition. These effects are the object of Sections 5.4 and 5.5.

Literature and modeling issues

In order to assess the impact of antitrust investigation, jail sentences, and leniency and whistleblowing programs on different interest groups, and particularly shareholders and managers, we use a very simple modeling incorporating some elements of the literature on leniency programs, reporting, and managerial compensation.

Cartel deterrence and Leniency Programs

We model collusion and Leniency Programs in a simple dynamic framework as in Motta and Polo (2001), Spagnolo (2003) and Aubert et al. (2005). Communication is taken as a prerequisite for collusion, as in McCutcheon (1997). It allows coordination on a collusive agreement, but firms remain free to implement this agreement or not, as in a standard tacit collusion situation. Communication moreover generates evidence that can be found by the antitrust authority, as well as by firms or individuals.[4]

We do not specify the budget constraint that the antitrust authority may face, and the probability of an antitrust investigation is taken as given. This prevents us from including the benefits of Leniency Programs related to saving on investigation costs. To the contrary, Motta and Polo (2001) specify a budget constraint and show that it can be efficient to grant leniency even after an investigation has started, to save on the costs of finding decisive evidence. Leniency and whistleblowing programs may nonetheless be valuable for other reasons, since they make collusion less substainable.

Spagnolo (2003) argues that positive corporate rewards can help deter collusion at no cost. Aubert et al. (2005) obtain the same result in a slightly different

[4] Purely tacit collusion cannot be punished by antitrust authorities since firms act non-cooperatively (see Werden, 2004, and the well-known woodpulp case).

model, and show that rewards for individuals can be more effective than corporate leniency, and even than corporate rewards. They may exacerbate agency problems within the firm and may encourage employees and managers to gather and keep evidence.

Collusion and managerial rewards

The impact of the incentive schemes received by managers on the intensity of competition has been studied in games of strategic delegation, especially by Fershtman and Judd (1987), Sklivas (1987), Fershtman et al. (**?**) or Aggarwal and Samwick (1999). Committing to a particular incentive scheme can indeed be a way for shareholders to credibly promise to compete more or less than they would have done without delegation. In Fershtman and Judd (1987), for instance, shareholders simultaneously choose the incentive scheme for their own manager before a second stage in which managers compete in an oligopolistic market. The wage scheme being given in this second stage, delegation to the manager solves a commitment issue for the shareholders. Spagnolo (2000) adopts a different perspective by considering stock-related compensation (as stock options) in the infinitely repeated game framework used to model tacit collusion. He shows that this type of compensation, delayed for one period, can lessen short-run incentives to deviate, provided that stock markets anticipate the decline in future profits after a deviation, and correspondingly reduce the stock price. Full collusion becomes possible for any discount factor. In order to introduce antitrust intervention in a coherent way, we prefer to rule out the role of the stock market, and we only briefly discuss the role of stock options when the stock market has imperfect foresight (an issue in our framework is that we need to make assumptions about the revision of belief out of the equilibrium path). We allow the manager to adjust his effort to the conduct she chooses, so as to potentially masks her market conduct choice.

Corporate crime

The literature on corporate crime mostly considers situations in which the manager or employee committing a crime acts in his best interest, but harms shareholders when so doing. Mullin and Snyder (2005) argue that in a number of cases, shareholders benefit from the crime, while the manager undertakes it only because the incentives she receives from shareholders make it optimal to do so. When the manager obtains no gain when committing a crime and the government authority can make mistakes and convict innocent firms, Mullin and Snyder show that imposing penalties on the manager is optimal. They also show that forbidding indemnification may be optimal if the authority seeks to enlist the cooperation of the manager. It can then offer a reduction in fines (as in a Leniency program) in exchange for cooperation, but such a reduction is only attractive to the manager if she is not fully indemnified. The analysis applies to cartels, even though it appears less likely that the antitrust authority mistakes innocent conduct for collusion, than for some other types of corporate crime.

The chapter is organized as follows. Section 5.2 summarizes the enforcement features of various developed countries. Section 5.3 summarizes the incentives that various interest groups have to denounce collusive behavior when aware of it. Sections 5.4 and 5.5 focus on conflicts of interest between shareholders and managers: Section 5.4 sets up a simple model, while Section 5.5 considers the effects of rewards and jail penalties on remuneration schemes and effort choices, and ultimately on shareholders' preference for collusion. Section 5.6 concludes.

5.2. The various instruments used for cartel deterrence in major O.E.C.D. countries

This section sketches the enforcement systems in different O.E.C.D. countries, with respect to the existence of jail sentences, Leniency Programs and other prominent features. We do not describe them in detail as our aim is to underline that these experiences are now sufficiently diverse to allow useful inference a few years from now.[5]

5.2.1. Recent trends towards more severe penalties

Before describing the general features of these systems, let us first stress the recent increase in penalties for price-fixing and other collusive agreements. The U.S. have recently strongly increased the maximum fines for cartel participants in 2001, and then again in 2004 with the Antitrust Criminal Penalty Enhancement Act (Klawiter, 2001; Hammond, 2005). The statutory maximum fine under the Sherman Act for corporations has increased from US $ 10 million in 2001 to ten times this amount, US $ 100 million since 2004, independently of the economic harm generated by the violation. Corporate violators can be assessed fines equal to twice the gain derived by the wrongdoer or twice the injury suffered by victims of the cartel.[6] The monetary maximum indicated for individual fines has increased from US $ 350 000 to US $ 1 million. And jail sentences, that could not exceed three years in 2001, can now reach ten years.

The European Union has followed a similar move towards the imposition of higher penalties. In France, the Conseil de la Concurrence has recently imposed much larger fines than in the past, as for the cartel on mobile telecommunications (256 million euros for Orange France, and 220 million euros for SFR). Japan has decided in April 2005 to double the maximum administrative fine on cartel participants (up to 10% of sales). In addition to the general increase in fines,

[5] We will not consider here the various legal restrictions on the modes of intervention, interviewing and searching by antitrust authorities.

[6] The criminal fines paid in 1999 by Hoffmann-LaRoche and BASF for their participation in the vitamins cartel reached US $ 500 million and US $ 225 million respectively. The second largest fine ($ 300 million) has been imposed in October 2005 on Samsung for a cartel in DRAM (Dynamic Random Access Memory).

several countries (most prominently the U.K. and Ireland) have switched to a criminal system and have introduced jail sentences, thereby increasing expected punishments for given fines levels.

5.2.2. The U.S.A.: A criminal system

The Sherman Act (1890) has resulted in antitrust enforcement powers being given to the Antitrust Division within the Department of Justice, thus naturally to a criminal system in which courts ultimately decide after a contradictory procedure. Due to the existence of such contradiction, the evidence provided by the Antitrust Division does not have to be as 'decisive' as in the E.U. (copies of documents and testimonies are accepted, including within the Leniency Program). Another important aspect is that individuals can be sentenced to imprisonment if convicted of collusive behavior. Many U.S. officials insist on the importance of this threat as a deterrent. Since 1999, more than a hundred individuals have served, or are serving, prison sentences related to antitrust enforcement, and the average term has increased from about 8 months by 2000, to 24 months in 2005 (Hammond, 2005). Incarceration is not limited to U.S. nationals as about twenty individuals from other nationalities have been incarcerated. To ensure that staying outside the U.S. is not sufficient to escape the sentence, the Antitrust Division uses since 2001 cooperation via Interpol, for fugitives to be arrested by cooperating polices and later extradited.

In addition to these 'stick' measures, the Leniency Program offers incentives to report existing cartels by providing full amnesty to the first informant. As in other existing Leniency Programs, information obtained from an amnesty applicant is not disclosed to other authorities, except if the applicant agrees to it. Reporting might indeed otherwise be costly to a firm, as it could be pursued by foreign authorities for the information it is revealing. To give firms added incentives, the U.S. are offering an 'Amnesty Plus' Program: A firm that is under an investigation can apply for amnesty in other markets than the one investigated. Even if the firm does not qualify for amnesty on this first market, its cooperation on a second cartel allows it to obtain, not only amnesty for the second offense, but also an additional reduction in fine for the first cartel. This supplementary reduction can be interpreted as a *reward* (rather than a reduced fine) in case of reporting with respect to the second market.

On the other hand, if a firm decides not to report the existence of collusion on a second market, and this collusion is later proved, a 'Penalty Plus' applies: the Antitrust Division 'will urge the sentencing court to consider the company's and any culpable executive's failure to report the conduct voluntarily as an aggravating sentencing factor [. . .] and will pursue a fine or jail sentence at or above the upper end of the Sentencing Guidelines range' (Hammond, 2005).[7]

[7] In a 'penalty plus case', Hoechst AG had to pay a fine of roughly 70% of the volume of affected commerce.

The U.S. enforcement system appears quite efficient as there is anecdotal evidence that cartel members avoid meeting, and even operating, in the U.S. for fear of criminal sanctions (an example is the reluctance of participants to the lysine cartel to meet in Hawaii, in a phone call recorded by the U.S. Department of Justice).

5.2.3. The United Kingdom and Ireland: Moving to a criminal system

The Competition Act (1998) in the United Kingdom describes infringements (Chapter I and II) in a similar way to E.C. Articles 81 and 82, and the U.K. Leniency Program follows the general rules of the 1996 version of the European L.P. The Competition Act has been amended on 1 May 2004 to empower the Office of Fair Trading (O.F.T.) to investigate and impose penalties on undertakings breaching the prohibitions on anti-competitive behavior contained in Articles 81 and 82 of the EC Treaty. More importantly for our concern, the U.K. has recently departed from the E.C. model: the Enterprise Act (2002) indeed introduces a cartel offence under which individuals taking part in the most serious types of anti-competitive agreements may be criminally prosecuted. Anyone convicted of the offence could receive a maximum of five years imprisonment and/or an unlimited fine (unless protected by application to the Leniency Program). In addition, as a result of amendments to the Company Directors Disqualification Act (1986) under the Enterprise Act, company directors may be subject to Competition Disqualification Orders, which will prevent them from being concerned in the management of a company for a maximum of 15 years. This criminal system together with directors disqualification[8] are the most noticeable features of antitrust enforcement in the U.K. The move to a criminal system is however very recent and it is not possible to draw any inference from observation at this date.

Ireland has also recently chosen a criminal system under the Competition Act (2002): The maximum fine for corporations is 'whichever of the following amounts is the greater, namely, Euros 4,000,000 or 10 per cent of the turnover of the undertaking in the financial year ending in the 12 months prior to the conviction'. In the case of individuals, the same maximum applies, 'or [. . .] imprisonment for a term not exceeding 5 years or to both such fine [. . .] and such imprisonment'. The Competition Authority launched its own Leniency Program, the 'Cartel Immunity Programme' in December 2001. It is explicitly mentioned that 'applications for immunity for an individual employed by an undertaking involved in a cartel will be considered, even where the employer undertaking does not apply or otherwise co-operate under this programme' (Section D). This appears as a useful complement to a criminal system.

As for the United Kingdom, however, the change is too recent to offer valuable insight for now (no jail sentences have been pronounced at this date).

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[8] Both features are obviously independent, and disqualification may even be viewed as some imperfect substitute for imprisonment.

5.2.4. France and Germany: The E.C. model with some twists

Since May 2001, the French Conseil de la Concurrence offers a Leniency Program ('procédure de clémence', art. L. 464-2 III) for firms that denounce their participation in a cartel. A more original feature is that it also offers a system of plea bargaining inspired by the U.S. and rather unusual for France ('procédure de transaction'): firms that admit their participation and commit to modify their behavior can obtain a reduction in fines (art. L. 464-2 II).

In Germany the Bundeskartellamt set up in 2002 a Special Unit for Combating Cartels (SKK) to increase the quota of uncovered cartel agreements and to speed up proceedings. A Leniency Programme exists since 2000 and follows the 1996 version of the E.C. Leniency Program. The German system is relatively close to the French one. An interesting point is that Germany has expressed a fear that reports be less credible under a Leniency Program: 'The Bundeskartellamt is aware that any statements by cartel members, who expect the fines impending to be considerably reduced as a result of their cooperation, must be treated with caution. Before a statement can serve as the basis of proof of the existence of a cartel and of the extent to which each member was involved, it must always be supported by other evidence.' (Notice No. 68/2000 on the guidelines of the Bundeskartellamt relating to the setting of fines.) This fear of falsified reports with leniency should certainly be addressed for the political acceptability of leniency and rewards to improve.

Other experiences should of course be worth some investigation. Japan, that has a criminal system inspired by the U.S., has introduced with the Anti-monopoly Act (2005) a leniency program that grants full amnesty for the first company reporting prior to the commencement of an investigation, and a 30% reduction in the administrative fines for the second leniency applicant. Leniency (even partial) is restricted to the first two informants, a particular feature. Last, one can note that some countries appear relatively behind others with respect to cartel deterrence, as they have not introduced a Leniency Program yet. This is the case of Italy. A few years from now, the comparison of the outcome of these various experiences should allow applied economists to make useful recommendations.

5.3. May we expect freely provided information on collusive practices?

This section investigates to what extent competition policy may rely on information provided by various parties aware of (or strongly suspecting) collusive practices. According to Stigler (1982), 'If you propose an antitrust law, the only people who should be opposed to it are those who hope to become monopolists'. We however argue below that the incentives of various parties to provide information are not as strong as they may seem. This implies that, if a whistle-blowing program is set up, bounties may be needed in excess of litigation costs coverage, in order to compensate for potential costs associated with reporting

(like losing one's position for an employee who reports about its firm's misconduct, but also other costs we detail below).

Numerous legal dispositions set up a duty to report particular information and impose higher fines on individuals or firms who did not report it, thus providing external incentives to report. The obligations to report have an obvious legal value and allow imposing fines and requesting closer supervision. We will not discuss them further, despite their practical value and focus below on parties' intrinsic incentives to report.[9]

5.3.1. Final customers

Incentives to provide information

Final consumers are the most obvious victims of collusive practices and clearly loose from collusion. Colluding firms sometimes try to justify their collusive practices by the need to coordinate to invest in new technologies, provide a better quality or to avoid over-use of a particular resource, all positive elements from the point of view of customers. Yet this is widely viewed as a non-valid justification: rather than adding another market imperfection such as collusion, one should try and solve for the first imperfection.[10] Final consumers should therefore always prefer antitrust intervention, possibly together with adequate regulation.

Adverse incentives

Final customers may nevertheless not be good informants due to lack of information as to what the 'normal' price and market conditions should be. In addition, they may also not have good incentives to actively look for collusive practices as, first, they tend not to be organized, and second, they may find it preferable to let antitrust authorities, with their better expertise, investigate on their behalf.[11]

Last, final consumers can sometimes be wary of competition in particular cases, if they fear that it will bring a worsening of quality of service: This appears to be a major concern of the general public when regulated, public utilities

[9] In the case of collusive behavior, shareholders and managers can use internal compliance programs, and invoke them to reduce their liability in case collusion is nevertheless proved to have taken place. They must nevertheless show evidence that the program was indeed functioning.

[10] If R&D requires coordination, this should come from a legal agreement, possibly a joint venture. And if pollution, or use of a non-renewable resource, make it preferable to lessen production, this should follow from focused government intervention, like imposing pollution or production quotas, or creating a market for pollution permits.

[11] Antitrust staff may devote more attention to cases involving final customers, as they often benefit from extended media coverage. Lawyers and economists within the authority need to signal their high ability to their future employers, and have therefore incentives to select cases involving large firms, well-known to the general public, or products that are widely consumed, often by end-users—as for instance the cartel on soccer shirts in the UK. Final customers can thus expect antitrust authorities to work well on their behalf.

undergo deregulation and removal of state entry barriers. The treatment by the French media of the promotion by the E.C. of entry in postal services and gas, provides a good example: Its (on average) quite negative tone conveys concerns with public service and USO obligations—that seem to require ongoing state monopoly in the view of the general public. Demonstrations by trade unions against the privatization of Gaz de France go the same way, and prove that political economy aspects may be difficult to seize with a simple cost–benefit analysis.

5.3.2. Downstream and upstream firms

Let us now consider a cartelized industry that produces an input for a second industry, the downstream industry. It also itself uses as an input a good produced by some upstream industry.

Incentives to provide information

Since colluding firms contract output, downstream customers will obtain lower quantities at a higher price, so that their profits can be expected to decrease with collusion. Upstream firms will undergo a reduction in their sales, hence also lowered profits. Collusion can also improve the bargaining power of the firms with respect to their suppliers and retailers. Upstream and downstream firms may therefore learn some information as to the existence of a cartel, and may want to denounce it.

Adverse incentives

Although upstream and downstream firms often suffer from the existence of collusion, there may be situations in which this collusion is profitable to them, in which case they will not want to bring it to term. To avoid raising suspicions, colluding firms tend to avoid large price changes (as analyzed in Harrington, 2004; Harrington and Chen, 2005) and will not react as strongly to economic shocks as competing firms would do. Collusion in the first industry thus imply less risk for the downstream and upstream participants. This facilitates tacit collusion in the vertically related market, as deviations from a collusive agreement downstream (or upstream) will be more noticeable. In a model à la Green and Porter (**?**), the reduction in uncertainty allows for more efficient collusion downstream (or upstream). In addition, if the industry to which firms buy sell their production is also collusive, profits from a unilateral deviation are lower: a deviating firm faces a smaller demand than if its customers were competing.[12]

[12] Bernheim and Whinston (1985) have shown how using a common retailer may help firms coordinate and collude. Several recent papers focus on how retail price maintenance can help reduce interbrand competition. Jullien and Rey (2001) base their analysis on the idea that retail price maintenance prevents prices from reacting strongly to demand and cost conditions, hence mak-

Thus collusion in an industry has a direct negative effect on profits in vertically related industries; but by reducing uncertainty and limiting deviation opportunities, it may make it easier for these vertically related markets to collude. Contrary to common beliefs, one may therefore not always expect customers to come forward with information when they discover that their suppliers/retailers are colluding.

5.3.3. Workers' interests

Incentives to provide information

By restricting output, collusion also restricts employment. Workers should therefore oppose collusion, and denounce it when they have information about it.

Adverse incentives

One should note that an employee faces losses when she reports her information to the antitrust authority. If secrecy is difficult to maintain, for instance because few employees had access to sensitive information, a reporting employee faces a high risk of retaliation—at least losing her job, perhaps permanently. If she expects staff reorganization after a cartel decision, she may fear losing her job even if secrecy is maintained. Employees should be compensated for these expected costs. This justifies granting bounties to reporting employees, a possibility we discuss further later.

It may also be the case in some instances that collusion enables one of the firms to survive, or to survive without restructuring, so that current employees may fear redundancy in case their firm is convicted. And colluding firms may be able to exclude outsiders from the market, possibly maintaining local employment at the expense of foreign or non local employment in the firms that are excluded. Local workers may therefore sometimes favor collusion, as they sometimes tend to favor non-competitive practices in large and regulated firms that are major employers in a particular area.

5.3.4. The shareholders

The situation of shareholders is different from that of the other interest groups mentioned above, as shareholders directly benefit from the higher profits obtained by a firm thanks to collusion. This benefit may nevertheless be lessened if

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ing deviations easier to detect in a tacit collusion setting. Dobson and Waterson (1997) and Rey and Verge (2004) use on the other hand a static model in which two producers can use any of two potential retailers—and possibly both. While Dobson and Waterson restrict the analysis to linear wholesale prices (hence giving rise to a double marginalization issue), Rey and Verge use two-part tariffs (solving for the double marginalization issue) and show that retail price maintenance indeed reduce competition in such a way that the monopoly outcome can be achieved.

the shareholders also possess equity in vertically related markets that are hurt by collusion upstream or downstream. And all shareholders may not wish to foster collusion, even in the absence of antitrust sanctions. Shareholders may indeed have diverging preferences for the present, so that some may prefer deviations to persistent collusion. However, shareholders, who will have to bear the cost of fines if the firm is convicted, can be expected to have very few incentives to provide information about an existing cartel agreement to an antitrust authority.

In the presence of antitrust sanctions, shareholders may also have divergent views as to the desirability of collusion, and of reporting, if they differ in their degree of risk aversion, and in their ability to insure and diversify. It is thus likely that informed[13] shareholders will not hold a unanimous view as to the desirability of a collusive behavior or of an amnesty application.

Allowing a shareholder to apply to a Leniency Program even in the absence of a general agreement of the board may allow for more information disclosure: A Leniency Program does not have to be as generous to be effective if it needs only be attractive to the informed shareholder with the weakest preference for collusion.[14]

5.4. Managerial incentive contracts and collusion

Since shareholders benefit from collusion, the question of their responsibility in inducing collusive agreement arises. Should shareholders be subject to extended liability? In the U.S., shareholders should prove that they have made good use of a compliance program to be exempted from responsibility. Buccirossi and Spagnolo (**?**) suggest going further: Since fines cannot be increased above certain bounds for fear of bankruptcy and lessened competitiveness in the industry, they suggest a dilution of shares of convicted firms, thereby penalizing shareholders. Controlling shareholders will then prefer to induce a competitive behavior, provided that the probability of conviction and the extent of share dilution are large enough.

Shareholders may have difficulties inducing the manager to maximize firm's profits while avoiding the occurrence of collusion. Providing incentives to managers and high executives that are very strongly linked with profits (such as a very large share of stock options) can be justified by moral hazard issues within the firm, but it can also induce the choice of more risky options, including collusion. We address this issue with a simple model. This section focuses on the impact of the instruments for cartel deterrence discussed in the introduction, on the cost for shareholders of giving adequate incentives to managers, when these managers can privately choose the type of conduct of the firm, together with their effort level. They can then substitute effort and collusion, since collusion allows obtaining higher profits without exerting much effort.

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[13] Obviously, small shareholders are unlikely to be aware of the collusive conduct of the firm.

[14] The effectiveness of such an extension of a Leniency Program may however be restricted by the lack of access of some shareholders to documents constituting evidence of collusion.

5.4.1. The basic model

We follow the general framework of Aubert et al. (2005) with potential collusion between N firms, adding the dichotomy between shareholders and managers. We assume that communication is a prerequisite for collusion, and generates some evidence. Since firms cannot enforce collusive contracts using legal institutions, collusion has to be self-enforcing.

For simplicity, shareholders will be modeled as a homogeneous, controlling, group with the same preferences.

Market conduct

N firms play an infinitely repeated game where, in each period, the following stages take place:

1. In each firm, a shareholder privately meets the manager and offers her a remuneration scheme w together with recommendations as to the market strategy to be followed.
2. Managers from all firms then have an opportunity to communicate before committing to a market strategy for the whole period. Communication between managers only takes place if all managers agree to, and concerns market conduct.
3. Managers privately choose their effort level, e, and (possibly following the recommendations of their shareholder) their market and reporting strategy. If one manager at least has preferred not to communicate, the subsequent market strategy is necessarily competitive. If communication has taken place, on the other hand, a collusive agreement has been reached; each manager can then decide whether to choose a collusive strategy as agreed, or a competitive one (i.e., to 'deviate' from the previous agreement), and simultaneously whether to report information to the antitrust authority.
4. If no information has been reported, the antitrust authority intervenes with probability ρ, in which case it always finds evidence of collusion when communication did take place.

Each shareholder obtains the firm's profit, minus the wage paid to the manager, w. All shareholders have the same discount rate $\delta \in (0, 1)$. We will assume that all managers remain only in their firm for one period, for simplicity. In addition, if a manager reports, shareholders are able to impose a cost R on her, corresponding for instance to a value for reputation.

Shareholders require a return to competition forever after a deviation.[15]

[15] If they were using misbehavior by a manager as an excuse allowing to resume collusion, incentives to deviate would be strengthened.

Managerial effort and discretion

In each firm, the (risk neutral) manager chooses her effort level, e. She can either exert a high effort, $e = \bar{e}$, or shirk, $e = \underline{e}$, $\bar{e} > \underline{e}$. Exerting a high effort involves a disutility $\psi > 0$ for the manager, while the cost of shirking is normalized to be zero. Neither effort nor the disutility of effort ψ are observable.

To simplify, we assume that there are two possible levels of profits for each conduct of the firm (collusion, competition, deviation, ...), depending in a certain way on the manager's effort. High profits, corresponding to a high effort level $\bar{e}$, are denoted by an upper bar, while a lower bar indicates that the manager's effort has been low. Superscript C stands for 'competition', M for 'monopolization' (and indicates that the firms collude) and D for 'deviation' (the manager has deviated whereas other firms colluded). In case of a deviation, the non-deviating participants obtain very low profits.

Although profits are linked with effort in a certain way, shareholders may not distinguish between high profits obtained thanks to a competitive behavior and a high effort ($\overline{\pi}^C$), and the same profits obtained with collusion and a low effort ($\underline{\pi}^M$). We assume the following ranking of profits: $\overline{\pi}^D > \underline{\pi}^D = \overline{\pi}^M > \underline{\pi}^M = \overline{\pi}^C > \underline{\pi}^C$. This ranking implies a 'prisoner's dilemma'-type issue as is standard in collusion games, together with a moral hazard aspect: For a given effort by the manager, shareholders gain from collusion, but each benefits at the expense of the others from deviating. The modeling, however simple, allows to consider the possibility for a manager of substituting effort for an illegal market conduct.

We will assume that the socially optimal situation—the most desirable one from the point of view of the antitrust authority—is competition together with a high effort, competition with a low effort coming second.

Shareholders can punish a manager who does not follow their recommendations, but only when the profits observed reveal this misbehavior. In addition, punishment is bounded since the manager can quit the firm at any time, in which case we assume that she gets a zero payoff from exerting her best outside option—hence 'limited liability' constraints, (*LL*). To simplify, we rule out dynamic incentives by assuming that the manager only remains with the firm for one period, as mentioned above, and that deferred payments (for instance via stock options) are not possible.[16]

The incentive scheme received by the manager is assumed to be soft private information, that cannot be credibly communicated to competing firms.[17]

[16] This is clearly an important restriction as we will discuss at the end of the section.

[17] We do not consider complex cheap talk games between managers about their own compensation package, and assume that communication between managers only bear on the particular collusive agreement to be adopted.

Evidence and antitrust intervention

The antitrust authority can impose (bounded) fines F on colluding firms, but only if it obtains evidence about current[18] collusion. For simplicity, we assume that the antitrust authority always finds this evidence when it audits a colluding industry. The probability of audit, denoted ρ, is supposed constant,[19] except if a report occurs, in which case the industry is kept under close scrutiny afterwards, so that subsequent collusion is deterred. The assumption that the probability of intervention does not depend on profits can be understood as an assumption about the degree of knowledge of the antitrust authority about the particular market considered: Since it monitors extremely various industries in diverse regions, it is not able to identify collusive and competitive profit levels in each industry, and can only use average values to assess the efficiency of its policy. Obtaining truthful expert advice for each market would be too costly.

It should also be noted that the assumption that the probability of audit is equal to the probability of convicting firms and does not depend on the existence of a Leniency Program is restrictive; it implies that we will *under-estimate* the benefits of such a program. First, reporting by a firm allows obtaining detailed information, making the probability of conviction noticeably higher than in the absence of cooperation. This effect has been highlighted by Motta and Polo (2001), who show that it may be sufficient to make it optimal to grant leniency to cooperating firms even after an investigation has been started by the antitrust authority. Second, this detailed information may enable the disclosure of another violation in a related or independent industry.[20] Any costs of Leniency Programs in our setting should therefore be traded against these potential benefits.

Under our simplifying assumption, the best collusive firm strategies are simple: when collusion is sustainable and profitable, the best strategy consists in colluding in every period, even after a successful audit.

Evidence can also be brought forward by each firm if it chooses to report to the antitrust authority. Some individuals, such as informed employees, also have access to this evidence.

The antitrust authority can impose a maximal fine F that is not large enough to deter collusion if it is imposed with probability ρ only: $\min\{\overline{\pi}^M - \overline{\pi}^C,$

[18] We assume to simplify that past behavior cannot be punished.

[19] Harrington (2005) characterizes optimal Leniency Programs when the probability of being detected by the antitrust authority varies over time.

[20] As noted by Hammond (2001) for the U.S., 'over half of these investigations [30 sitting grand juries currently investigating suspected international cartel activity] were initiated as a result of leads generated during an investigation of a completely separate market. What that simply means is that every time the Division opens an international cartel investigation, the chances are better than even that it will also uncover a second, separate conspiracy.' An example is the prosecution of the international citric acid cartel, which led in a chain reaction to the investigation and prosecution of the international sodium gluconate cartel, then of the international sodium erythorbate cartel, and in turn of the maltol cartel.

$\underline{\pi}^M - \underline{\pi}^C\} > \rho F$. Reports to the antitrust authority are assumed to be public, and observed by firms (see Rey, 2003, on leniency with secret reports).[21]

5.4.2. Managers' incentives in the absence of antitrust intervention

When shareholders decide which remuneration scheme to offer the manager, they should offer wages $w(\pi)$ that depends on the profits realized π so as to satisfy incentive compatibility constraints, a participation constraint (P) and limited liability constraints (LL).

As mentioned previously, we make the strong assumption that deferred payments depending on future profits are not feasible, and will later discuss their effect. Suppose that shareholders want to induce a high effort level and collusion, then they should satisfy the following constraints in a symmetric equilibrium, that relate to effort and conduct choice, and participation (P):

$$w\left(\overline{\pi}^M\right) - w\left(\underline{\pi}^D\right) - \psi \geq 0, \tag{5.1}$$

$$w\left(\overline{\pi}^M\right) - w\left(\underline{\pi}^M\right) - \psi \geq 0, \tag{5.2}$$

$$w\left(\overline{\pi}^M\right) - w\left(\underline{\pi}^C\right) - \psi \geq 0, \tag{5.3}$$

$$w\left(\overline{\pi}^M\right) - w\left(\overline{\pi}^C\right) \geq 0, \tag{5.4}$$

$$w\left(\overline{\pi}^M\right) - w\left(\overline{\pi}^D\right) \geq 0, \tag{5.5}$$

$$w\left(\overline{\pi}^M\right) - w\left(\overline{\pi}^D\right) \geq 0, \tag{5.6}$$

$$w\left(\overline{\pi}^M\right) - \psi \geq 0, \tag{P}$$

$$w\left(\overline{\pi}^k\right) \geq 0, \qquad w\left(\underline{\pi}^k\right) \geq 0 \quad \forall k = M, C, D. \tag{LL}$$

Since the corresponding profit levels are not distinguishable, one necessarily has $w(\underline{\pi}^D) = w(\overline{\pi}^M)$ and $w(\overline{\pi}^C) = w(\underline{\pi}^M)$. Thus, (5.1) becomes $0 - \psi \leq 0$. Clearly, the first constraint cannot be satisfied. In this setting, it is impossible to induce collusion together with a high effort level, unless the manager can be given some more complex incentives, for instance a delayed compensation based on profits (as in Spagnolo, 2000). A concern for reputation can also help solve this issue.

If no other incentive device is available, then shareholders will have to decide whether they prefer to induce collusion with a low effort, competition with a high effort, or competition with a low effort. It is easy to see, applying the same type of reasoning, that the manager will never choose to exert a high effort and

[21] Note that we abstract from the usual credibility issue related to audit in such a context: In equilibrium, if the tools used by the antitrust authority are effective, collusion is deterred and firms never collude. An investigation is then always a waste of resources. The antitrust authority has thus *ex post* incentives not to audit the industry with the announced probability—but if it does not, firms may prefer collusion. If the antitrust authority cannot credibly commit to a probability of investigation, the equilibrium is in mixed strategies. See Khalil (1997).

compete, when shirking and colluding allows obtaining the same compensation at a lower disutility of effort. There cannot be an equilibrium with competition and a high effort, in the absence of antitrust intervention. The firms will be little efficient, as effort will be lower than if it was observable. The possibility of colluding without being detected and without suffering from the associated drop in profits implies that managers will exert a suboptimal effort.

Here the manager always receives a wage of ψ if she is asked to exert effort, and a wage of zero otherwise. She should always receive a zero wage if the profits realized reveal that she has not been following the recommendations. Shareholders must therefore choose between competition and no effort, hence a zero wage for the manager together with profits of $\underline{\pi}^C$, and collusion and no effort.

Since there is no antitrust intervention, the manager can be given incentives to agree on collusion and then deviate, whether with or without effort, at no other cost than the full information one: $\overline{\pi}^D$ cannot be achieved without effort, and achieving $\underline{\pi}^D = \overline{\pi}^M$ by exerting effort and not deviating is not attractive to the manager.

Since $\frac{1}{1-\delta}\underline{\pi}^M > \frac{1}{1-\delta}\underline{\pi}^C$, shareholders should require a collusive behavior whenever the latter is sustainable, i.e., whenever the excess profits from deviating in the current period do not compensate the losses from the ensuing return to competition:

$$\max\left\{\underline{\pi}^D, \overline{\pi}^D - \psi\right\} - \underline{\pi}^M \leq \frac{\delta}{1-\delta}\left[\underline{\pi}^M - \underline{\pi}^C\right].$$

Note that the optimal remuneration schemes are implementable with constant bonuses for profits reaching some given threshold level ($\underline{\pi}^C$ or $\underline{\pi}^M$ depending on the conduct they want to induce). But remuneration schemes continuously increasing in profits cannot be used to induce collusion nor competition.

In such a framework, effort can only be induced by auditing the manager's effort, or by offering deferred payments based on future profits. But one should note that the latter solution may not be sufficient, as in practice, effort choices and profit levels are not binary, and shocks in the economy can prevent the stock market from adequately reflecting the value of the firm.

From a methodological point of view, one does not want to assume that stock markets can perfectly infer the market conduct of firms, as antitrust authorities would then find it relatively cheap to obtain the same information. If the stock market bases the value of shares on current profit levels together with the sign of the variation of these profits from the last period, one needs to check that its beliefs are consistent with the actions taken by managers (i.e., a drop in profits can indicate a deviation followed by a return to competition, but can also indicate that the previous manager had been exerting a high effort level, contrary to the current one, which is a priori an out-of-equilibrium occurrence, the best incentive scheme from the point of view of shareholders being the same in all periods in equilibrium. The results obtained would thus depend on the assumptions made on the revision of beliefs after an out-of-equilibrium action.

The setting we are using is too simple to be realistic but it highlights the possibility that the manager substitutes collusion for effort. One may indeed believe that among the benefits of collusion, is 'an easy life' for managers .... The next section introduces antitrust intervention and focuses on its impact on incentives.

5.5. Managers' incentives with antitrust intervention

Let us now add the possibility of antitrust intervention. We assume that the antitrust authority can impose a penalty J on the manager in case of conviction. The compensation to be paid by shareholders was assumed to be subject to a limited liability constraint. Such a constraint clearly does not apply in the case of an antitrust intervention. We do not distinguish in this section between jail sentences and monetary penalties. Jail penalties,[22] available in countries with criminal sentences, such as the U.S. or Ireland, have the advantage of not being bounded by existing wealth; Managers are not likely to lack financial resources, so that large monetary fines are also potentially available despite the limited liability constraints on wages (note that according to many legislative settings, as in the U.K., a conviction for collusion implies director disqualification, hence future foregone profits). We will also consider the possibility of offering leniency, or even bounties B, to managers who report their information.

As previously mentioned, the probability of antitrust intervention, ρ, is independent of the profits realized. In practice, it may be that high profits trigger more scrutiny by antitrust authorities, in which case a high effort would have the drawback of increasing the expected fine. We abstract from this possibility to focus on the basic effects at work when introducing jail sentences, leniency and possibly positive rewards for informants.

Sentences for colluding managers

It may now be the case that a manager can be induced to compete and exert a high effort. She would then obtain in expectation $w(\overline{\pi}^C) - \psi$, to be compared with $w(\overline{\pi}^C) - \rho J$ if she were to collude and shirk. A high enough penalty on managers ($J \geq \frac{\psi}{\rho}$) thus helps shareholders in inducing efficient competition. The cost for shareholders of inducing a high effort is then simply ψ.

On the other hand, inducing collusion becomes more costly since the wage that the manager must receive is now ρJ for collusion without effort. Inducing efficient collusion (with a high effort) is still not possible as long as deviating firms are not punished more than colluding ones—for instance via an increase in the probability of an antitrust intervention.

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[22] Jail sentences can only be interpreted in terms of a constant monetary equivalent if there are no wealth effects. In practice, it is likely that the marginal cost of a jail sentence is larger, the richer the individual.

Collusion with a low effort it thus more profitable than competition with a high effort—i.e., $\frac{1}{1-\delta}(\overline{\pi}^C - \psi) < \frac{1}{1-\delta}(\overline{\pi}^C - \rho J - \rho F)$—only when competition with a high effort is not feasible ($\rho(J+F) < \psi$). In the reverse case, shareholders will prefer to induce competition and a high effort.

If collusion remains more profitable, the shareholders will choose to collude rather than compete with a low effort whenever collusion is sustainable, i.e.,

$$\max\left\{\underline{\pi}^D, \overline{\pi}^D - \psi\right\} - \underline{\pi}^M \leq \frac{\delta}{1-\delta}\left[\underline{\pi}^M - \rho(J+F) - \underline{\pi}^C\right].$$

The left-hand side is the same as without antitrust intervention, since deviating does not shield the manager from potential sanctions, but the right-hand side is decreased, so that fines on managers indeed reduce the sustainability of collusion.

To summarize,

- An individual fine plays the same role on sustainability as corporate fines, thereby increasing cartel deterrence, via increased wages for managers.
- Individual fines have the added advantage of making it more likely that shareholders can induce a high effort together with competition, hence a better outcome from the point of view of social welfare, of consumers and shareholders.[23]

Individual leniency

Assume now that informants can obtain a full fine exemption. Collusion with a high effort remains impossible to implement. In addition, using the program in case communication has taken place (whether with a deviation or not) allows the manager to save on potential fines, and is always preferable when the cost of lost reputation is small, i.e., when $R < \rho J$. Collusion without effort is then no longer implementable in the sense that, if the shareholders were to offer an incentive scheme inducing collusion, all managers would report in the first round, and firms would compete afterwards. This cannot be an equilibrium.

If only the first reporting manager is eligible for leniency, there still cannot be an equilibrium in which managers do not report when $R < \rho J$: True, the expected loss suffered by managers when all decide to report is $-R - \frac{N-1}{N}J$ to be compared to $-\rho J$ when no one reports. But if a manager anticipates that the other managers will not report (so that she will obtain full leniency with certainty if she does), then it is optimal to report if R is smaller than the expected penalty when not reporting, ρJ. In this case, not reporting cannot be an equilibrium.

Individual leniency is thus a powerful complement to the individual fine J, as inducing collusion is no longer possible in equilibrium whenever J is large

[23] Managers do not loose, as they are indifferent in equilibrium between exerting effort and being exactly compensated for it, or not exerting effort.

enough. However, leniency is useless when reputation concerns are strong, or in other terms when the individual penalty J is not sufficiently large.

The next question to consider is the impact of leniency on managerial incentives when shareholders want to induce competition. Assume that the shareholders want to induce a high effort:

- If all reporting managers were allowed to obtain leniency, then the choices of managers would be as follows: if $R < \rho J$, then a manager deciding to shirk and collude rather than exert effort and compete would make use of the program. As long as R is larger than the disutility of effort ψ, the manager would not find such a strategy profitable. But if, on the other hand, reputation concerns were not powerful enough, then inducing a high effort would no longer feasible—although it might have been in the absence of collusion.
- Assume now that only the first reporting manager can obtain leniency. If managers collude, each will prefer to report if she anticipates that others do not: not reporting cannot be an equilibrium. And each manager will find it profitable to report, assuming that others do report as well, if $R + \frac{N-1}{N} J < \rho J$, i.e., $R < (\rho - \frac{N-1}{N})J$. This condition cannot be satisfied for R positive if ρ is smaller than $1/2$, a realistic assumption.[24] Assume nevertheless that the condition is satisfied. Then, when deciding whether to communicate or not, managers must then compare the cost of effort ψ with the expected penalty if they collude and report, $R + \frac{N-1}{N} J$. They will collude, and then report simultaneously, only if the disutility of effort, ψ, is quite large.

In some cases (if $R < \psi < \rho J$ with leniency for all reporting parties, or if $R + \frac{N-1}{N} J < \psi < \rho J$ with leniency only for the first reporting party), leniency destroys the possibility for shareholders of inducing a high effort together will competitive behavior, a possibility that existed in the absence of leniency—when the prospect of a sanction J was powerful enough to induce effort. Note that competition with a low effort level remains unaffected, as the adverse incentives on the side of managers stem from their desire to avoid costly effort.

To summarize,

- Leniency complements a policy of individual fine, by deterring collusion when the expected fine is large enough compared to reputation concern ($\rho J > R$); it is otherwise useless.[25]
- When leniency is useful, it may be the case that competition can no longer be efficient (thanks to a high effort) whereas it would have been so in the absence of a leniency program. There is thus an efficiency cost associated to the use of the program, to be compared to the benefits of increased collusion deterrence.

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[24] In practice, the probability of antitrust intervention in an industry has been estimated to be around 0.15, up to 0.20.

[25] If we had incorporated the positive effect of reporting on the probability that the antitrust authority convicts cartel offenders, a Leniency Program could still be useful, as shown by Motta and Polo (2001).

- It should nevertheless be noted that restricting leniency to the first reporting party allows to strongly restrict the range of parameters for which this adverse effect arises (while still destroying any equilibrium in which managers who were given incentives to collude, did not report). In particular, it becomes very unrealistic, independently of the size of reputation concerns, when the probability of antitrust intervention is reasonable small (lower than one half).

Individual bounties

Assume now that informants can obtain not only full leniency, but also bounties B.

Then the larger the bounty, the more likely it is that the cost of deviating, R, is smaller than the benefit, $\rho J + B$ when all reporting parties are eligible, or when a manager anticipates that the others will not report. The condition under which an equilibrium in which managers are given incentives to collude and do not report, is thus easier to satisfy. A bounty is clearly more efficient than simple leniency at deterring collusion, and is particularly useful if reputation concerns are assessed as important.

But as leniency, and with more likelihood (whenever $R < \psi < \rho J + B$, when all reporting parties are eligible) bounties may give rise to the adverse effect of preventing efficient competition (competition with effort). Bounties thus increase the range of parameters for which collusion is deterred, but also that for which efficient competition becomes impossible. If leniency is sufficient to obtain collusion deterrence, it is thus better not to use bounties. If leniency is not sufficient, bounties should be restricted to the first reporting party.

One may also be worried that the existence of bounties induce the manager to always choose to collude and then deviate, rather than compete. This reasoning has been frequently mentioned by practitioners with respect to whistleblowing programs. It is not necessarily valid in the case of cartels, as collusion can only occur if other managers participate, and they have the same incentives in equilibrium as the particular manager we are considering. Nevertheless, and contrary to the case of leniency, very large bounties could possibly prevent shareholders from inducing competition, even without effort: Assume that managers are asked to undertake no effort and to compete, and that the bounty is larger than the reputation cost, $B > R$. Then if the whistleblowing program grants a bounty to all reporting parties, managers are better off colluding, and then reporting. This is obviously an absurd setting, and one can expect that if bounties are offered, they only concern the first reporting party. In that case, a manager who anticipates that her counterparts intend to report will never accept to communicate in the first place if the overall gain is negative, i.e., if $\frac{B-(N-1)J}{N} - R < 0$. A 'reasonable' bounty will therefore not give managers incentives to collude and report rather than compete. And given our assumption that the antitrust authority is able to closely monitor the industry after a report—possibly thanks to a better information on the characteristics of the industry—this adverse effect would only take place in a first period.

To summarize,

- Bounties are more effective than individual leniency at deterring collusion when shareholders wanted to induce it.
- As leniency, bounties can give rise to adverse effects and prevent competition from being fully effective.
- In addition, bounties may also prevent an equilibrium with competition altogether, inducing a situation in which all managers would collude and simultaneously report in a fist period. This last setting appears however rather unrealistic.

5.6. Conclusion

We have seen that one may not expect information to be often provided by individuals who are not given explicit incentives to do so. This is indeed strongly confirmed by observation. Mechanisms inducing the revelation of information, such as corporate and individual, Leniency and whistleblowing programs, are therefore potentially quite beneficial.

To summarize, bounties can be quite effective, as already underlined in Spagnolo (2003) and Aubert et al. (2005), and they can maximize the net amount levied as fines when they are used, compared to simple leniency. They may nevertheless give rise to adverse effects in the relationship between shareholders and high executives. It is indeed useful to note that an individual leniency program, despite being a useful complement to individual fines or jail sentences, also entails costs, as it may prevent achieving an efficient type of competitive outcome. Bounties present the same shortcomings. These adverse effects can be lessened by restricting eligibility to the program to the first informant, and have to be traded against the benefits of increased cartel deterrence. If reporting allows increasing the probability of convicting firms, an added benefit should be taken into account. Although bounties are frequently refused on the ground of potential adverse incentives with respect to market conduct, the adverse incentives that appear the most realistic are the ones concerning effort choices in competitive industries. And these incentives are already in existence with an individual leniency program.

A jail sentence is costly, and generally to be avoided on that account, when monetary penalties are available. Yet individuals with a taste for justice may prefer criminal sentences as they are associated with a stronger moral condemnation. In the same line, assume that voters have a preference for fairness and justice, in the sense that they are ready to bear costs for wrong-doers to be punished. Then obviously, a leniency program will have a low political acceptability. Individuals may prefer to bear the costs of imposing jail sentences on convicted wrong-doers, and of possibly lessened cartel deterrence, rather than use a whistleblowing program. A program granting positive rewards may be unacceptable from a political point of view due to individuals' taste for fairness

and justice. An individual bounty program fares however better than a corporate one in that respect (and requires smaller bounties[26]).

Both jail sentences and fines for managers of convicted firms are helpful in deterring cartel behavior as they make it more costly for shareholders to induce a collusive behavior from their managers. In more complex settings than the one we have used, and in particular if high profits attract more investigations by the antitrust authority and such investigations are sometimes misleading, it may be the case that in equilibrium, firms compete but in an inefficient way, with managers exerting very little effort so as to maintain profits at a low level.

Note that we have assumed that evidence was 'hard', verifiable by third parties, so that false reports are not possible. A whistleblowing program may have to require the informant to provide sufficiently decisive evidence, since courts may be reluctant to believe a paid informant in a criminal context (as in the U.S. for instance). In a related line of ideas, the literature on economics and psychology (e.g., Benabou and Tirole, 2004) has shown that paying for actions that conveyed a positive message (as giving one's blood, or as here, denouncing illegal activities) may ruin the value attached to executing this action. A very low reward may therefore deter reports by 'moral' individuals who would have reported for free—while not sufficiently covering associated costs (such as losing one's job) for inducing reports by individuals with a lower sense of 'morals'. If a reward is offered, it should therefore be high enough.

Both 'sticks' and 'carrots' being effective but imperfect, the optimal 'policy-mix' is likely to depend on political choices, given the weight among voters of taxpayers relative to consumers (that depend on the share of exports and imports in the economy), and preferences for fairness and moral messages.

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(European Union, 1996) (Fershtman et al., 1987) (Hinloopen, 2005) (Marshall and Meurer, 2004) (Polinsky and Shavell, 2000) (Stigler, 1971)

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[26] If the antitrust authority offers a bounty B to employees reporting incriminating evidence, colluding firms have to 'bribe' all informed employees to prevent them from reporting their inside knowledge, which reduces collusive profits proportionally to the number of informed employees. Collusion is less sustainable as a consequence. Even if the bounty is paid only to the first employee who denounces collusion, colluding firms must give each informed employee the equivalent of the rewards in each period, hence a 'multiplier effect' (see Aubert et al., 2005).

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