Managerial effort incentives and market collusion

Cécile Aubert[*]

This version: September 2007

Abstract

This paper investigates the interactions between the incentives of managers to collude, and to exert productive effort. Managers have discretion over the competitive strategy of the firm, and private information on their own effort to maximize profits. As both collusion and effort increase profits, a manager may substitute collusion to costly effort. This affects the congruence of interests between the manager and shareholders: Incentives to induce competition may conflict with incentives to undertake a high effort level.

We show that firms may choose inefficient effort levels due to managerial incentives to collude. Welfare losses may thus arise even when the industry does not become cartelized. Efficient competition may no longer be feasible – rendering collusion relatively more attractive to shareholders. Antitrust instruments are studied in this context: Contrary to corporate leniency, individual leniency programs have ambiguous results, even when not used; Individual liability is unambiguously beneficial and complements corporate leniency.

JEL Codes: L41, K21, D82.

Keywords: Collusion, Managerial incentives, Leniency programs.

1 Introduction

The Scandivanian airline company, SAS, has recently been under investigation from the U.S. and E.U. antitrust authorities for participation in a cartel. SAS claims it had no knowledge of the cartel, and was the victim of its own executive – despite the existence of an internal compliance program. SAS has indicated in the spring of 2008 its intention to sue the decision-making executive – though the latter would not be in a position to pay for cartel infringement fines, even if convicted. SAS may of course be undergoing this unusual procedure simply because of reputation issues, but one may fairly reasonably see this case as highlighting the discretion of managers and executives.[1] Shareholders and executives may indeed have divergent interests with regard to market conduct.

This paper focuses on this issue, and more particularly on the possibility that managers use collusive behavior as a substitute for their own costly profit-enhancing effort. Shareholders may not be able to distinguish between high profits due to effort and high profits due to collusion. This may affect the effort level required from a manager when shareholders want collusion, as well as when they do not want it. We highlight that the possibility of collusion may generate social losses (due to inefficient effort levels) even when firms ultimately do not collude. The paper also analyzes the impact of antitrust instruments in this context. We show that an otherwise efficient instrument may have detrimental effects in some circumstances, when internal incentives are taken into account.

The interactions between internal incentives and market conduct are complex. The disciplining effect of more intense competition on managers has also been the object of much theoretical and empirical work (see Hart, 1983, Scharfstein, 1988, Schmidt, 1997). Conversely, and closer to our concern, the impact of managerial incentives on the intensity of competition has been particularly studied in the context of strategic delegation. But the possibility that managers have sufficient discretion to select cartel practices has been largely neglected. As these practices are

---

[1] It should indeed be noted that the general public is often not very sensitive to cartel conviction and tends not to boycott convicted firms – Danone, for insance, does not seem to have suffered much from its conviction as repeat offender. SAS would thus probably not have seen its market share much reduced even if it had not advertised its lack of knowledge of the infringement.

illegal, shareholders cannot offer a contract specifying that the manager should choose collusion. Yet they may design managerial incentives so as to make, or not, collusion the manager's best choice. We argue that incentives may not be so easy to provide when there are two sources of moral hazard on the side of the manager: the choice of market conduct and the choice of effort.

Managers and other senior-level executives may have incentives to resort to illegal practices, including price-fixing and other collusive behavior, even when shareholders would rather have them act in a lawful way. In a recent survey, Price Waterhouse Coopers (2008) has conducted interviews of over 5,400 companies in 40 countries on the issue of 'economic crime' and fraud within firms. Over 43 % of the companies interviewed reported suffering one or more significant economic crimes. In case of a fraud, more than 80 % of respondents stated that this had caused damage or significant damage to their business – and the more so when senior executives were involved. The fraud reported in this survey was generally detrimental to the firm owners. Yet it needs not be so, and collusion is a particular violation of the law for which firm owners are particularly likely to gain. This raises difficulties in determining responsibilities for misconduct. Note that similar issues can arise between parent-company and branches or subsidiaries. In the E.U., a parent-company will be held responsible for the misconduct of a branch if the European Commission can prove its involvement in the branch's decisions.[2] This is not so in the U.S.

Shareholders do bear monetary penalties for price-fixing or colluding, as the fines paid by the firm are deducted from their dividends, independently from their actual involvement in the decision to collude (except, in some countries, when the firm has an effective internal compliance program[3]). They also suffer some depreciation in the value of their shares (Langus and Motta, 2007). Yet they do not have to bear additional penalties, that could differentiate controlling and minority shareholders; nor do they face the same threats of imprisonment as top-level executives. Buccirossi and Spagnolo (2005) 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 further penalizing shareholders. If the

---

[2]In the E.U., as parent-companies, which are involved in many activities, may be held responsible, recidivism is more often observed as an aggravating circumstance.

[3]In the U.S., shareholders should prove that they have made good use of a compliance program to be exempted from monetary responsibility.

remuneration scheme offered by shareholders to the manager is such that collusion emerges as a unique response from the manager, then it is clear that shareholders should be held responsible for inducing collusion. And the measure suggested by Buccirossi and Spagnolo (2005) can be quite acceptable.[4] However, it is not unlikely that the remuneration scheme offered to the manager does not pin down a unique choice of market conduct from this manager. Shareholders are entitled to using mechanisms that will foster internal efficiency. But it may be difficult to induce 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 (e.g., stock options) can be justified by internal moral hazard, but it can also induce the choice of more risky options, including collusion. Moreover, in this context, the type of instruments used by antitrust authorities will have an impact on the trade-off between effort incentives and competitive market conduct; They may, or not, exacerbate agency problems between shareholders and managers. This paper addresses these issues.

Our approach and main results   We use a very simple dynamic modeling incorporating some elements of the literature on leniency programs, reporting, and managerial compensation. Communication allows coordination on a collusive agreement, but firms remain free to implement this agreement or not, as in a standard tacit collusion situation. The main difference with this tacit collusion framework is that communication generates evidence. Evidence can be found by the antitrust authority, as well as by firms or individuals, so that leniency programs can be used.[5]

   We use a simple model, that highlights that collusion can be used by managers as a way to save on costly, productivity-enhancing, effort. More precisely, we assume that managers can (privately) choose the market conduct of the firm jointly with their effort to increase profits, under moral hazard. The manager has incentives to substitute un-competitive conduct to a high

---

[4]One may of course expect debates about the actual involvement of each shareholder in offering such a remuneration scheme, but this is the type of problem routinely addressed by judges, who can make decisions regarding each party's responsibility.

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

effort (we focus on collusive behavior in this paper, but the incentive issue we highlight would apply to other types of non competitive behavior). In our model, profits will not constitute an adequate indicator of the existence of collusion. Asymmetric information adds within-firm, internal, incentive constraints to the standard within-cartel incentive constraint (a.k.a. the sustainability condition).

We show that to prevent a manager from colluding, shareholders may have to provide him with weak incentives to exert effort. Collusion indeed allows saving on effort. When the marginal cost of effort is increasing, saving on effort by this means is more attractive when the level of effort required is high. By reducing the effort level requested, shareholders reduce the gain the manager can obtain by colluding. This parallels to some extent the idea that requesting very high levels of performance from a manager or employee leads them to misbehave. This result implies that competition becomes less attractive for shareholders, as the efficiency of the firm will be lessened. Paradoxically, although managers have a 'natural' incentive to use collusion, so as to save on their costly effort, once all incentive issues are taken into account, colluding firms may not always find it easier to induce effort together with collusion. They may have to pay managers information rents, or may have to require inefficient effort levels. Neglecting internal incentive issues leads to underestimating the welfare losses that are due to cartelization, either actual or potential.

The impact of various antitrust instruments on these choices is then analyzed, taking into account the optimal response by shareholders. The antitrust instruments considered encompass fines, corporate and individual leniency programs and rewards for informants – as used in Korea, and as advocated by Spagnolo (2004) and by Aubert, Rey and Kovacic (2006). We also consider the role of individual leniency, managerial disqualification and jail sentences. This matters as many analysts believe that corporate fines are still too low (despite recent increases), as cartels still abound (Connor, 2001, 2004, Levinstein and Suslow, 2004, Schinkel, 2007). As the incentives of individuals (managers or other executives) are taken into account, we can attempt to provide a first picture of the impact of measures targeted at individuals, such as jail sentences or disqualification, or individual leniency.

While we cannot estimate whether it is more likely that internal asymmetric information will

affect more shareholders who wish to induce collusion, or shareholders who want to compete, we can derive clear-cut results in terms of policy recommendations: Except for individual leniency programs, antitrust instruments all benefit cartel deterrence. They reduce the profitability of collusion, either directly (as for corporate fines) or through a higher wage for the manager, or lower internal efficiency (as for individual liability, disqualification, or a higher detection probability); They may also make it easier for shareholders to induce collusion: in our model, this implies that the best effort level compatible with the manager's incentives to compete becomes closer to the efficient, full-information, level. Individual leniency programs, however, have an ambiguous impact: they raise the costs of inducing collusion; but they also make it more likely that shareholders must pay information rents and request inefficient effort levels, in order to induce competition. This holds even though the program is not used in equilibrium.

Related literature   The literature considers incentives to adopt a particular market conduct, but does not simultaneously allow for incentives to invest in the firm's internal efficiency. 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, Judd, and Kalai (1991) 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. Chen (2007) focuses on the decision to delegate when a firm owner considers participating in a cartel. His analysis centers on the relative advantages of centralization, with and without leniency programs. 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. Spagnolo (2005) takes into account the preference

6

of managers for income-smoothing: they have lessened incentives to deviate, as this provides a sudden increase followed by a drop in profits. Collusion is thus more sustainable with a desire for income-smoothing.[6]

If the stock market had perfect foresight, antitrust authorities should be able to obtain information from its activity. This is not so in our setting: The manager can adjust her effort to the conduct she chooses, and that will potentially mask collusive behavior. Stock market prices are thus quite imperfect indicators of market conduct. Aubert (2007) already studies such a setting, but managers are assumed to remain in the firm for a limited time period only, and effort is discrete. Both assumptions severely limit the incentives shareholders can provide. Incentive problems are thus particularly stark, and Leniency Programs have the undesirable property of making it more difficult to induce effort together with competition.

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 of the incentives she receives from shareholders. 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. A reduction in fines (as in a Leniency program) in exchange for cooperation is indeed attractive to the manager only 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 paper is organized as follows. Section 2 sets up a model where conflicts of interest may arise between shareholders and managers. It also provides benchmarks. Section 3 characterizes the equilibrium when shareholders want to achieve the collusive outcome, while Section 4 considers the case in which they prefer competition. We assess the effects of rewards and jail

---

[6]Somewhat relatedly, Bernhardt and Chambers (2006) show how sharing income with employees (in the absence of incentive issues) can reduce incentives to deviate for (decision-making) shareholders. Their perspective is very different though as employees play a passive role with respect to collusion.

7

penalties on remuneration schemes and effort choices, and ultimately on shareholders' preference for collusion in Section 5. Section 6 concludes.

2 A model of managerial incentives and collusion

2.1 The model

Firms compete, and may collude, on a given market. Each firm is owned by a controlling shareholder and run by a manager. Although we recognize that shareholders often have diverse preferences[7], we will here assume that they constitute a homogeneous group. We will not consider the position of minority shareholders[8], so as to focus on managerial incentives.

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, possibly 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 their market and reporting strategy. If one manager at least has preferred not to communicate, the subsequent market strategy is

---

[7]All shareholders may not wish to foster collusion, even in the absence of antitrust sanctions: they may indeed have diverging preferences for the present (due, e.g., to different opportunity costs of funds, or to different personal situations), so that some may prefer deviations to persistent collusion. They may also differ in their degree of risk aversion, and in their ability to insure and diversify.

[8]Minority shareholders are under the current system penalized in case of proven collusion, even though they are not able to impact market behavior. One might want to consider setting up specific leniency programs for these minority shareholders, so as to protect them from such fines in case they report their information as to collusive practices. It should however be noted that minority shareholders often have little information, and even less evidence, with respect to such illegal strategies. This would severely limit the effectiveness of a specific leniency scheme.

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.

Shareholders require a return to competition forever after a deviation[9]. Each shareholder obtains the firm's profit, minus the wage paid to the manager, w. All shareholders have the same discount rate $\delta^s \in]0, 1[$, while all managers have a discount rate $\delta \in]0, 1[$. The two discount rates may differ as the two groups are likely to have different time preferences.

Managerial effort and discretion In each firm, the (risk neutral) manager privately chooses her effort level e, $e \geq 0$, and market conduct, $K \in \{C, M, D\}$, where C refers to competition, M to collusion or 'monopolization' and D to deviation from a collusive agreement.

Effort e is non observable and imposes a non observable cost $\psi(e)$ on the manager, where $\psi(0) = 0$ and $\psi(.)$ is a strictly convex, increasing, function. It increases profits for all possible market conduct, though possibly to a different extent.

Shareholders may not distinguish between high profits obtained thanks to a competitive behavior and a high effort, and the same profits obtained with collusion and a low effort. Each strictly positive profit level $\hat{\pi}$ can be obtained with three different effort levels associated to the three possible market conduct: there exist effort levels, e^C, e^M and e^D such that $\pi(e^C, C) = \pi(e^M, M) = \pi^(e^D, D) = \hat{\pi}$, and $e^C > e^M > e^D$. Thus, in a static context and in the absence of antitrust intervention, if shareholders require a given profit level, the manager always has incentives to provide this level through collusion together with a low effort (in a symmetric setting, managers from other firms have the same incentives to collude). In our dynamic setting, incentives may however be provided, as we will see.

To highlight the interplay between internal incentives and market conduct, we focus on the

---

[9]If misbehavior by a manager was tolerated as an excuse, allowing to resume collusion, incentives to deviate would be strengthened.

case in which the two are technically independent: The marginal impact of effort does not depend on market conduct. This will arise when effort bears on fixed costs, or when its impact is not sensibly different when the firm sells competitive quantities rather than collusive ones. This assumption thus provides a clear benchmark.

The profit function takes the following form: Profits for conduct K and effort e are given by

$$\pi^K(e) = e + \gamma^K,$$

where $\gamma^C \equiv 0$ represents the benchmark case of competition, and γ^D and γ^M the additional profits obtained by deviating and colluding. $\gamma^D > \gamma^M > \gamma^C = 0$.

Moreover, profits are lower when the firm engages in collusion and faces deviation by one of its partners in the cartel: profits are then

$$\underline{\pi}^K(e) = e + \underline{\gamma}^K$$

when $K = M, D$, and another firm at least has chosen to deviate (conduct D). To simplify, we assume that the profits obtained when several firms deviate are identical to competitive profits: $\underline{\pi}^D(e) = e + \underline{\gamma}^D = \pi^C(e) = e$. And $\underline{\pi}^D(e) > \underline{\pi}^M(e)$. Note that $\underline{\gamma}^M < \underline{\gamma}^D < 0$.

Hence, to achieve a target level of profit $\hat{\pi}$, a manager can exert effort $\hat{\pi}$ at cost $\psi(\hat{\pi})$ under competition, or exert effort $\hat{\pi} - \gamma^M$ at cost $\psi(\hat{\pi}) - \gamma^M$ if a cartel forms (and a lower effort would suffice if the manager was able to be the only deviator from a cartel agreement, at $\hat{\pi} - \gamma^D$).

In this set-up, due to the absence of direct link between effort and market conduct, the optimal level of effort is independent from market conduct, under full information: Maximizing the firm's profits with respect to effort yields this optimal level, e^*, as characterized by

$$\psi'(e^*) = 1.$$

This feature of the model allows an easy comparison between the effort levels that will be required under competition and under collusion, when shareholders lack information.

Managerial compensation   We assume that auditing would be too costly for shareholders. Hence they cannot learn (at a reasonable cost) the true market conduct in the industry. Here,

the only variable on which wages can be conditioned is profit. When there is antitrust intervention, to the contrary, an additional variable can be used to adjust wages: the outcome of antitrust intervention. This outcome is related to the market conduct K chosen by the manager, though with imperfect correlation. Shareholders may then distinguish between a clearing, a conviction for cartel, or a conviction for cartel together with leniency application from the manager. Conviction constitutes an ex-post signal on the fact that the manager has chosen to collude. The managerial compensation or 'wage' paid to the manager, w, will thus turn out to be relatively simple, although the set-up is dynamic (we will use notations for wages that do not refer to the complete history of the game, as this will not be necessary here).

Shareholders cannot impose some penalty on the manager in case of misbehavior, unless this misbehavior is proven by the antitrust authority. We allow for the possibility that an antitrust investigation provides evidence about a misconduct from the manager that was not required by shareholders. In that case, the manager will suffer costs due to reputation issues and potential private litigation from shareholders. We denote by P these (possibly small) expected penalties, and assume that no such penalty can be imposed when shareholders have wilfully induced a cartelized behavior – although they lack commitment power not to sue the manager, they would not be able to convince other economic agents of their innocence.

The manager can quit the firm at any time, in which case we assume that she gets a zero reservation wage from exerting her best outside option. There are thus 'limited liability' constraints: $w \geq 0$.

The incentive scheme received by the manager is assumed to be soft private information, that cannot be credibly communicated to competing firms.[10] We abstract from coordination issues between the managers of the different firms, in order to focus on the interplay between internal incentives and market conduct.

Evidence and antitrust intervention   The antitrust authority can impose (bounded) fines F on colluding firms, if it obtains evidence about current collusion. For simplicity, we assume that the antitrust authority always finds this evidence when it audits a colluding industry. The

---

[10]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.

probability of audit, denoted ρ, is supposed constant[11], except if a report occurs, in which case the industry is kept under close scrutiny afterwards, so that subsequent collusion is deterred.[12] 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. Reports to the antitrust authority are assumed to be public, and observed by firms (see Rey, 2003, on leniency with secret reports).[13]

Last, the antitrust authority can also impose fines on managers if it operates under a regime of individual liability. Jail sentences and managerial disqualification share an interesting feature: the manager cannot retain its position after a cartel conviction, even when shareholders would have wished them to stay in office.[14] For simplicity, we will consider that the association of a monetary penalty and disqualification is identical to a jail sentence. We will denote by J the penalty imposed on a colluding executive, where J is zero in the absence of individual liability, J^{mon} under monetary liability, and $J^{mon} + J^J$ in case of a jail sentence, or of monetary liability plus disqualification (J^j is the additional cost associated with disqualification or with jail). We denote by $\mathbb{1}_j$ the proxy indicating whether jail sentences or managerial disqualification can be

---

[11]Harrington (2008) characterizes optimal Leniency Programs when the probability of being detected by the antitrust authority varies over time.

[12]We do not specify the budget constraint that the antitrust authority may face, contrary to Motta and Polo (2003), and we assume that the detection probability does not depend on profit levels, contrary to Harrington (2005): The antitrust authority monitors extremely various industries in diverse regions, and is not able to identify collusive and competitive profit levels in each industry; Obtaining truthful expert advice for each market would be too costly. In addition, in our model, profits may not provide adequate indications as to market conduct, as they also depend on effort. Our assumptions on the probability of audit are quite simple. As we focus on internal incentives, issues relating to the disclosure enabled by an investigation or by a report under a leniency program can however be left aside.

[13]Note that we abstract from the usual credibility issue related to audit in such a context. If the antitrust authority cannot credibly commit to a probability of investigation, the equilibrium is in mixed strategies (Khalil, 1997).

[14]Admittedly, retaining a manager convicted of collusive behavior may constitute a signal that shareholders were not opposed to collusion. Changing managers may thus appear necessary in any case. Yet there may be ways of providing another, less visible, employment to the manager in some subsidiary or other.

imposed: $1\!\!1_j$ equals one if they can be used, and zero otherwise. Thus $J = J^{mon} + 1\!\!1_j J^j$, when individuals are liable. Criminal sanctions are used in the U.S, the U.K., Ireland or Estonia, in particular, and are suggested as an efficient deterrent by Wils (2005) or Klawiter (2001). Our modeling will allow assessing one of their effect, but this effect will not be truly distinguishable from managerial disqualification in our model.

2.2 Some benchmarks

Full information Assume first that the shareholders are perfectly informed on both effort e and market conduct K. They can then impose choices on their manager (including the optimal effort level e^*), and the latter will not quit the firm provided his wage w covers his cost of effort and potential liability in case of collusive behavior.

- Let us first assume that no leniency or whistle-blowing program is offered.

Under competition, the manager's wage will be exactly equal to the cost of effort, $\psi(e^*)$.

Under collusion, the wage will depend on whether the manager is individually liable, and risks disqualification or jail. Shareholders must thus offer a wage $\psi(e^*) + \rho J$ (where J equals 0 in the absence of individual liability, and $J = J^{mon} + 1\!\!1_j J^j$ otherwise).

A cartel is thus profitable for shareholders if and only if

$$\frac{1}{1 - \delta^s}[e^* - \psi(e^*)] < \frac{1}{1 - \delta^s}[e^* + \gamma^M - \rho F - (\psi(e^*) + \rho J)]. \tag{1}$$

Frequent investigations, individual liability, criminal liability and disqualification have the obvious advantage of reducing the profitability of the cartel.

A cartel is sustainable if and only if

$$\gamma^D - \gamma^M < \frac{\delta^s}{1 - \delta^s}[(e^* + \gamma^M - \rho F - \psi(e^*) - \rho J) - (e^* - \psi(e^*))] \tag{2}$$

$$\Leftrightarrow \quad \gamma^D - \gamma^M < \frac{\delta^s}{1 - \delta^s}[\gamma^M - \rho F - \rho J]. \tag{3}$$

Managerial liability does not directly affect the sustainability of the cartel.

- Let us now assume that a deviating firm can use a Leniency Program, and that this program is attractive (f low enough) and removes individual liability for firm employees. A cartel is now

sustainable only if

$$(\gamma^D - f) - (\gamma^M - \rho F - \rho J) < \frac{\delta^s}{1 - \delta^s}[\gamma^M - \rho F - \rho J].$$

The Leniency Program is unambiguously good for deterrence here, and its benefits are reinforced by managerial liability, as shareholders do not have to compensate the manager for his liability when using the program. A reward for reporting firms ($f < 0$) would be even more effective.

Moral hazard on market conduct   Assume now that shareholders cannot observe market conduct. As there is no uncertainty in our model, they can deduce this market conduct from the joint observation of effort and profits. In the absence of rewards for individual informants, no incentive issue arises as the manager would not benefit by adopting a different market conduct than the one required – a result that may not hold with whistle-blowing programs as we will see.

Moral hazard on effort   Last, assume that market conduct is observable to shareholders, but not effort. As above, the joint observation of market conduct and profits provides information. However, when required to join a cartel, a manager could use the following strategy: He may under-exert effort and pretend that the low profit levels obtained are due to deviation from another cartel member. This would allow him to exert only effort $\underline{e} = e^* + \underline{\gamma}^M - \gamma^M$, where $\underline{\gamma}^M < 0$ (this effort level is such that profits correspond to $\underline{\pi}^M(e^*)$). The manager saves $\psi(e^*) - \psi(e^* + \underline{\gamma}^M - \gamma^M)$. Shareholders can however easily prevent such behavior by simply not paying the manager when the desired level of profit is not reached. The incentive issue highlighted here would then disappear. We will assume that this solution is available in the remainder of the paper. If this assumption did not hold, shareholders would have to leave an information rent (equal to $\frac{1-\delta}{\delta}\psi(e^* + \underline{\gamma}^M - \gamma^M)$) to the manager when inducing collusion.[15]

---

[15]For the sake of completeness, let us assume here that shareholders cannot so drastically reduce wages for the manager without attracting attention. Then the strategy described becomes attractive to the shareholder. It would trigger a return to competition forever after (and possibly a dismissal of the manager). As long as the manager gets no share in the higher profits obtained under collusion, the strategy provides him with a short-term gain but no long-term losses (he gains zero after a return to competition or a dismissal). Shareholders must thus grant him an information rent to ensure that this strategy is not attractive: in other words, they must pay him

The next sections analyze the consequences of asymmetric information on both effort and market conduct, when shareholders want to induce collusion, and then when they want to induce competition.

3 Managers' incentives when shareholders prefer collusion

We will here consider the incentive and participation constraints for the manager to choose collusive behavior when shareholders can observe neither his effort nor market conduct. The manager has 'natural' incentives to collude as this reduces the effort level needed to reach a particular profit target. This however does not imply that there are no incentive constraints to be met.

3.1 Managerial incentives to collude

Let us denote by $PC(K, e)$ the participation constraint of the manager for market conduct K and effort e. $IC(K_1 \prec K_2)$ will denote the incentive constraint ensuring that the manager prefers to choose conduct K_2 to K_1.

Let us first assume that when the manager obeys the instructions of the shareholders, he remains in the firm even after a successful investigation (there is no criminal liability): $J = J^{mon}$ here.

---

a wage w above the compensation of costs $\psi(e^*) + \rho J$ described under full information, as long as they require a collusive conduct; While the wage under competition remains at its minimal level, $\psi(e^*)$. The information rent must be such that the long-term losses for the manager due to return to competition off-sets the gain obtained by shirking in one period:

$$\psi(e^*) - \psi(e^* + \underline{\gamma}^M - \gamma^M) \leq \frac{\delta}{1-\delta}[w - \psi(e^*)] \Leftrightarrow \quad w \geq \psi(e^*) + \frac{1-\delta}{\delta}\psi(e^* + \underline{\gamma}^M - \gamma^M).$$

The information rent will thus be exactly $\frac{1-\delta}{\delta}\psi(e^* + \underline{\gamma}^M - \gamma^M)$. The profitability of collusion is reduced by the same level in each period. In this set-up, asymmetric information is detrimental to shareholders when they wish to obtain a cartelized industry, but not when they wish to compete. As noted, we will however assume in the following that shareholders can simply pay the manager a null wage (or more precisely a low wage) when profits do not reach the required target.

For an effort level e^M, the participation constraint writes as

$$PC(M, e^M): \quad w(\pi^M(e^M)) - \psi(e^M) - \rho J \geq 0.$$

The incentive compatibility constraints ensuring that the manager prefers cartellization are

$$IC(C \prec M): \quad \frac{1}{1-\delta}[w(\pi^M(e^M)) - \psi(e^M) - \rho J] \geq$$
$$\max\{\frac{1}{1-\delta}[w(\pi^M(e^M)) - \psi(e^M + \gamma^M)], 0\}$$
$$IC(D \prec M): \quad \frac{1}{1-\delta}[w(\pi^M(e^M)) - \psi(e^M) - \rho J] \geq$$
$$w(\pi^M(e^M)) - \psi(e^M - (\gamma^D - \gamma^M)).$$

When choosing competition instead of collusion, the manager must either exert more effort to still achieve the target profit level ($\pi^M(e^M) = e^M + \gamma^M = (e^M + \gamma^M) + 0$), or not exert effort at all (and gain 0) as his behavior will be discovered anyway.[16] Clearly, as competing instead of colluding involves higher effort levels, this can only be attractive if the manager's individual liability is quite large: $\rho J > \psi(e^M + \gamma^M) - \psi(e^M)$.

Constraint $IC(C \prec M)$ will not bind for the first-best effort level if $\rho J \leq \psi(e^* + \gamma^M) - \psi(e^*)$. This condition will always be satisfied in the absence of individual liability ($J = 0$).

If it is not satisfied, however, shareholders will choose a different effort level from the efficient one e^*: As $\psi(.)$ is a strictly convex function, reducing e^M to a level lower than e^* allows to relax to some extent the incentive compatibility constraint.

To ensure that the manager does not want to deviate, his wage must satisfy

$$w(\pi^M(e^M)) \geq \frac{1-\delta}{\delta}[\rho J + \psi(e^M) - \psi(e^M - (\gamma^D - \gamma^M))],$$

while one must also have $w(\pi^M(e^M)) \geq \psi(e^M) + \rho J$ for participation.

The relevant constraints thus write as a first constraint on e^M, and a second on the wage:

$$\rho J \leq \psi(e^M + \gamma^M) - \psi(e^M)$$
$$w(\pi^M(e^M)) \geq \max\{\psi(e^M) + \rho J, \frac{1 - \delta(1 - 1\!\!1_j\rho)}{\delta(1 - 1\!\!1_j\rho)}[\rho J + \psi(e^M) - \psi(e^M - (\gamma^D - \gamma^M))]\}.$$

_____

[16]A last possibility is pretending that another collusive partner has deviated, to explain low profits; As mentioned in the previous section, we assume that this would yield the manager a null wage, so that his best strategy is to exert no effort.

Depending on functional forms and parameters, the optimal wage scheme when shareholders want to induce collusion can be as follow:

- It may be that both constraints are satisfied with $e^M = e^*$ and $w(\pi^M(e^*)) = \psi(e^*)$: This is the case if $\rho J \leq \psi(e^* + \gamma^M) - \psi(e^*)$ and $0 \leq \frac{1-2\delta}{1-\delta}(\rho J + \psi(e^*)) - \psi(e^* - (\gamma^D - \gamma^M)))$. In that case, inducing collusion under asymmetric information is not more difficult than under full information; the conditions under which collusion is profitable and sustainable are then unchanged compared to the benchmark case (conditions (1) and (2)).

- It may however also be the case the the shareholders must require a lower level of efficiency, $e^M < e^*$ (if managerial liability is sufficient to have $\rho J > \psi(e^* + \gamma^M) - \psi(e^*)$).

- Last, they may also have to leave an information rent to the agent whenever compensating the manager for his costs (including his potential liability) is not sufficient to deter deviations.

In the last two cases, collusion becomes less attractive to the shareholders. They are more likely to occur when the liability of managers raises from low levels. Although a positive effect of managerial liability on deterrence could have been expected, the means through which if affects collusive firms under asymmetric information is less obvious. It indeed tends to allow managers to obtain information rents, in addition to the simple compensation of the risk they bear; and it tends to reduce their efficiency.

Proposition 1 *When shareholders can observe profits, but not market conduct and managerial effort, inducing collusion may require leaving an information rent to the manager, or requiring a lower level of effort than the efficient one. This holds when managers suffer sufficient penalties when convicted. Collusion is thus less attractive than under full information.*

3.2 Criminal sanctions and jail

Let us now add criminal sanctions or jail to the penalties borne by the manager in case of cartel conviction. The net present value of his compensation is thus weighted by $\frac{1}{1-\delta(1-\rho)}$, instead of $\frac{1}{1-\delta}$ in the absence of criminal sentences and/or disqualification. This is because his prospects of

obtaining wages in the industry end with a conviction, so that he behaves as if he was discounting the future more.

To take into account this possibility, one can rewrite the incentive constraints faced by shareholders as

$$IC(C \prec M): \quad \frac{1}{1 - \delta(1 - 1\!\!1_j\rho)}[w(\pi^M(e^M)) - \psi(e^M) - \rho J] \geq$$
$$\max\{\frac{1}{1 - \delta(1 - 1\!\!1_j\rho)}[w(\pi^M(e^M)) - \psi(e^M + \gamma^M)], 0\}$$
$$IC(D \prec M): \quad \frac{1}{1 - \delta(1 - 1\!\!1_j\rho)}[w(\pi^M(e^M)) - \psi(e^M) - \rho J] \geq$$
$$w(\pi^M(e^M)) - \psi(e^M - (\gamma^D - \gamma^M)),$$

where $1\!\!1_j$ equals 1 if there is managerial disqualification or criminal liability, and 0 otherwise.[17]

When there are criminal sanctions, i.e., when $1\!\!1_j = 1$, it is less likely that internal incentives will have no bite. Thus, in the presence of criminal sanctions, incentives are more likely to compel shareholders to pay information rents or to distort effort levels, when inducing collusion.

3.3 Individual leniency

Let us assume now that the manager can apply to an individual leniency program (ILP) and get amnesty. Then, a new incentive constraint arises if leniency is sufficiently attractive (i.e., if the manager's liability was sufficiently strong), and if it can become public only after the manager has been paid. To ensure that the manager will not use the leniency program, one must have

$$IC(ILP \prec M): \quad \frac{1}{1 - \delta(1 - 1\!\!1_j\rho)}[w(\pi^M(e^M)) - \psi(e^M) - \rho J] \geq w(\pi^M(e^M)) - \psi(e^M).$$

This requires $\rho J < \delta(1 - 1\!\!1_j\rho)[w(\pi^M(e^M)) - \psi(e^M)]$.

The shareholders may have to increase the wage paid to the manager in order to ensure that this condition is satisfied, again paying an information rent. This reduces the profitability of the cartel. Disqualification or criminal sentences reinforce this effect ($1\!\!1_j = 1$).

Note that if the manager is rewarded for his information, as in a whistle-blowing program (instead of being simply amnestied, as in an individual leniency program), the condition above

---

[17]The constraints rewrite as $\rho J \leq \psi(e^M + \gamma^M) - \psi(e^M)$ and $w(\pi^M(e^M)) \geq \max\{\psi(e^M) + \rho J, \frac{1 - \delta(1 - 1\!\!1_j\rho)}{\delta(1 - 1\!\!1_j\rho)}[\rho J + \psi(e^M) - \psi(e^M - (\gamma^D - \gamma^M))]\}$.

becomes more difficult to ensure, as the reward is added, in the left-hand side, to the avoided cost of individual sanctions, ρJ. Independently from effort incentives, the wage paid to the manager when rewards are offered by antitrust authorities must increase, as shareholders must bribe the manager into silence (Aubert, Rey and Kovacic, 2006).

From a policy perspective, let us note the following:

- As both managerial disqualification and criminal liability act as to reduce the time preference of the manager, they tend to make it more difficult for shareholders to induce collusion. Both thus prove useful in this context.

- Individual leniency can add to the incentive constraints faced by shareholders, when they want to induce collusion. It complements individual liability.

4   Managers' incentives when shareholders prefer competition

Let us now consider the situation in which shareholders want to induce competition. As in the previous section, we abstract from jail sentences and disqualification to highlight the main effects (both would result in a different aggregate discount factor for a colluding manager).

For an effort level e^C, the participation constraint is

$$PC(C, e^C): \quad w(\pi^C(e^C)) - \psi(e^C) \geq 0.$$

The incentive compatibility constraints ensuring that the manager prefers competition are

$$IC(M \prec C): \quad \frac{1}{1-\delta}[w(\pi^C(e^C)) - \psi(e^C)] \geq \frac{1}{1-\delta(1-\rho)}[w(\pi^C(e^C)) - \psi(e^C - \gamma^M) - \rho(P+J)]$$

$$IC(D \prec C): \quad \frac{1}{1-\delta}[w(\pi^C(e^C)) - \psi(e^C)] \geq w(\pi^C(e^C)) - \psi(e^C - \gamma^D) - \rho(P+J)).$$

Indeed, shareholders will not be able to assess whether there is collusion going on, as long as no antitrust intervention occurs. But they will fire the manager (and possibly impose an expected penalty P on him, after private litigation) if an antitrust investigation reveals the existence of a cartel. The time horizon of the manager is thus determined by the probability of antitrust intervention. A deviation triggers dismissal of the manager (as profits are lower than

the competitive one) but may not provide shareholders with the necessary evidence to convict the manager.

Clearly, high individual penalties on managers help satisfy the incentive constraints.

We will neglect the incentive constraint that ensures that the manager does not prefer to collude and deviate, to focus on the incentive constraint that is more relevant for a high discount factor δ, $IC(M \prec C)$.

We thus focus on

$$PC(C, e^C): \quad w(\pi^C(e^C)) \geq \psi(e^C)$$

$$IC(M \prec C): \quad w(\pi^C(e^C)) \geq \frac{1}{\rho\delta}\Big[(1 - \delta(1-\rho))\psi(e^C) - (1-\delta)[\psi(e^C - \gamma^M) + \rho(P + J)]\Big].$$

Binding participation constraint   Assume that the participation constraint is more stringent that the incentive constraint for $e^C = e^*$.

Then shareholders can induce competition together with an efficient effort level e^*, and at no higher cost than under full information.

Binding incentive constraint   Assume now that the incentive constraint is more stringent than the participation one for $e^c = e^*$. Then the optimal effort level will be reduced to lessen the incentives of the manager to collude: $e^C < e^*$. Indeed, optimizing the profits of the shareholders $(e^C - w(\pi^C(e^C)))$ with respect to e^C, one obtains the following level, as characterized by the first-order condition of this program:

$$\psi'(e^C) = \frac{\delta}{1 - \delta(1-\rho)}[1 + (1-\delta)\psi'(e^C - \gamma^M)].$$

The larger the probability of intervention ρ, the higher the effort level e^C will be. The size of the penalty J imposed on the manager does not directly affect the efficiency of competitive firms (as it does not enter the equation characterizing e^C) but it does so indirectly by making it more probable that the participation constraint will be binding in equilibrium, and not the incentive constraint.

As the cost of effort $\psi(.)$ is strictly convex, reducing the effort required also reduces the gain in shirking on this effort thanks to collusion $(\psi(e^C) - \psi(e^C - \gamma^M))$. Shareholders thus distorts

the required effort level from the first-best e^*, and grant an information rent (as the wage will be above the cost of effort $\psi(e^C)$), in order to achieve competition at a relatively low cost. Asymmetric information thus involves information rents and deteriorated internal efficiency, as in more standard models.

Proposition 2 *Due to the discretion of the manager, shareholders may require from him an inefficient effort level, and pay him an information rent, in order to induce competition. Competition then goes along increased internal, functioning, costs.*

4.1 Individual leniency

It should be noted that individual leniency has a drawback: We have seen in the previous section that it can make it more costly for shareholders to induce collusion. Unfortunately, it will also make it more costly for them to induce competition: Indeed, by using an individual leniency program, a manager can get protection from criminal liability and escape the sanction J. He can even possibly escape sanctions incorporated in P. Thus, the incentive constraint $IC(M \prec C)$ becomes more difficult to satisfy. It is more likely that this constraint will be binding. Note that the program will not be used in equilibrium. Yet its existence will increase the set of parameters for which the manager must be paid an information rent, and exerts an inefficient level of effort, when shareholders induce collusion.

Lemma 1 *An individual leniency program has an ambiguous impact: While it increases the costs of inducing collusion, it also increases the costs associated with inducing competition. This holds even though the program is ultimately not used.*

This result raises some doubts as to the desirability of individual leniency programs. It would be necessary to assess whether their positive impact offsets their negative effect. In practice, such programs have not had much success. But they may have an impact on the equilibrium reached even if they are not used.

4.2 Summary

Our analysis has an important implication: Due to the interplay between incentives to choose to collude and incentives to exert effort, effort levels may be distorted away from the first-best level in equilibrium. We have seen how this may be the case when shareholders want to induce collusion. And the result above shows how this may also be necessary when shareholders want to induce competition instead.

Proposition 3 *When shareholders cannot observe market conduct and managerial effort, the possibility of collusion generates additional welfare costs: Inefficient effort levels may be exerted in colluding firms, but also in competing firms.*

Analyzes of the costs of cartel practices – and cost-benefit analyzes of the value of antitrust enforcement – tend to focus on damages for consumers. Our result indicates that this may lead to under-estimating the value of improving antitrust deterrence: First, colluding firms may indeed behave inefficiently; this possibility was already considered to some extent as it is generally known that colluding firms have distorted incentives to invest in advertising and innovation. Second, and more importantly, even non-colluding firms, in non-cartelized industries, may be behaving inefficiently, so as to lessen the incentives of executives to set up an illegal agreement. We believe that the effect we highlight may apply to other type of illegal practices than cartel practices, and that measuring its impact would be particularly difficult. Yet it is worth stressing that the sheer possibility of collusion may have adverse consequences, even when no cartel forms.

Last, our analysis assumes that the value of effort does not depend on market conduct. If instead effort were to increase profits more when a large quantity is sold, then it would be easier to induce effort from the manager when the firm is either competing or deviating (in our model, the efficient effort level would depend on market conduct). We would however still have higher profits with collusion than with competition, and potential trade-off between effort and market conduct. So our main results would remain, in qualitative if not in quantitative terms.

5 Shareholders decisions

The previous sections have characterized the wage and effort corresponding to respectively collusion and competition, depending on the characteristics of antitrust intervention. It is now straightforward to compute whether shareholders prefer competition or collusion.

The condition under which collusion is profitable is now

$$\frac{1}{1-\delta^s}[e^C - \psi(e^C)] < \frac{1}{1-\delta^s}[e^M + \gamma^M - \rho F - w(e^M, M)],$$

where $w(e^M, M) \geq \psi(e^M) + \rho(J^{mon} + \mathbb{1}_j J^j)$. Clearly, if the manager must be paid an information rent when colluding, this wage increases, and collusion tends to become less profitable.

It is more difficult to analyze the impact of moral hazard on the effort levels requested. The effort level compatible with incentives to compete, e^C, may or may not equal the efficient level e^*, as we have seen. And similarly, the effort level compatible with incentives to collude, e^M, may or not differs much from e^*. One cannot assert whether moral hazard makes collusion more profitable. Yet we have seen that more antitrust intervention (larger penalties J, larger probability of being caught ρ, and corporate leniency programs) all tend to make it easier to induce competition: e^C gets closer to e^*; While the reverse holds for collusion: e^M is more likely to be distorted away from e^*.

Similar effects play on the condition under which collusion is sustainable:

$$\gamma^D - \gamma^M < \frac{\delta^s}{1-\delta^s}[(e^M + \gamma^M - \rho F - w(e^M, M) - (e^C - \psi(e^C))].$$

Compared to the full-information situation, the right-hand side is $\frac{\delta^s}{1-\delta^s}[(e^M + \gamma^M - \rho F - w(e^M, M) - (e^C - \psi(e^C))]$ instead of $\frac{\delta^s}{1-\delta^s}[\gamma^M - \rho F - \rho J]$. It is thus increased, or reduced, by $e^M - w(e^M, M) + \rho J - e^C + \psi(e^C)$.

Several cases must be considered. Assume first that parameters are such that both competition and collusion are incentive-compatible for the manager for the first-best level of effort, $e^C = e^M = e^*$. Then the sustainability condition will only differ from the full-information one (1), if the manager receives an information rent under collusion, that is if $w(e^M, M) > \psi(e^*) + \rho J$.

Assume now that parameters are such that competition required a reduction in effort ($e^C < e^*$) while collusion does not ($e^M = e^*$). Then, the profitability of collusion is clearly increased

compared to the full information benchmark (1), due to the gap $e^* - e^C$. And when comparing the costs and benefits of a deviation, shareholders will take into account that a return to competition is particularly detrimental as efficiency will also decrease. This makes sustainability somewhat easier to obtain than under full information (2). This is the only effect to be considered provided that the manager does not receive an information rent ($w(e^*, M) = \psi(e^*) + \rho J$). In this set-up, internal incentive issues make collusion more attractive, as competition requires a loss in efficiency.

The reverse holds when $e^C = e^*$ and $e^M < e^*$.

These results highlights the importance of achieving an effective antitrust policy mix, so as to facilitate efficient competition and make collusion as costly as possible, including in terms of information rents and effort.

6   Conclusion

Taking into account managerial discretion over market conduct together with moral hazard on effort highlights a novel cost of the possibility of collusion: Firms may be less efficient than if information was perfect. More precisely, managers in colluding firms may undertake an inefficient level of effort, but so may managers in non colluding firms. Aubert, rey and Kovacic (2006) study how colluding firms may choose inefficient investment levels in order to mask their collusive behavior to lower level employees – who could become antitrust informants. Yet in their set-up, the inefficiency had a positive side, as it made collusion less attractive. This is not so here. To the contrary, it may be that these inefficiencies dissuade firms from competing.

Mechanisms inducing the revelation of information on collusive behavior, such as corporate and individual, Leniency and whistleblowing programs, are potentially quite beneficial, as they may help obtain a better internal efficiency for firms that choose to compete, contrary to firms that choose to collude. Although bounties are frequently opposed on the ground of potential adverse incentives with respect to market conduct, the adverse incentives that may arise in our setting concern effort choices in competitive industries. And these adverse incentives exist in the absence of any such program. In particular, individual leniency programs appear effective when one only considers shareholders interested in collusion. But if shareholders want to induce

competition, individual leniency will tend to increase their costs – thereby making it more likely that shareholders will decide in favor of cartel practices.

Our result stress that detrimental effects from the possibility of competition may exist even when firms ultimately choose not to collude. This reinforces the need for antitrust deterrence, provided antitrust instruments go beyond corporate fines: as we have seen, sufficient individual liability and corporate leniency programs are needed, as corporate fines do not directly affect internal efficiency choices.

7   References

Aggarwal, Rajesh K., and Andrew A. Samwick (1999) - "Executive Compensation, Strategic Competition, and Relative Performance Evaluation: Theory and Evidence", *The Journal of Finance*, 54(6): 1999 - 2043.

Aubert, Cécile (2007) - "Instruments for Cartel Deterrence and Conflicts of Interests", in *The Political Economy of Antitrust*, Vivek Ghosal and Johan Stennek, eds., North Holland, 123-148.

Aubert, Cécile, Patrick Rey and William Kovacic (2006) - "The Impact of Leniency and Whistle-blowing Programs on Cartels", *International Journal of Industrial Organization*, 24: 1241-1266.

Bernhardt, Dan, and Christopher P. Chambers (2006) - "Profit Sharing (with Workers) facilitates Collusion (among Firms)", *The RAND Journal of Economics*, 37(3): 483502.

Bernheim, Douglas and Michael D. Whinston (1985) - "Common Marketing Agency as a Device for Facilitating Collusion", *Rand Journal of Economics*, 16(2): 269-281.

Buccirossi, Paolo, and Giancarlo Spagnolo (2007) - "Corporate Governance and Collusive Behavior", forthcoming in *Issues in Competition Law and Policy*, Dale W. Collins, ed., Antitrust Section, American Bar Association.

Chen, Zhijun (2007) - "Cartel Organization and Antitrust Enforcement", mimeo, University of East Anglia.

Connor, John M. (2004) - *Global Price Fixing: 'Our Customers Are the Enemy'*, Kluwer Academic Press, Boston, MA.

Fershtman, Chaim, and Kenneth Judd (1987) - "Equilibrium Incentives in Oligopoly", *The American Economic Review*, 77(5): 927-940.

Fershtman, Chaim, Kenneth Judd, and Ehud Kalai (1987) - "Observable Contracts: Strategic Delegation and Cooperation", *International Economic Review*, 32(3): 551-559.

Harrington, Joseph (2005) - "Optimal Cartel Pricing in the Presence of an Antitrust Authority", *International Economic Review*, 46: 145-169.

Harrington, Joseph (2008) - "Optimal Corporate Leniency Programs", Journal of Industrial Economics, 56(2): 215 - 246.

Hart, 0liver (1983) - "The Market Mechanism as an Incentive Scheme", *Bell Journal of Economics*, 14: 366- 382.

Khalil, Fahad (1997) - "Auditing Without Commitment", *The RAND Journal of Economics*, 28(4): 629-640.

Klawiter, Donald C. (2001) - "After the Deluge: The Powerful Effect of Substantial Criminal Fines, Imprisonment, and Other Penalties in the Age of International Cartel Enforcement", *George Washington Law Review*, 69(5/6): 745-765.

Kovacic, William E. (1996) - "Whistleblower Bounty Lawsuits as Monitoring Devices in Government Contracting", *Loyola of Los Angeles Law Review*, 29: 1799-1857.

Kovacic, William E. (2001) - "Private Monitoring and Antitrust Enforcement: Paying Informants to Reveal Cartels", *George Washington Law Review*, 69(5/6): 766-797.

Langus, Gregor, and Massimo Motta (2007) - "The Effect of EU Antitrust Investigations and Fines on the Firm Valuation", mimeo, European University Institute.

Levenstein, Margaret, and Valerie Y. Suslow (2004) - "Contemporary International Cartels and Developing Countries: Economic Effects and Implications for Competition Policy", *Antitrust Law Journal*, 71(3): 801-852.

Marshall, Robert C., and Michael J. Meurer (2004) - "Bidder Collusion and Antitrust Law: Refining the Analysis of Price Fixing to Account for the Special Features of Auction Markets", *Antitrust Law Journal*, 72(1): 83-118.

Motta, Massimo, and Michele Polo (2003) - "Leniency Programs and Cartel Prosecution", *International Journal of Industrial Organization*, 21: 347-379.

Mullin, Wallace P. and Snyder, Christopher (2005) - "Targeting Employees for Corporate Crime and Forbidding Their Indemnification", George Washington University working paper, http://ssrn.com/abstract=558341

Price Waterhouse Coopers (2008) - "Global Economic Crime Survey 2007: Economic Crime: People, Culture and Controls", under the direction of Steven Skalak and Neil Keenan, available at http://www.pwc.com/

Rey, Patrick (2003) - "Towards a Theory of Competition Policy", in *Advances in Economics and Econometrics: Theory and Applications, Eighth World Congress*, M. Dewatripont, L. P. Hansen, S. J. Turnovsky eds., Cambridge University Press, Cambridge, UK.

Scharfstein, David (1988) - "Product-Market Competition and Managerial Slack", *The RAND Journal of Economics*, 19(1): 147-155.

Schinkel, Maarten Pieter (2007) - "Effective Cartel Enforcement in Europe", *World Competition*, 30(4): 539-572.

Schmidt, Klaus M. (1997) - "Managerial Incentives and Product Market Competition", *The Review of Economic Studies*, 64(2): 191-213.

Sklivas, Steven (1987) - "The Strategic Choice of Managerial Incentives", *The RAND Journal of Economics*, 18: 452-458.

Spagnolo, Giancarlo (2000) - "Stock-related Compensation and Product-Market Competition", *The RAND Journal of Economics*, 31: 22-42.

Spagnolo, Giancarlo (2004) - "Divide et Impera: Optimal Leniency Programs", mimeo, Mannheim.

Spagnolo, Giancarlo (2005) - "Managerial Incentives and Collusive Behavior", *European Economic Review*, 49(6): 1501-1523.

Werden, Gregory J. (2004) - "Economic Evidence on the Existence of Collusion: Reconciling Antitrust Law with Oligopoly Theory", *Antitrust Law Journal*, 71(3): 719-800.

Wils, Wouter (2005) - "Is Criminalization of EU Competition Law the Answer?", in *Remedies and Sanctions in Competition Policy*, Kati Cseres, Maarten Pieter Schinkel and Floris Vogelaar, eds., Edward Elgar Publishing, London.