**Which Sanctions and Moral Costs Can Prevent the Formation of Cartels?**

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Béatrice Boulu-Reshef[1], Constance Monnier-Schlumberger[2]

**Abstract** Cartels result from the decision to engage in anti-competitive price-fixies conspiracies. This article investigates experimentally the effectiveness of several anti-cartel schemes with varying levels of financial costs onto the party that suffers from the cartel. The paper contributes to the literature on the impact of sanction schemes on cartel decisions by comparing the propensities to form cartels when individuals face only monetary sanctions schemes, or monetary sanctions schemes with leniency schemes, compliance schemes or exclusion schemes. The results show that monetary sanctions and leniency schemes are not the most effective tools to deter cartel formation. The probabilities of sanctions and the level of fines have the expected effects. The study evaluates the impact of the types of sanction schemes, with varying levels of monetary sanctions and varying probabilities of detection. The main results are that only compliance and exclusion schemes allow to lower the choice of cartel and cartel formation. Monetary sanctions and leniency do not lead to a substantial decrease in cartel choice and formation. In addition to the testing the relative effectiveness of these schemes, the paper tests the impact of the size of the moral cost of forming a cartel by varying in a between-subject design the levels of financial costs onto the consumer-type participant who cannot decide on whether or not a cartel is formed but occurs a loss in case a cartel is formed. The main results are that moral costs do not impact the choice of cartel and that only moving to a full loss for the consumer-type participant lead to a decrease in cartel formation. The results indicate that cartelists largely disregard moral costs of cartel choice and cartel formation. The study also identifies the impact of individual characteristics such as gender and risk aversion. In addition, gender and risk aversion influences the propensity to choose the decision to form a cartel as well as the rate of formation. The implications for the regulator and firms are substantial.

**Key words** Cartel, moral costs, experiment, sanctions, anti-trust policies.

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## 1. Introduction

Following the work of Gary Becker (1968), the economics of crime has been the main framework to analyze cartel practices. Such practices comprise typically, often through their managers, agreements over higher prices than those that would have prevailed with free competition. According to the Beckerian approach, a firm is encouraged to engage in cartel practices when the gain resulting from this illicit practice exceeds its expected cost, which typically is equal to the penalty multiplied by the probability of detection.

The law literature focuses on the choice of liability regimes for anti-competitive practices. In Europe, these regimes focus on legal entities that include companies and professional associations, involving low criminal sanctions for cartels (Vagner-von Papp 2016).

At the same time, the literature on corporate governance highlights the existence of a divergence of interests between shareholders and managers (Jensen and Meckling 1976): the unity of the objective of maximizing shareholder profit is opposed to the potential multiplicity of the managers' objectives, which may include their remunerations, careers and promotions, the possible reduction of the risk of bankruptcy, or the reduction of the risks of cartel detection, etc. This approach provides a new analytical framework that legitimizes the study of the behaviors and determinants of choice of individuals who engage in collusive practices. In addition to individual remuneration and sanctions, other factors, in particular psychological and behavioral factors, are likely to influence potential cartelists. The latter have received little attention, although largely they determine the effectiveness of anti-trust measures.

Thus, while approaches focused on legal persons neglect the question of individual determinants of engaging in cartels, the implementation of a behavioral approach to these practices aims to renew their analysis. An experimental approach will be used to better understand the behavior of individuals who engage in cartel practices and to assess its consequences on the effectiveness of antitrust devices.

To test the robustness of the results, the paper studies the effectiveness of the tested anti-cartel schemes by varying the levels of financial costs that is imposed onto the party that suffers from the cartel and that can neither choose nor punish the cartelists. The paper allows thus to test the moral costs of cartel formation.

This article summarizes the results of experiments that make it possible to carry out an experimental evaluation of anti-trust measures in a context in which several sanction schemes are reviewed. It focuses on a comparison of the most common mechanisms, such as monetary

sanctions, clemency, compliance and exclusion mechanisms (such as disqualification). In the first part, we will present our methodology and the literature related to our approach, then in the second part, our results and their implications.

## 2. Related literatures

Experimental studies have been carried out to better understand collusive mechanisms. Following in the footsteps of Plott (1982) and Holt (1995), Norman (2006) provides a synthesis of results from experiments on collusive behavior and its determinants. The latter focus mainly on the study of the effect of communication, price announcements and/or leniency on the formation and stability of anti-competitive practices, as well as on price levels.

First, the experiments focused on the effect of communication on market price setting. By allowing communication between players, Isaac et al (1984) found a significant effect of communication on prices. Davis and Holt (1998) obtain higher prices with communication but this increase is more limited when hidden discounts can be granted to buyers. More recently, Chowdhury et al. (2015) replicated this type of experiment but introduced a phase in which communication is no longer possible. They find that post-collusion prices are determined by a hysteresis effect involving a continuation of price increases after the call is completed.

With regard to the effect of sanctions and detection in cartel cases, Bigoni et al. (2012) show that fines have a significant deterrent effect, but also a pro-collusive effect to the extent that the existence of a competition policy is associated with an increase in cartel prices. Bigoni et al. (2015) test two levels of fine and probability of detection. They show that the size of the fine in itself plays a role in deterring cartels, regardless of the probability of detection. Finally, Chowdhury et al (2018) conducted an experiment involving two combinations of fines and detection probabilities. They obtain that in the absence of clemency, the probability of detection and the fine are substitutable. However, with leniency, a regime that combines low detection rates with high fines reduces the incidence of cartels.

Other experiences have focused more specifically on leniency programmes. Apesteguia et al (2006) find that in the presence of a leniency programme, prices appear significantly lower but that the rate of cartel formation remains high (50% cartels). In addition, 71% of these agreements are terminated. Hinloopen and Soetevent (2008) introduce a repeated version of Apesteguia et al's (2006) game and show that clemency reduces cartel formation.

Others devices such as reward devices were examined in experimental settings. Hamaguchi et al. (2009) find that rewarding the whistleblower helps to deter these practices. Bigoni et al.

(2012) finally develop a dynamic approach and shows that a reward system that can achieve a better deterrent than clemency.

The investigation of the impact of moral costs on cartel decisions remains sparse and mainly outside economics. The literature on business ethics examines the role of individuals and their traits as a key factor of corporate fraud. Zahra et al. (2005) developed a framework in which individual variables (age, experience, education, gender, and self-control) influence the likelihood of corporate fraud. There is ample evidence of the influence of personal traits of CEOs on corporate fraud. Cohen et al. (2011) analyze evidence from press articles covering corporate fraud cases and show that the personality traits of managers appear to be a major fraud-risk factor. Van Staveren (2013) reviews empirical literature about gender differences in behavioral, experimental and neuro-economics. She concludes that women tend to perform on average better than men under uncertainty and that their reasoning in complex situations is more contextual than men's. Such contextual reasoning involves ethical matter. Ramdani and Van Witteloostuijn (2012) show for instance that bribery is more likely to occur when the principal-owner is male rather than female.

This literature also focus on the ethical attitudes of individuals within the firm. Ashforth et al. (2008) explained that corruption has been attributed to individual predispositions, including lack of integrity (Frost and Rafilson, 1989), moral identity (Aquino and Reed, 2002; Reed and Aquino, 2003), self-control (Marcus and Schuler, 2004), and empathy (Eisenberg, 2000). Studies have depicted the CEO ethical profile as a factor at the origin of managerial fraud (Carson 2003; Chen 2010). Zona et al. (2013) show that a complex set of personal/ psychological attitudes of a CEO (e.g., lack of moral values, aspirations levels, narcissistic traits, charisma, and such) affect multiple domains of organizational conduct, including ethical and legal behaviors. Rijsenbilt and Commandeur (2012) find a positive relationship between plausible proxies for CEO narcissism and fraud which confirms the psychologic perspective of CEO narcissism as a cause of fraud. Zona et al. (2013) show that a complex set of personal/ psychological attitudes of a CEO (e.g., lack of moral values, aspirations levels, narcissistic traits, charisma, and such) affect multiple domains of organizational conduct, including ethical and legal behaviors.

As for the individual characteristics of managers who defraud form a cartel, the empirical literature has established a "composite picture" of the corporate fraudster: according to a recent PWC study (2016), it is generally a man, a graduate of higher education, of middle age (in his thirties or forties) and who already has 3 to 5 years' experience. Other studies show that women have a greater aversion to unethical behavior than men (see in particular: Robinson et al.[2000]). In particular, Alawi's (2014) econometric study shows that the presence of women in the management team significantly reduces the probability that a company will enter or

remain in a cartel, compared to a control group composed of similar companies that have not participated in a cartel. The experimental economics study by Hamaguchi & Alii (2009) concludes that women are more likely than men to end a cartel by denouncing them through a leniency program. Also, Beckmann and Menkhoff (2008), Eckel and Grossman (2008), Meier-Pesti and Penz (2008), Croson and Gneezy (2009) showed that women were more risk averse than men and that men and women would differ in their behavior in lottery situations, investment and financial risk-taking. In the area of illegal agreements, Alawi's (2014) work also shows that the presence of women in the management team reduces the probability that a company will enter or remain in a cartel. Finally, the experience of Hamaguchi et al (2009) shows that women are more likely than men to end the cartel by denouncing them.

Finally, in corporate fraud, risk aversion or risk appetite is likely to play a role in the choice of individuals. Tan and Yim (2014) show that being more risk averse decreases the propensity for tax evasion. Bernhardt and Rastad (2016) find that cartelists with high risk will collude less.

The experimental design and implementations are now presented.

## 3. The experiment

### 3.1. The objective of the study

The objective of our study is to conduct a global experimental study that will make it possible to compare the relative effectiveness of different anti-trust devices, as well as to identify some individual characteristics on the incentive to form a cartel.

On the one hand, the experiments will aim to study the effect of levels of sanctions and probability of detection on collusion behavior. The aim is to plan experiments with a higher probability of detection and fines.

On the other hand, the nature of the sanctions envisaged in the previous studies consists exclusively of a monetary fine. In reality, in addition to fines, sanctions can take the form of criminal sanctions, such as disqualification. Disciplinary sanctions such as dismissal could also be used. Finally, other mechanisms are likely to influence managers' choice in terms of compliance with competition law, in particular compliance programs, whose influence has not yet been tested in a laboratory.

Our protocol thus includes other types of sanctions, including a temporary exclusion (on a decision). In fact, exclusion following the detection of a cartel makes it possible to simulate sanctions such as temporary incapacitation sentences. The effect of compliance programs on

encouraging individuals to reach agreement can be assessed from a treatment that includes increased surveillance of individuals (involving a forced choice on a decision).

In addition, the experimental framework makes it possible to analyze the individual characteristics of cartelists that are likely to influence cartel formation. In this respect, two behavioral aspects are investigated: aversion or taste for risk and gender.

Finally, the robustness of the results on impact of moral costs is investigated. This introduction of varying moral costs allows to both check the robustness of the results on sanction schemes, probabilities as well as fine levels, but to also investigate the impact of

### 3.2. The protocol

These experiments were carried out at the experimental economics laboratory of the University of Paris 1 (LEEP). Participants were drawn from the database of volunteer participants in experimental experiments. They were paid 6 euros for their participation, then their additional remuneration varies according to their decisions and the decisions of the participants in their group. In total, they earned on average 16.78 euros with a standard deviation of 1.34. All decisions are anonymous. Sessions lasted about 1 hour and 15 minutes.

Participants interacted in a group of three individuals composed of two Type 1 participants and one Type 2 participant. The roles were fixed for the whole experiment. Type 1 participants had to choose between a decision that resulted in a 10 experimental unit earning (Decision A) or a decision that resulted in a 20 experimental unit earning (Decision B) if both participants chose it. Decision A corresponded to a competitive strategy. Decision B corresponded to a strategy of agreement between the two Type 1 participants. In the instructions, the word cartel is avoided and the word agreement is used.

Type 2 participants answered a questionnaire on their preferences over competitive policies and they were informed of their surpluses. The simultaneous choice of decision B increased the profit of Type 1 participants and reduced the surplus of Type 2 participants. If both Type 1 participants chose Decision A, the earnings of Type 1 participants were 10 and the earnings of the Type 2 participant were 10. If one of the Type 1 participants chose Decision A and the other chose Decision B, the earnings of Type 1 participants were 10 and the earnings of Type 2 participants is 10. If both Type 1 participants choose Decision B, the earnings of Type 1 participants is 20 and the remuneration of the Type 2 participant is 7.

This agreement may be sanctioned if detected and an agreement can only be detected during the period in which the agreement is formed.

Decisions are made in environments that are characterized by a probability of detection and a fine. Decisions are taken within four sanctions frameworks. The Monetary Sanctions sanction framework (called "Basic" in the instructions), in case of detection, implies a monetary sanction only. The Compliance sanction framework (called "Basic + Compliance" in the instructions), in case of detection, implies a monetary sanction. In addition, Decision B is no longer available for the period following detection.

The Exclusion box (called "Basic + Exclusion" in the instructions), in case of detection, implies a monetary penalty. In addition, the ability to make a decision is no longer available for the period following detection: the participant is excluded from the experience for a period of time. The Clemency framework (called "Basic + Clemency" in the instructions) in case of detection, implies a monetary sanction. In addition, he gives Type 1 participants the following option: if only one of the two Type 1 participants terminates the agreement, his fine is cancelled and if both Type 1 participants terminate the agreement, the fastest participant has his fine cancelled. The other Type 1 participant, on the other hand, must pay his fine.

There are a total of 96 decisions for each Type 1 participant, in two probability regimes (1/3 or 2/3 and 1/10 or 9/10, presented in reverse order in the sessions to control order effects); and 3 possible types of monetary sanctions (5, 10 or 15). For the same environment, Type 1 participants will make two successive decisions. At the time of the first decision, they know the environment in which possible sanctions of the Compliance and Exclusion type will be imposed. At the time of the second decision, they do not know the environment in which possible sanctions of the Compliance and Exclusion type will take place.

In total 288 individuals participated in the experiments, 192 participants held Type 1 participant positions and 96 participants held Type 2 participant positions. They were assigned to four different in-between treatments, which varied the cost onto Type 2 participants. These costs were null (0), low (3), high (7) or full (10).

The following section reviews the results.

## 4. Results

### 4.1. The effect of sanction schemes

Our experiments have allowed to study and compare the relative effectiveness of different sanctions and detection frameworks implemented by competition authorities. The exclusion policy, which corresponds to a penalty such as a penalty of temporary incapacitation or dismissal, is the most dissuasive sanction mechanism, both in terms of individual choice and the proportion of cartels formed.

Thus, while the rates of choice and cartel formation under monetary sanctions are 62% and 47.3% respectively, the latter are reduced to 42.3% and 27.8% under the exclusionary framework. The difference between the rates of choice and formation of cartels in a simple monetary sanction framework and in an exclusionary framework is very statistically significant.

Similarly, the compliance policy makes it possible to substantially reduce the rate of choice and formation of cartels (around 50 and 40% respectively). However, exclusion is more of a deterrent than compliance (very statistically significant difference).

However, the reduction in the proportion of cartel choices and their formation in these two sanctions frameworks could be explained in part by a mechanical effect, since individuals excluded or subject to increased post-detection surveillance no longer have the possibility of forming a cartel in the following period (which automatically reduces the number of cartel and trained cartel choices).

On the other hand, with regard to compliance, excluding cases where individuals could not choose the cartel option, the difference in the results with those obtained under simple monetary sanctions is no longer significant. The rates of cartel choice and formation are close to those observed in a basic framework, when only those cases are taken into account in which individuals actually had a choice between respecting the competitive option or reaching an illegal agreement. The effectiveness of compliance is thus more a matter of ex-post monitoring than ex-ante deterrence, unlike exclusion.

However, our protocol formalizes a compliance program in the form of full monitoring of individuals over a period of time. In reality, the effectiveness of these programmes can be qualified according to their actual modalities (see Combe and Monnier 2016 for a summary). Finally, they involve monitoring costs that may act as a disincentive for the company and/or the regulator. These costs were not included in the experiment.

As far as leniency is concerned, our results show that this mechanism is of limited

effectiveness in terms of deterring cartels. Thus, the possibility of denouncing the cartel and obtaining immunity is associated with training rates and a proportion of cartel choices that do not differ significantly from those observed under basic sanctions. On the other hand, in our experiments this device has proven to be effective in terms of detection. It makes it possible to increase the detection of cartels, and thus to reduce its cost.

| Treatment | Baseline | Leniency | Compliance | Exclusion | Total |
|---|---|---|---|---|---|
| *Choice of cartel* | | | | | |
| Choice A (No cartel) | 1,753 | 1,592 | 2,233 | 2,659 | 8,237 |
| Choice B (Cartel) | 2,855 | 3,016 | 2,375 | 1,949 | 10,195 |
| Total | 4,608 | 4,608 | 4,608 | 4,608 | 18,432 |
| Mean of Choice B | 62% | 65.5% | 51.5% | 42.3% | 55.3% |
| *Cartel formation* | | | | | |
| No cartel | 2,428 | 2,304 | 2,780 | 3,326 | 10,838 |
| Cartel | 2,180 | 2,304 | 1,828 | 1,282 | 7,594 |
| Mean of cartel | 47.3% | 50% | 39.7% | 27.8% | 41.2% |

### 4.2. The effect of fines

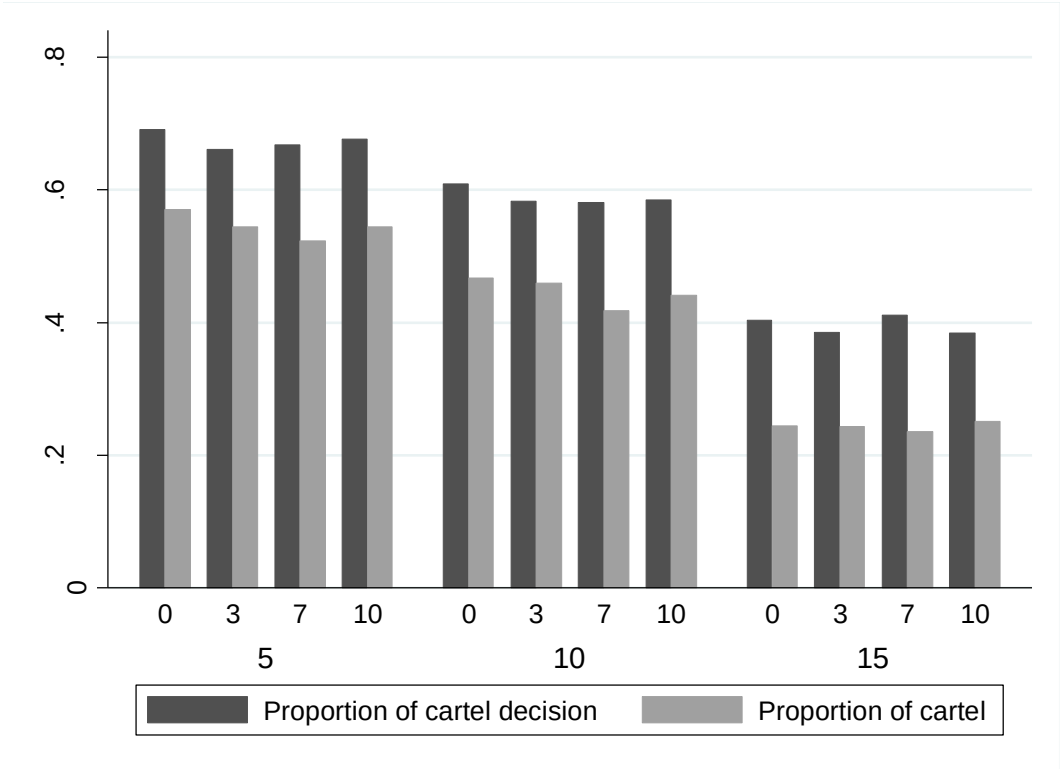


**Figure 2 Propensity of cartel behavior by fine (5, 10, 15) and by moral cost (0, 3, 7, 10)**

| Baseline | Leniency | Compliance | Exclusion |
|---|---|---|---|

| | | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation |
|---|---|---|---|---|---|---|---|---|---|
| Combined | 5 vs 10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| | 10 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 5 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| No cost (0) | 5 vs 10 | 0.045 | 0.003 | 0.000 | 0.001 | 0.269 | 0.061 | 0.001 | 0.001 |
| | 10 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 5 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Low cost (3) | 5 vs 10 | 0.082 | 0.108 | 0.002 | 0.000 | 0.121 | 0.043 | 0.007 | 0.012 |
| | 10 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 5 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| High cost (7) | 5 vs 10 | 0.002 | 0.000 | 0.000 | 0.000 | 0.214 | 0.246 | 0.014 | 0.018 |
| | 10 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.021 | 0.005 |
| | 5 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Full cost (10) | 5 vs 10 | 0.125 | 0.148 | 0.001 | 0.000 | 0.027 | 0.009 | 0.000 | 0.000 |
| | 10 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 5 vs 15 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Figure 2 Comparision of propensity of cartel behavior by fine (5, 10, 15) and by moral cost (0, 3, 7, 10)**

Higher fines are associated with a lower propensity to engage in cartel activity in all sanction frameworks. The proportion of cartels formed is also reduced by the increase in fines. In the basic framework of monetary sanctions, if the fine is 5, more than 70% of individuals choose the cartel option and the proportion of cartels trained rises to nearly 60%. With a fine of 15, these proportions are reduced to 40% respectively. These rates of choice and trained cartels are found to be the lowest in the context of exclusion. For a fine of 15, the rate of choice and formation of cartels is reduced.

The deterrent effect of the penalty is greater when it is increased from 10 to 15 (maximum fine level). The difference in the choices of individuals and agreements reached in cases where the fine is 10 and those where it is 15 is very significant (see Table 2). This is also the case when comparing the increase in the fine from 5 to 15. By multiplying the amount of the fine by three, the proportion of cartels formed can be reduced by half. Thus, individuals react more strongly when the sanction exceeds the illicit overprofit of the (which is equal to 10). Our results thus argue in favour of severe fines, which exceed the overprofit achieved under the cartel.

Finally, it can be noted that the relative effect of fines is substantial in the case of leniency: the tripling of the amount of the fine is associated with an even greater reduction in the proportion of cartels formed. In this sanction framework, the difference in the choices and formation rate of agreements for a sanction of 5 and 10 even becomes significant (see Table 2). Clemency therefore increases the deterrent effectiveness of fines (which is similar to the results

obtained by Chowdhury et al. (2018).

### 4.3. The effect of detection probability

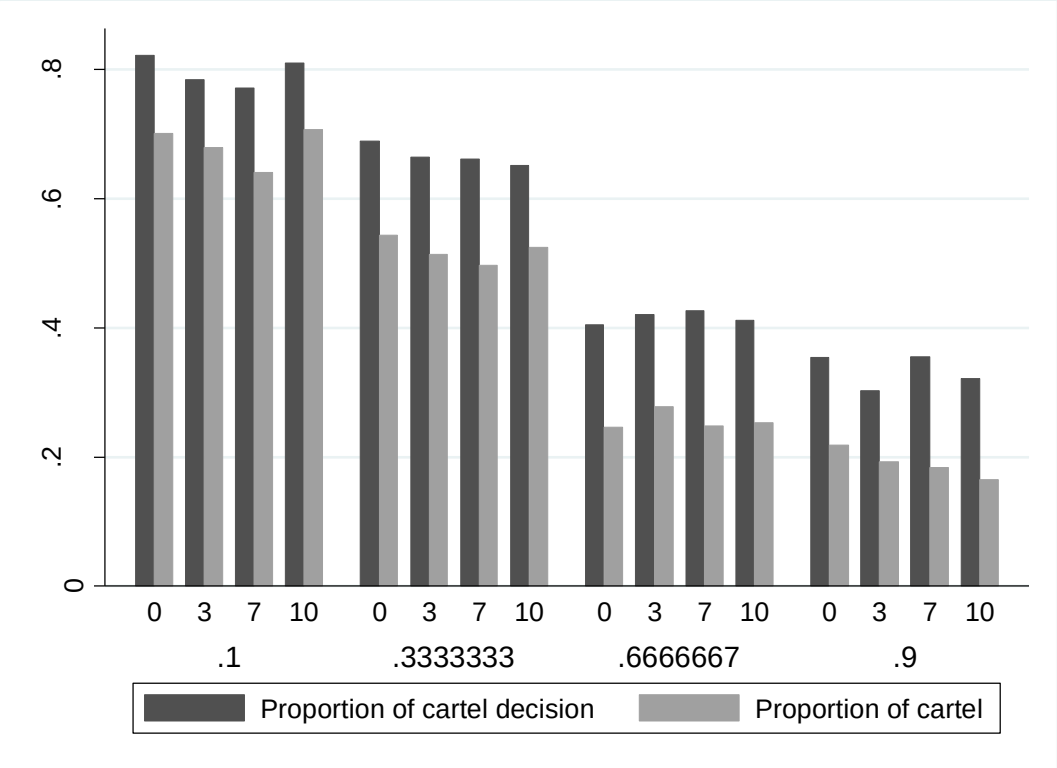


**Figure 3 Propensity of cartel behavior by probability of detection and moral costs**

| | | All data | | Baseline | | Leniency | | Compliance | | Exclusion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation |
| Combined | 1/3 vs 2/3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 1/10 vs 9/10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| No cost (0) | 1/3 vs 2/3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 1/10 vs 9/10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Low cost (3) | 1/3 vs 2/3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 1/10 vs 9/10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| High cost (7) | 1/3 vs 2/3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/10 vs 9/10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Full cost (10) | 1/3 vs 2/3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 1/10 vs 9/10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Table 3 Comparision of propensity of cartel behavior by probability of detection and moral costs**

Higher probabilities of detection are associated with lower cartel choice and formation propensities. In particular, the change from a probability of one third to two thirds, as well as between one tenth and nine tenths, implies a very significant difference in the decisions of individuals in all treatments. On the other hand, the difference between the results obtained when one moves from a probability of one tenth to one third no longer becomes significant in terms of cartel choices in the basic framework (see Table 3). When the probability of detection is high, the difference in the results between a probability of two thirds and nine tenths is significant, except for the rate of training in the basic framework. In addition, it is noted that exclusion is the sanction framework for which the deterrent effect of detection is highest, particularly for high probabilities.

It should be noted that when the probability of detection is very low, the rate of choice and formation of cartels is not significantly different between the sanctions frameworks, with the notable exception of exclusion (see Table 4). Thus, exclusion is the only framework to deter cartels when the probability of detection is very low (with a probability of one tenth, in the basic framework, the rate of choice of cartel and training is about 80%.

### 4.4. The effect of moral costs

The effect of moral costs are reported in Table 4, Table 5 and Table 6 and in Figure 4. The main results are that are that moral costs do not impact the choice of cartel and that only moving to a full loss for the consumer-type participant lead to a decrease in cartel formation. The results indicate that cartelists largely disregard moral costs of cartel choice and cartel formation.

| Treatment | | Baseline | Leniency | Compliance | Exclusion | Total |
|---|---|---|---|---|---|---|
| *Choice of cartel* | No cost (0) | 65% | 66% | 53% | 43% | 57% |
| | Low cost (3) | 62% | 64% | 52% | 39% | 54% |
| | High cost (7) | 63% | 66% | 50% | 42% | 55% |
| | Full cost (10) | 58% | 66% | 51% | 45% | 55% |
| *Cartel formation* | No cost (0) | 50% | 51% | 40% | 30% | 43% |
| | Low cost (3) | 49% | 51% | 41% | 26% | 42% |
| | High cost (7) | 46% | 47% | 38% | 26% | 39% |
| | Full cost (10) | 44% | 51% | 40% | 30% | 41% |

**Table 4 Cartel behavior by sanction scheme and moral cost**

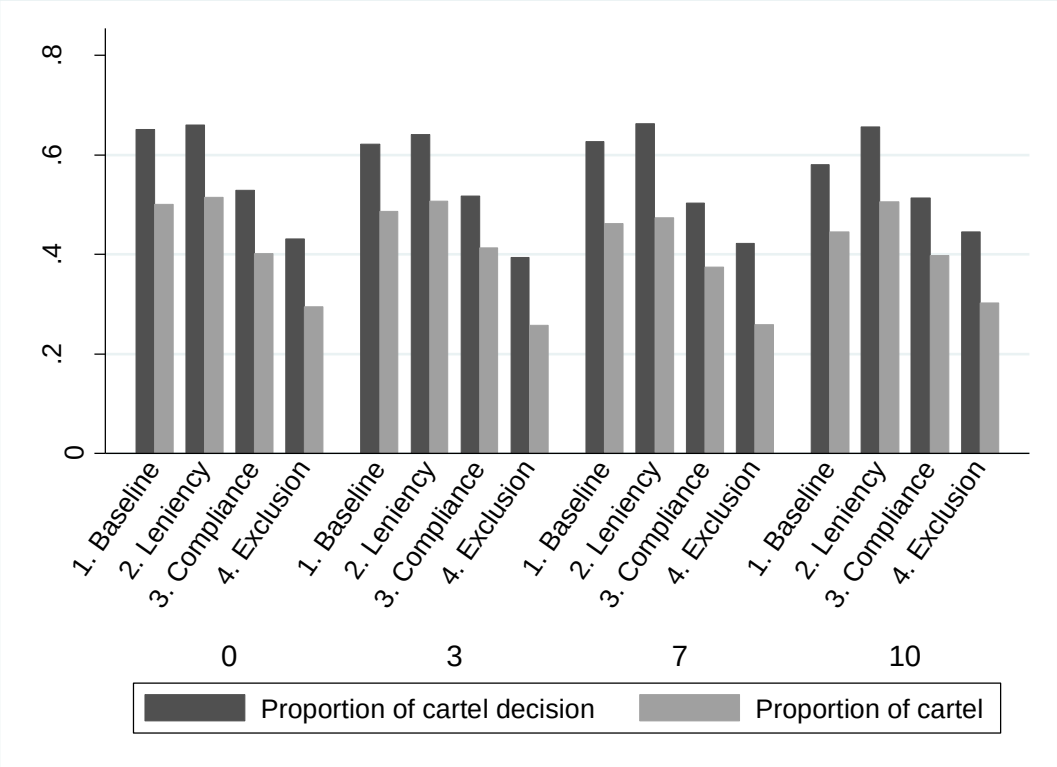


**Figure 4 Cartel behavior by sanction scheme and moral costs**

| Comparaison traitement | Decision | Combined | No cost (0) | Low cost (3) | High cost (7) | Full cost (10) |
|---|---|---|---|---|---|---|
| All data | | | | | | |
| Baseline vs Leniency | Choice | 0.000 | 0.661 | 0.321 | 0.074 | 0.000 |
| | Cartel formation | 0.010 | 0.505 | 0.317 | 0.559 | 0.003 |
| Baseline vs Compliance | Choice | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| | Cartel formation | 0.000 | 0.000 | 0.000 | 0.000 | 0.023 |
| Baseline vs Exclusion | Choice | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | Cartel formation | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Compliance vs Exclusion | Choice | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| | Cartel formation | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Individual averages | | | | | | |

| | | Combined | No cost (0) | Low cost (3) | High cost (7) | Full cost (10) |
|---|---|---|---|---|---|---|
| Baseline vs Leniency | Choice | 0.661 | 0.681 | 0.481 | 0.152 | 0.189 |
| | Cartel formation | 0.505 | 0.127 | 0.016 | 0.028 | 0.031 |
| Baseline vs Compliance | Choice | 0.000 | 0.112 | 0.153 | 0.048 | 0.417 |
| | Cartel formation | 0.000 | 0.001 | 0.000 | 0.005 | 0.016 |
| Baseline vs Exclusion | Choice | 0.000 | 0.007 | 0.022 | 0.007 | 0.049 |
| | Cartel formation | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 |
| Compliance vs Exclusion | Choice | 0.000 | 0.361 | 0.053 | 0.000 | 0.258 |
| | Cartel formation | 0.000 | 0.000 | 0.000 | 0.023 | 0.003 |

**Table 5 Comparison of Cartel behavior by sanction scheme and moral costs**

| | All data | | Baseline | | Leniency | | Compliance | | Exclusion | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation | Choice | Cartel formation |
| *All data* | | | | | | | | | | |
| No cost (0) vs low cost (3) | 0.018 | 0.255 | 0.130 | 0.505 | 0.337 | 0.739 | 0.559 | 0.553 | 0.075 | 0.040 |
| No cost (0) vs medium cost (7) | 0.179 | 0.001 | 0.225 | 0.067 | 0.895 | 0.055 | 0.227 | 0.200 | 0.674 | 0.051 |
| No cost (0) vs full cost (10) | 0.065 | 0.140 | 0.000 | 0.008 | 0.826 | 0.677 | 0.453 | 0.865 | 0.475 | 0.716 |
| Low cost (3) vs medium cost (7) | 0.305 | 0.022 | 0.763 | 0.243 | 0.274 | 0.113 | 0.532 | 0.061 | 0.175 | 0.924 |
| Low cost (3) vs full cost (10) | 0.601 | 0.735 | 0.046 | 0.045 | 0.458 | 0.934 | 0.868 | 0.647 | 0.013 | 0.016 |
| Medium cost (7) vs full cost (10) | 0.615 | 0.051 | 0.021 | 0.403 | 0.725 | 0.134 | 0.647 | 0.266 | 0.256 | 0.020 |
| *Individual averages* | | | | | | | | | | |
| No cost (0) vs low cost (3) | 0.462 | 0.001 | 0.577 | 0.165 | 0.850 | 0.000 | 0.410 | 0.001 | 0.551 | 0.038 |
| No cost (0) vs medium cost (7) | 0.301 | 0.035 | 0.657 | 0.030 | 0.912 | 0.017 | 0.370 | 0.018 | 0.460 | 0.009 |
| No cost (0) vs full cost (10) | 0.383 | 0.010 | 0.381 | 0.004 | 0.591 | 0.053 | 0.323 | 0.257 | 0.703 | 0.004 |
| Low cost (3) vs medium cost (7) | 0.119 | 0.063 | 0.237 | 0.112 | 0.753 | 0.114 | 0.648 | 0.104 | 0.259 | 0.006 |
| Low cost (3) vs full cost (10) | 0.313 | 0.022 | 0.338 | 0.364 | 0.151 | 0.000 | 0.871 | 0.062 | 0.185 | 0.079 |
| Medium cost (7) vs full cost (10) | 0.279 | 0.035 | 0.764 | 0.029 | 0.395 | 0.116 | 0.705 | 0.141 | 0.622 | 0.000 |

**Table 6 Comparison of Cartel behavior by sanction scheme and moral costs**

## 5. Conclusion

The analysis in an experimental framework of the effectiveness of the framework of sanctions imposed on individuals who engage their companies in illegal cartels makes it possible to identify the conditions for the effectiveness of competition policy.

First, it appears that high fines have a higher deterrent effect. Our results argue for severe fines, which exceed the overprofit achieved under the cartel, the results showing the existence of a threshold effect.

In addition, our results show that fines have a greater deterrent effect in a lenient environment. In such cases, leniency policies, which as such do not deter cartels but facilitate their detection, should be combined with high fines.

At the same time, deterrence is facilitated when the risk of detection is not too low. The latter must be perceived by individuals so that the sanctions framework can play a role. Competition authorities must therefore make a minimum detection effort, while maintaining high fines.

Above all, our work shows that if compliance proves to be a mechanism whose relevance can be discussed, a framework of sanctions providing for exclusion, even temporary, is most effective in this comparison framework. Exclusion is a sanction framework that is therefore more effective in deterring cartels, particularly among individuals at risk.

The benefits associated with disability sentences have been highlighted in the literature, as they have a significant stigmatizing effect (Hammond [2010]). Moreover, these types of sanctions are better accepted by the general public (Stephan [2015]) than prison sentences. In order to dissuade individuals from engaging in collusive practices, other solutions exist, in particular the one that consists in granting a reward to individuals who denounce an agreement to the competition authorities. Such a reward system was introduced in South Korea in 2002 to combat cartels. We have not included this case in our experiments, but it would be appropriate in the future to test the effectiveness of this device in an experimental setting.

Finally, with regard to the individual characteristics of individuals who engage in cartel practices, it appears that some individuals are less sensitive to the values of detection and sanction parameters (those who have a taste for risk). This raises the question of the identification of these individuals. In addition, our results confirm that women have a more limited propensity to get along illegally than men.

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## Appendix – Effect of individual characteristics

In terms of risk preference, Figure A1 reports that higher risk aversion is associated with a lower propensity to choose the cartel decision.

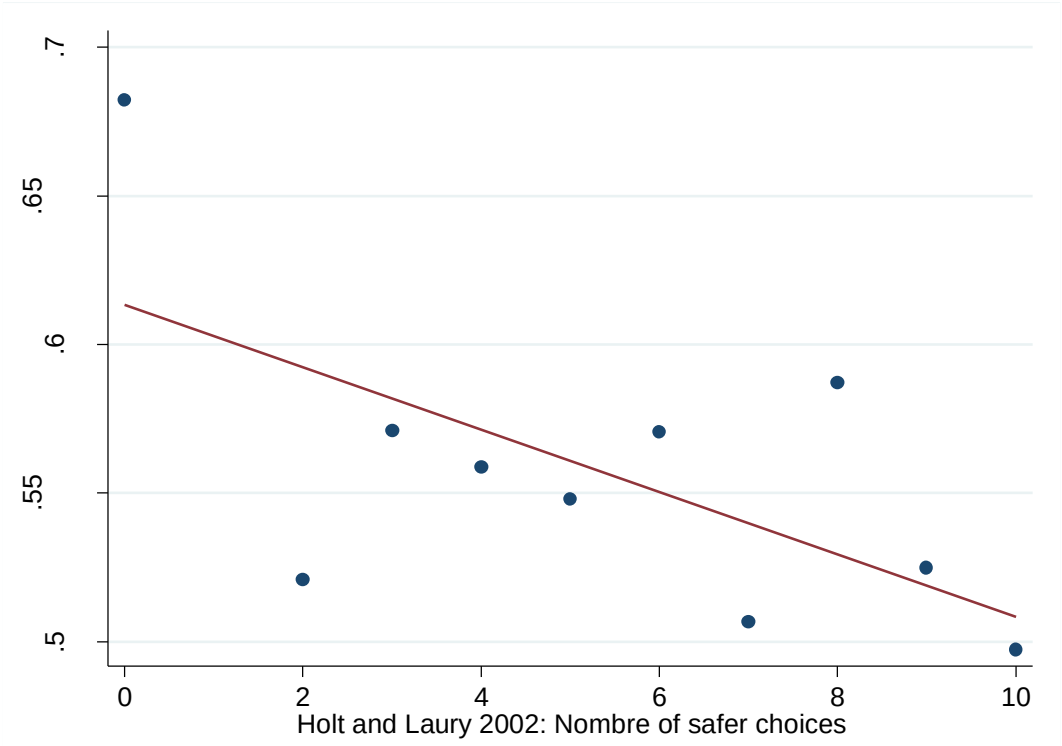


**Figure A1 Proportion of cartel decisions over number of safe choices in a Holt and Laury 2002**

With regard to gender, it appears that the propensity to choose the decision to get along illegally is higher among men than women, and this is very significant (p-value = 0.000). Their propensity to form cartels is also statistically lower than men's propensity (p-value = 0.000).