Compliance with cartel laws and the determinants of deterrence – an empirical investigation

Rob van der Noll & Barbara Baarsma

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Rob van der Noll[a,b] and Barbara Baarsma[c,d]

[a]Senior Researcher, SEO Amsterdam Economics, Amsterdam, The Netherlands; [b]Economist at the Netherlands Authority for Consumer and Markets (ACM), The Hague, The Netherlands; [c]Managing Director, SEO Amsterdam Economics, Amsterdam, The Netherlands; [d]Professor of Market Forces and Competition Issues at the Faculty of Economics and Business, University of Amsterdam, Amsterdam, The Netherlands

ABSTRACT
This paper empirically investigates the drivers of compliance to cartel law and deterrence properties of enforcement tools with conjoint firm-level online survey data from the Netherlands. Compliance is measured by a response to varying hypothetical cartel scenarios. Respondents were asked to indicate the likelihood on a scale from 1 (lowest) to 10 (highest) that they would end a cartel that they discovered within their organization. The personal fine for the manager and the fine for the company have a statistically significant deterrent effect. Firm size, publicity following an infringement and the leniency program have no significant effect on compliance. For the most deterring scenario, the probability of a fully compliant outcome (defined as likelihood equal to 10) is estimated at .68. Self-reported knowledge of cartel law, having a compliance officer and the habit to consult a lawyer on competition law matters are statistically significant drivers of compliance.

I. Introduction

This paper empirically investigates the drivers of compliance to cartel law and the deterrence properties of enforcement tools with conjoint firm-level online survey data from the Netherlands. The main reason for governments to introduce and enforce anti-cartel laws is to deter firms from participating in socially detrimental cartels. By punishing firms and managers, authorities seek to decrease the incentive for recidivism of the actors involved and discourage other firms to engage in illegal behaviour. Wils

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CONTACT Barbara Baarsma ✉ b.e.baarsma@uva.nl

discusses the role of fines and the perceived probability of detection in various conceptual traditions.[1] The basic logic of deterrence originates from Becker[2] and assumes that a crime is not committed when the expected loss exceeds the expected gain of the violation. In the balancing of costs and benefits, the nominal fine has to be discounted by the probability that a fine is effectively imposed.[3] Heimler and Mehta work out optimal ranges of fines for use by competition authorities using this logic.[4] Harding critically discusses the arguments and evidence for cartel deterrence and summarizes the methodological complexities.[5] He notes that "it remains far from clear what amounts to effective deterrence … , or indeed how deterrence may be measured. A major problem resides in the fact that, while the rhetoric [of deterrence] is strong, it remains inexact".[6] The Chicago school idea that businesses are informed and respond rationally and calculating to sanctions (giving rise to theories of "optimal deterrence") is also contested by Christine Parker, who examines the knowledge business people have about the law, its sanctions and their beliefs about the relevance of cartel law to themselves.[7]

It thus emerges that deterrence is part of the larger picture of compliance. Both concepts need to be studied in more detail and in relation to each other, taking into account behavioural and psychological aspects. This paper does so by empirically studying the links between a manager's knowledge, compliance resources and the parameters of enforcement. Our paper does not adhere to any particular school of thought, but measures the behavioural reactions of managers. Specifically, the paper investigates whether knowledge and compliance resources of firms affect their compliance with the cartel prohibition. The conjoint assignment differed with respect to the probability of detection and the loss after detection. The paper therefore contributes to understanding the role of fines and managers' perceived probability of detection.

The empirical methods used to test deterrence vary greatly and the results obtained are mixed. Empirical studies can be divided between

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[1] Wouter Wils, 'Optimal Antitrust Fines: Theory and Practice' (2006) 29(2) *World Competition* 183.

[2] Gary Becker, 'Crime and Punishment: An Economic Approach' (1968) 76(2) *Journal of Political Economy* 169.

[3] There is a difference between the deterrence approach and the internalization approach, where in the latter approach, the fine should be set at a level such that only the "inefficient violations" are being deterred. See Wils (n 1).

[4] Alberto Heimler and Kirtikumar Mehta, 'Violations of Antitrust Provisions: The Optimal Level of Fines for Achieving Deterrence' (2012) 35(1) *World Competition* 103.

[5] Christopher Harding, 'Cartel Deterrence: The Search for Evidence and Argument' (2011) 56(2) *The Antitrust Bulletin* 345.

[6] ibid 347.

[7] Christine Parker, 'The War on Cartels and the Social Meaning of Deterrence' (2013) 7 *Regulation & Governance* 174.

studies using surveys[8] and studies using other methods. Veljanovski critically assesses the survey results that are used by the U.K. Office of Fair Trading (OFT) to claim that their enforcement produces a significant deterrent effect.[9] He finds that the survey, which asked respondents about the rate of abandonment of anti-competitive plans, is methodologically flawed and the results not robust. Also, there are papers that did not find evidence that enforcing cartel legislation deters firms from illegal conduct.[10] Some of these papers discuss the effectiveness of competition policy more generally. Schildberg-Hörisch and Strassmair conducted an experiment in which they found that the deterrent effect does not increase when sanctions increase.[11] The experiment was, however, not a cartel context. Bos and others develop a theoretical argument that provides a link between the cartel overcharge and the deterrence hypothesis. Using historical data on legal cartels to approximate undetected cartels, their results support the deterrence hypothesis.[12] Other papers find a positive deterrent effect of competition policy as a whole.[13] Some papers measure in detail the deterrent effect of distinct enforcement tools.[14]

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[8]Barbara Baarsma and others, 'Let's Not Stick Together: Anticipation of Cartel and Merger Control in the Netherlands' (2012) 160(4) *De Economist* 357. Allan Beckenstein and Landis Gabel, 'Antitrust Compliance: Results of a Survey of Legal Opinion' (1983) October, *Antitrust Law Journal* 459. Robert Feinberg, 'The Enforcement and Effects of European Competition Policy: Results of a Survey of Legal Opinion' (1985) 23(4) *Journal of Common Market Studies* 373. Fiammetta Gordon and David Squires, 'The Deterrent Effect of UK Competition Enforcement' (2008) 156(4) *De Economist* 411. Kai Hüschelrath, Nina Leheyda and Patrick Beschorner, 'The Deterrent Effect of Antitrust Sanctions: Evidence from Switzerland' (2011) 56(2) *Antitrust Bulletin* 427. Christine Parker and Vibeke Lehmann Nielsen, 'The ACCC Enforcement and Compliance Survey: Report of Preliminary Findings' (2005) University of Melbourne Legal Studies Research Paper, No. 150, ANU Centre for Competition and Consumer Policy Working Paper.

[9]Cento Veljanovski, 'A Statistical Analysis of U.K. Antitrust Enforcement' (2014) 10(3) *Journal of Competition Law and Economics* 711.

[10]Robert Crandal and Clifford Winston, 'Does Antitrust Policy Improve Consumer Welfare? Assessing the Evidence' (2003) 17(4) *Journal of Economic Perspectives* 3. Josef Konings, Patrick van Cayseele and Frederic Warzynski, 'The Dynamics of Industrial Mark-Ups in Two Small Open Economies; Does National Competition Policy Matter?' (2001) 19 *International Journal of Industrial Organization* 841.

[11]Hannah Schildberg-Hörisch and Christina Strassmair, 'An Experimental Test of the Deterrence Hypothesis' (2012) 28(3) *Journal of Law, Economics, and Organization* 447.

[12]Iwan Bos, Stephen Davies, Joseph E. Harrington Jr. and Peter L. Ormosi, 'Does Enforcement Deter Cartels? A Tale of Two Tails' (1 March 2017).

[13]Michael Kent Block, Frederick Carl Nold and Joseph Gregory Sidak, 'The Deterrent Effect of Antitrust Enforcement' (1981) 89(3) *Journal of Political Economy* 429. Paolo Buccirossi and others, 'Competition Policy and Productivity Growth: An Empirical Assessment' (2013) 95(4) *The Review of Economics and Statistics* 1324. Julian Clarke and Simon Evenett, 'The Deterrent Effects of National Anti-cartel Laws: Evidence from the International Vitamins Cartel' (2003) Fall, Antitrust Bullentin 689. Robert Feinberg, 'Strategic and Deterrent Pricing Responses to Antitrust Investigations' (1984) 2(1) *International Journal of Industrial Organizations* 75. Keith Hylton and Fei Deng, 'Antitrust Around the World: An Empirical Analysis of the Scope of Competition Laws and Their Effects' (2007) 74 *Antitrust Law Journal* 271. Nathan Miller, 'Strategic Leniency and Cartel Control' (2009) 99(3) *American Economic Review* 750.

[14]Vasiliki Bageri, Yannis Katsoulacos and Giancarlo Spagnolo, 'The Distortive Effects of Antitrust Fines Based on Revenue' (2013) 123 (November) *The Economic Journal* F545. Allan Beckenstein and Landis Gabel, 'The Economics of Antitrust Compliance' (1986) 52(January) *Southern Economic Journal* 673. Maria Bigoni and others, 'Trust, Leniency and Deterrence' (5 January 2014) SSRN: <http://ssrn.com/abstract=2469778>. Joseph Harrington, 'Penalties and the Deterrence of Unlawful Collusion' (2014)

Most of these studies find a positive effect for the level of the fine on deterrence, but the debate remains unsettled.

This paper empirically estimates the deterrent effect of enforcement tools and the drivers of compliance, based on conjoint survey data gathered in the Netherlands.[15] The advantage of our method compared to a direct way of questioning (i.e. would you abandon this cartel?) is that it minimizes the distortions that are usually associated with surveys, such as social bias, strategic bias and cognitive burden. Our method is therefore fundamentally different from the measurement of abandonment rates, as discussed by Veljanovski and Harding as well as from the earlier study for the OFT which merely uses direct questions and asks for opinions on statements on the cartel prohibition.[16] As explained by Hildebrand in the context of market definition, conjoint analysis is an empirical method which is widely applied in market research.[17] At its core is modelling a choice problem, based on hypothetical scenarios (vignettes).[18] One of the advantages of conjoint analysis is that it can analyse the "trade-offs" between various desirable alternatives or "attributes" of a product or service. These "trade-offs" resemble real-life situations better than a direct way of questioning. The "trade-offs" can usually not be disentangled with other methods. In the context of cartel control, the use of conjoint analysis makes it possible to work out the effects of various enforcement tools that are usually simultaneously at work.

Most papers rely on the assumption that firms find the cartel law clear and therefore know whether their behaviour is illegal or not, which allows firms to rationally decide whether to enter into a cartel. However, it is likely that not all firms understand the cartel prohibition. Parker surveyed 567 Australian business people.[19] Their understanding differed greatly regarding the illegality of participating in cartels and its associated punishments. Our survey data have information on what managers of firms know and think about competition law and its enforcement by the

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124 *Economics Letters* 33. Yannis Katsoulacos and David Ulph, 'Antitrust Penalties and the Implications of Empirical Evidence on Cartel Overcharges' (2013) 123 *The Economic Journal* F558. Eleanor Morgan, 'Controlling Cartels – Implications of the EU Policy Reforms' (2009) 27 *European Management Journal* 1. Jeremy West, 'Are We Winning the Fight Against Cartels?' (2012) February (2) *Competition Policy International, Antitrust Chronicle* 1.

[15] The paper measures general deterrence rather than specific deterrence. This follows directly from the empirical method: respondents answer questions about hypothetical scenarios in which no reference is made to earlier conduct.

[16] Gordon and Squires (n 8).

[17] Doris Hildebrand, 'Using Conjoint Analysis for Market Definition: Application of Modern Market Research Tools to Implement the Hypothetical Monopolist Test' (2006) 29(2) *World Competition* 315.

[18] ibid 328.

[19] Parker (n 7).

Dutch competition authority ACM. These data are used to explain the level of compliance.

The survey data used in this paper are part of a larger dataset also containing regular (non-conjoint) survey questions. The results of the regular survey questions are published in Baarsma and others.[20] The main conclusions are that almost a third of the managers do not find it clear when the Netherlands competition authority ACM considers agreements[21] to be prohibited. The survey asked also about firms' compliance resources and strategies. Interestingly, 21% of firms reported to use an external adviser for competition enforcement matters that was different from a lawyer (namely accountant, bank, consultant or other). Managers were asked how often they had taken competition law enforcement into account when attending meetings, contacting other companies, drafting contracts, setting prices and commercial strategies and in other situations. On average, firms had taken enforcement 14 times into account over a period of 5 years. For 52% of firms, competition law enforcement was taken into account at least once per year. Ideally, agreements should only be deterred by competition law if they are anti-competitive.[22] Respondents were asked how often, in their opinion, cartel control deters practices that are in fact not anti-competitive. About 22% of the surveyed managers believe this so-called business chilling occurs often.

The current paper is the first journal publication using the conjoint data in the dataset. Moreover, we use a novel econometric specification. The paper is structured as follows. Section II describes the data and method used for the empirical study. Section III provides descriptive statistics on compliance and firm characteristics. Section IV empirically investigates the drivers of compliance and the deterrence of enforcement tools. Section V discusses our results and provides policy implications.

II. Data and method

A. Data

This paper uses survey data that were randomly collected from firms and competition advisers in the Netherlands in 2010. The collection of this

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[20]Baarsma and others (n 8).

[21]The cartel prohibition refers to agreements as well as conducts. In this paper, we often speak of agreements only.

[22]The economist's perspective is to look at social welfare. See eg Paolo Buccirossi and others, 'Deterrence in Competition Law' (2009) Governance and the Efficiency of Economic Systems (GESY), Discussion Paper No. 285.

data was part of a research project commissioned by the Dutch competition authority ACM.[23] The survey consisted of two parts: a regular part with various questions on cartel enforcement and merger control and a conjoint part. The regular part of the survey asked respondents to count the number of times they had modified or abandoned their (merger or cartel) plans due to competition enforcement. This yields abandonment rates which are used by an National Competition Authority (NCA) to compute the number of deterred cartels on the basis of the number of observed cartels.

The online survey was sent to all firms in the nationwide database of the Chamber of Commerce with 100 or more employees ($n = 4831$). The survey was addressed to the managing director or in-house lawyer. It was (partly or fully) completed by 512 respondents, of which 342 completed it in full, yielding a response rate of 11%. Representativeness of the response was analysed by comparing characteristics of the sample with characteristics of the population (industry, size, geography and firm age). The analysis yielded that the sample was representative.[24] No selection, other than firm size, was made in the sample design. The Chamber of Commerce database provided the data on firm size (number of employees) and industry.

B. Conjoint analysis

Conjoint analysis is an empirical method which is widely applied in market research. At its core is modelling a choice problem, based on hypothetical scenarios (vignettes).[25] The respondent's choice is usually estimated with a logit model. One of the advantages of conjoint analysis is that it can analyse the "trade-offs" between various desirable alternatives or "attributes" of a product or service. These "trade-offs" can usually not be disentangled with other methods. For example, it can be assumed that every customer prefers higher quality and lower prices. However, in marketing research, it is relevant to work out "the extent to which they would forego a high level of one attribute to achieve a high level of another".[26]

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[23]Rob van der Noll and others, 'Anticipating Cartel and Merger Control' (January 2011). Report commissioned by the NMa (Netherlands Competition Authority) SEO-report 2010–76a. Translated from the Dutch original. <https://www.acm.nl/download/documenten/nma/SEO%20Report%202010%20Anticipating%20cartel%20and%20merger%20control.pdf>. The Dutch original is available at: <http://www.seo.nl/uploads/media/2010-76_Anticipatie_op_kartel-_en_concentratietoezicht.pdf>.
[24]See also the study mentioned in footnote 23.
[25]See, eg Hildebrand (n 17).
[26]ibid 328.

The ability to (implicitly) express a preference for one attribute in terms of the other attributes makes the choice problem easier for the respondent. Another advantage is that strategic and social biases are minimized using conjoint analysis. Various hypothetical situations are presented to the respondent, who is then asked to classify or rate them. In our data, respondents are asked how likely it is they would end a cartel that is discovered within their organization. Situations are presented in brief descriptions, also known as vignettes. A vignette consists of a (limited) number of attributes, which express the variables relevant to the problem.[27] The respondents were first asked to complete the vignettes for merger control. The original assignment for cartel control (translated to English) reads as follows:

> "We are going to present you once again with six hypothetical situations. The following applies in each case.
>
>   You have discovered that your company has entered into a price fixing agreement with a competitor. You strongly suspect that this agreement is not compatible with the cartel prohibition. The sales department has informed you that your business unit's annual turnover is 20% higher as a result of this price fixing agreement. Each situation describes a hypothetical regulatory regime. Please indicate how probable it is in each of these situations that you would give instructions to terminate the price fixing agreement. You can express probability by assigning it a score on a scale of 1 to 10, 1 being the lowest probability and 10 the highest. You can click on the underlined words for an explanation."

Table 1 is a schematic representation of the assignment that followed the above introduction.

The blank cells in Table 1 were automatically filled with values (see Table 2). The order of appearance of the attributes was randomized. The above assignment was repeated three times, presenting Situations C and D and E and F in pairs. After the three pairs were presented and scores provided, the respondent could reassess all six scenarios A–F and adjust the scores submitted. The scores Y^A to Y^F were then stored as responses. The variables in the blank cells in Table 1 that differed between the six scenarios are depicted in Table 2. Respondents could click highlighted words for more information about these concepts.

The attributes and their values were chosen on the basis of desk research and input from the Netherlands Competition Authority ACM. To deal with cognitive limitations of respondents, the set of attributes was limited. Table 2 implies that there are in total $3 \times 4 \times 2 \times 3 \times 3 = 216$

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[27]The art of vignette analysis lies in constructing a number of vignettes that represent a certain tension or trade-off in the attributes. The term "tension" refers to the fact that it is not possible to predict a priori how a respondent would strike the balance in the trade-off. The respondent assesses the vignettes and in doing so is implicitly required to reveal the trade-offs between different attributes.

Table 1. Schematic representation of the first pair of vignettes.

Situation A	Situation B
Publicity after infringement	Publicity after infringement
Personal fine	Personal fine
Leniency	Leniency
Company fine	Company fine
Industry in NCA work plan?	Industry in NCA work plan?

What is the probability that you would give instructions to terminate the price-fixing agreement?
  Please indicate with a score on a scale from 1 to 10, 1 being the lowest probability and 10 the highest.

| Score A | Y^A | Score B | Y^B |

Table 2. Conjoint analysis design.

Attribute	Number of values	Values
Personal fine	3	None, €450,000, €650,000
Company fine	4	2% annual turnover, 10% annual turnover, 20% annual turnover, 30% annual turnover
NCA plan of work	2	Your industry is not listed, your industry is listed
Leniency	3	You expect to be the first applicant, you expect to be the second or subsequent applicant, leniency not possible
Publicity	3	Only on the NCA website, NCA website and trade journals, all newspapers and television news

unique scenarios. For each respondent, six different vignettes were automatically selected and presented. Figure A1 in the appendix is a screenshot of a pair of vignettes.

Care was taken to ensure the attribute values of each pair did not deviate too markedly in a particular direction. This was done to ensure that the choice would not be too easy or difficult. After all, if all attributes in vignette A are more favourable than those in vignette B, there would be a risk that A would be given a score of 10 and B a score of 1. That would have had the disadvantage that the answers would not reveal the relative importance of the different attributes. The values in Table 2, except for leniency, show an increasing deterrent effect from left to right.[28] This was used to construct a theoretical deterrent index for each vignette, ranging from the minimum (all attributes at the lowest level) to the maximum (all values at most deterrent level). The algorithm to obtain the six vignettes A–F can be described by the following steps: two random vignettes were drawn from the set of 216 vignettes; if the two vignettes are too "close" or too "different" in terms of their theoretical deterrent index, one of the vignettes was put back and a new random

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[28]For leniency, the theory does not tell us how the values should be ranked. It was assumed that the deterrent effect increases from left to right in Table 2.

draw was made, the procedure is repeated until two vignettes A and B are obtained that are not too far and not too close to one another. Technically, a restriction was put on the difference between the theoretical deterrent indexes. For vignettes C and D again two vignettes are randomly drawn, but vignettes A and B cannot be drawn again. The two draws are thus from the set of 214 vignettes. Again, C and D cannot be too close or too far to one another. The steps are repeated for vignettes E and F.[29]

The assignment results in the following data: each respondent i evaluates six hypothetical scenarios $v \in \{A, B, C, D, E, F\}$ and assigns a whole number from the range 1, … , 10 to each scenario v. A scenario consists of five attributes that are indicative of the probability of cartel detection and the loss after detection. An attribute assumes one value from the options provided in Table 2. The assigned number indicates the likelihood that the respondent would terminate a cartel that is strongly suspected to be illegal and generates 20% additional turnover for the respondent's business unit. In this paper, we call this number the compliance score. The aim of the paper is to empirically explain the compliance score.

III. Results

The results are as follows. Two hundred and forty-eight respondents evaluated a total of 1488 scenarios. Fifty-five per cent of these scenarios triggered the score 10 as a response. The average compliance score assigned was 8.6 on the scale 1, … ,10. A cumulative distribution function shows the number of observations that is equal to or lower than X. Figure 1 shows the cumulative distribution function for the compliance score. It shows that 45% of the assigned scores was 9 or lower; 35% of the scores was 8 or lower. The score equal to 10 is clearly the most frequent. The "pivotal" compliance score 5 or lower (in the Netherlands, the score 5 or lower is considered as failure in examination contexts) was assigned to 9% of the hypothetical cartel cases. Note that respondents were not provided with any framing of scores. The analogy with examination context was not mentioned.

The illegal nature of the cartel is made explicit to the respondent in the assignment. The assumed benefit to the respondent is an additional 20% turnover. It is therefore relevant whether the compliance score varies with the attributes of enforcement. If the illegal nature *per se* is a

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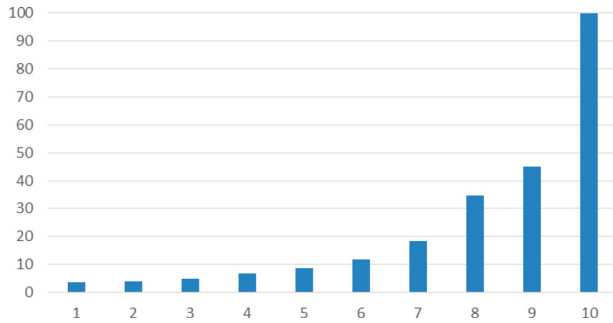[29]See also the study mentioned in footnote 23.

Figure 1. Cumulative distribution of compliance scores (per cent).
Note: $N = 1488$.

strong determinant of compliance,[30] we would expect to see a relatively high compliance score and low variation between the six scores. Moral views on compliance with the laws would arguably also result in a relatively high compliance score and low variation. On the contrary, if detection by the NCA and loss after detection are important determinants of compliance, one would expect to observe variation in the compliance scores.

Table 3 breaks down the respondents accordingly. It shows that 46% of respondents replied fully compliant to all six scenarios: they assigned the number 10 to each cartel situation. A minority of 15% of respondents rated the six scenarios equally, but less than fully compliant. The average compliance score equals 7.2 in this group. Thirty-nine per cent of respondents varied their compliance score between the six scenarios and their mean compliance score equals 7.5. For these respondents, the variation in the scenarios mattered and the possible consequences of enforcement seem more important drivers of compliance than moral views on the law.

A. Does compliance differ by firm characteristics or answers to other questions in the survey?

Variables of interest are firm size (number of employees), industry, whether the firm employs a compliance officer, whether the firm consults an external adviser on competition law matters, whether the firm believes business chilling occurs often and whether the firm finds it clear when the

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[30]A cartel is per se illegal or hard-core if an agreement between competitors restricts competition by price fixing, output restrictions, market allocation or bid rigging.

Table 3. Variation in respondents' compliance scores.

Category of respondents:	N (%)	Mean
Fully compliant $Y_i = \{10, 10, 10, 10, 10, 10\}$	115 (46%)	10.0
Less than fully compliant, no variance in Y_i	37 (15%)	7.2
Variance in compliance scores Y_i	96 (39%)	7.5
Total	248 (100%)	8.6

NCA considers an agreement to be a violation of cartel law.[31] Table 4 and subsequent tables show the mean compliance score and the size for various categorizations of respondents.

More than half (64/112 = 57%) of the firms with a compliance officer behave fully compliant, whereas this equals 51/136 = 38% for firms with no compliance officer (Table 4). A similar pattern is observed for firms that consult a lawyer: more than half (52%) behave fully compliant, whereas only 37% of firms that do not consult a lawyer behave fully compliant. The table also shows that firms that have a compliance officer and firms that consult a lawyer for competition matters report a higher compliance score.[32] Respondents were also asked whether they believe business chilling occurs often and whether they find the cartel prohibition clear, see Table 5.

Table 5 shows that the firms that do not understand cartel law are mostly not fully compliant (the percentage that reported full compliance is 37%) and for that group, the compliance score is rather low (6.8). On the contrary, those firms that understand cartel law are more often fully compliant (50%) and report higher compliance scores. This result is surprising because the hypothetical scenarios stated that there was a strong suspicion that the cartel was illegal. Respondents therefore did not need an understanding of cartel law to determine whether the scenario described an illegal situation. Nonetheless, the respondents who self-reported not to understand the law behaved less compliant, as Table 5 shows. The result suggests that the importance of firms' understanding might be higher than previously suggested.

Regarding business chilling, 14% of the companies believed business chilling occurs often. These firms were more often fully compliant and reported a higher mean compliance score. If respondents are fully compliant, and if they indicate that business chilling often occurs, then this suggests that they are probably risk averse. Note, however, that the

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[31]The complete survey questionnaire, as well as other technical details, are contained in the studies mentioned in footnote 23.
[32]Note the correlation between having a compliance officer and consulting a lawyer is weak: 41% of respondents report to use one but not the other.

Table 4. Compliance officer and habit to consult a lawyer on competition law issues.

| | Compliance officer, mean (N) | | Consult lawyer, mean (N) | |
	Yes	No	Yes	No
Fully compliant	10 (64)	10 (51)	10 (81)	10 (34)
Other	8.0 (48)	7.1 (85)	7.7 (74)	7.1 (59)
Total	9.1 (112)	8.2 (136)	8.9 (155)	8.1 (93)

Table 5. Understanding the law, belief on business chilling.

| | Understand cartel law, mean (N) | | Business chilling occurs often, mean (N) | |
	Yes	No	Yes	No
Fully compliant	10 (90)	10 (25)	10 (21)	10 (94)
Other	7.7 (90)	6.8 (43)	7.3 (13)	7.5 (120)
Total	8.9 (180)	8.0 (68)	9.0 (34)	8.6 (214)

correlation between the two variables is rather weak: 7% of respondents both believe business chilling occurs often and do not understand the cartel law.

Are larger firms more often compliant? Table 6 shows results by firm size. The percentage of full compliance is around 47% in each size category. However, the respondents who did not report full compliance show an increase in compliance by firm size. Firm size ((measured by the number of employees) in a number of employees), understanding the law and having a compliance officer are pairwise positively correlated at .05 statistical significance. The results above also show that each of these three properties is associated with a higher compliance score on average. This triggers the question which determinant is more important and which effects are statistically significant? Are larger firms more compliant no matter their understanding of the law and compliance policies? Or are larger firms more compliant because they more often understand the law and more often have a compliance officer? In the first case, the NCA could direct guidance and advocacy mostly towards smaller firms. If the second case is true, however, also the compliance resources of larger firms need to be boosted.[33]

We use an econometric model in the next section to answer these questions.

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[33]Note that in our sample (N = 506), 39% of the firms with more than 600 employees (N = 54) have no compliance officer for competition matters. Twenty per cent of the firms in the sample that answered both questions lack a compliance officer and understanding of the law. The average size of these firms is 192 employees.

Table 6. Mean compliance score by firm size (and number of respondents).

	100–225 employees	226–600 employees	More than 600 employees
Fully compliant	10 (75)	10 (25)	10 (15)
Other	7.2 (88)	7.6 (28)	8.3 (17)
Total	8.5 (163)	8.7 (53)	9.1 (32)

IV. Econometric model of compliance

In this section, we exploit the variation between scenarios to assess the contribution of enforcement tools to compliance and deterrence. Thirty-nine per cent of the respondents varied their self-stated compliance scores according to the values of these attributes (see Table 2 for the values of these attributes). The tools that will be investigated are the personal fine for the manager, the company fine, publicity after a finding of infringement, listing industries in the NCA plan of work and the leniency programme. The control variables used are understanding cartel law, having a compliance officer in the firm, consulting a lawyer on competition matters and firm size (number of employees).

The data have been analysed by means of ordered logistic regression. The explained variable is the compliance score that is an element of the ordered set of alternatives $Y = \{1, \ldots, 10\}$. The objective is to predict for each vignette $v \in \{A, B, C, D, E, F\}$ the probability that alternative $j \in Y$ will be chosen by the individual i, using maximum likelihood. The values of the attributes of the vignettes are the explanatory variables, combined with the control variables. The estimated equation is:

$$Y_i^v = \beta X_i + \alpha S^v + \epsilon_i.$$

In this equation, X_i denotes firm characteristics and S^v captures the values in the hypothetical scenarios. The error term ϵ_i is clustered by respondent. The personal fine and firm size are included as continuous variables, and the other explanatory variables are categorical. The ordered logit model is the preferred method for this type of data. This is because the data from the conjoint measurement are multinomial: score 1–10 are discrete data and cannot take on more than these 10 values. This is an important distinction with, for example, continuous data such as annual turnover in euros. Due to this distinction, the ordered logit is preferable to, for example, OLS regression; see also Cameron and Trivedi.[34] Note that the ordered logit model is not

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[34]Colin Cameron and Pravin Trivedi, *Microeconometrics, Methods and Applications* (Cambridge University Press 2005).

focused on the outcome $Y = 10$: it estimates all probabilities and would measure the effect that a respondent would, for example, submit $Y = 8$ rather than $Y = 6$ due to the personal fine. The results are provided in Table 7.

The results show that the personal fine and the company fine have an effect on the level of compliance. For the other enforcement tools as well as the publicity following an infringement, no significant effect is shown. Understanding cartel law, having a compliance officer and consulting a lawyer all have a statistically significant and positive effect on compliance. Note that respondents could be morally influenced by the law and this is an unobserved determinant. The effect would be captured by the error term ϵ_i and also, we would expect to observe lower variance in Y_i^v across vignettes for those respondents who are most morally influenced. The moral influence of the law could be correlated to understanding cartel law, having a compliance officer and consulting a lawyer.

The regression results in Table 7 show that firm size does not have the expected sign and has no (direct) effect on compliance. The effect of firm size on compliance runs through the other determinants: understanding cartel law, employing a compliance officer and the habit to consult a lawyer on competition issues. An important result is that understanding cartel law has a statistically significant effect on the probability of a compliant response, despite the fact that knowledge of cartel law was not needed to appreciate the illegal nature of the hypothetical scenario. The same can be said about the effect of having a compliance officer: one would not expect this positive effect because the hypothetical situation

Table 7. Ordered logistic estimation of compliance to cartel law.

	Coefficient (Std. Err.)	p-Value
Attributes of scenarios		
Personal fine (€100,000)	0.1020 (0.0205)***	.000
Company fine 20% or 30% of annual turnover	0.2566 (0.1103)**	.020
Industry listed in NCA plan of work	0.0488 (0.1055)	.643
There is a leniency programme	0.0367 (0.1126)	.744
Publicity after infringement finding medium (NCA website and trade journals)	−0.0756 (0.1227)	.538
Publicity after infringement finding high (all newspapers and TV news)	0.0213 (0.1452)	.883
Firm-level characteristics		
Understand cartel law	0.4864 (0.2748)*	.077
Compliance officer	0.6671 (0.2345)***	.004
Consult lawyer	0.5298 (0.2444)**	.030
Number of employees	−0.0002 (0.0002)	.302

Note: Number of observations equals 1482. Standard errors have been corrected for clusters. Pseudo R^2 equals 0.0301.

is self-explanatory for the respondent. A possible explanation is that compliance is a habit, rather than a rational response to the information presented. An alternative explanation that fits more within the rational theory of "optimal deterrence" is that these respondents estimate the probability of detection and finding infringement to be higher than other respondents. After all, rational deterrence theory is built on the expected benefits and costs of participating in a cartel. The costs can be calculated by multiplying the probability of detection with the loss after detection. The loss after detection is rather completely specified by the vignettes, but the probability of a finding of infringement by the NCA is only indicated by the inclusion of the firm's industry in the NCA plan of work.

The coefficients in Table 7 cannot readily be interpreted. The required step is to calculate the probability of the different outcomes. We label the following scenario as "least deterrent": the personal fine is nil, the company fine is 2% of turnover, the industry is not mentioned in the plan of work, there is no leniency programme, the publicity after a finding of infringement is lowest, the firm does not consult a lawyer on competition law matters, the firm does not understand the cartel prohibition, has no compliance officer and has average firm size (350 employees, the sample mean). In that case, the probability of a fully compliant response on a single vignette is .12 (or 12%). Table 8 shows the marginal effects on that probability of the explanatory variables that were found to be statistically significant.

Table 8 shows that increasing the personal fine from nil to €100,000 increases the probability of a fully compliant response from .12 to .13. Increasing the company fine from 2% to 20% or 30% of turnover has a larger effect. The effect of having a compliance officer is equal to the

Table 8. Determinants of compliance.

	Probability of fully compliant outcome ($Y_i^v = 10$)	Probability of moderate compliant outcome ($Y_i^v \geq 8$)
Least deterrent scenario	.12	.32
Marginal effects at least deterrent scenario (p-value):		
Compliance officer	.07 (.004)	.17 (.008)
Personal fine (€100,000)	.01 (.000)	.02 (.000)
Consult lawyer	.07 (.060)	.11 (.080)
Understand cartel law	.06 (.074)	.11 (.105)
Company fine 20% or 30% of turnover	.03 (.048)	.08 (.012)
Most deterrent scenario	.68	.90

Note: For the fully compliant outcome, post-estimation calculations on the regression in Table 7 were used. For the moderate compliant outcome, a binary logistic regression was estimated, with outcomes $Y_i^v < 8$ and $Y_i^v \geq 8$.

effect of introducing a personal fine approximately equal to €700,000. When all the parameters are set at their most deterring levels (according to Table 2), the probability of full compliance equals .68. Understanding cartel law (.06) has almost the same effect as the habit to consult a lawyer (.07).

Arguably, a score of 8 or 9 on a scale of 1–10 could also be interpreted as a compliant outcome. The last column in Table 8 therefore reports results for the outcome $Y_i^v \geq 8$, termed as "moderate compliant outcome". In the least deterrent scenario, the probability of a moderate compliant response is .32 or 32%. This probability is enhanced by increasing the fines or boosting the firm's compliance features (compliance officer, consulting a lawyer on competition law matters and knowledge about the law). When all variables are set at their most deterring levels, the probability of a moderate compliant outcome is increased to 90%.

V. Discussion of results

Managers were presented with six hypothetical price-fixing scenarios that were invariably strongly suspected to be illegal. They were asked to indicate the likelihood that they would terminate the price-fixing agreement. Fifty-four per cent of respondents responded less than fully compliant on at least one scenario. The attributes that varied between scenarios were informative about the probability of detection (industry listed in NCA plan of work or not), the (financial) loss after detection and whether leniency was possible. Only the personal fine for the manager and the company fine were found to be statistically significant drivers of compliance. The finding that fines boost deterrence confirms similar results in the literature on deterrence. However, this paper is the first paper to obtain this result with conjoint survey data. The actual levels of maximal fines in the Netherlands in 2015 are within the range of hypothetical fines studied. For example, the personal fine is €450,000 at maximum. The results show that lowering this level is expected to result in a lower level of compliance; increasing it leads to higher compliance. Similarly, increasing the company fine from the current 10% of annual turnover to 30% of turnover is estimated to increase the probability of a fully compliant outcome from .44 to .55. The deterrent effect of adverse publicity was not confirmed.

For the least deterring scenario (no personal fine, company fine equal to 2% of turnover), the probability of a moderate compliant response (defined as a score of 8 or higher on a scale 1, … ,10) is estimated at .32. These results suggest that, generally, absent enforcement, compliance

is low and can be boosted by fines. Social and strategic bias may distort survey results, but these biases would push the respondent to a higher compliance score. Our results could therefore overestimate the degree of compliance. The above conclusions are therefore not affected by these biases. The results suggest that the NCA could direct guidance and advocacy mostly towards firms without a compliance officer and to firms that do not typically consult a competition lawyer. Also, the NCA could advise firms to either consult an external lawyer or have an internal compliance officer who understands competition law.

The first policy lesson from these results is that fines, either personal or firm-based, help to deter anti-competitive agreements. The results suggest that it is more effective to fine tune these fines than it is to rely on leniency programmes, naming and shaming (adverse publicity) and warnings in the NCA annual work plan. Note, however, that the impact of compliance features has a larger magnitude than the increase of the company fine to 30% of turnover. The second policy insight is linked to the result that firms that do not understand cartel law are mostly not fully compliant, whereas those firms that do understand cartel law are more often fully compliant and report higher compliance scores. In the least deterrent scenario, the probability of a moderate compliant outcome was estimated to be .11 higher for a manager who understands cartel law, as compared to a manager who does not understand cartel law. The appropriate policy avenue towards increasing compliance with cartel law depends on the explanation behind this result. Can a manager's knowledge of cartel law be improved and would managers show more compliant behaviour as a result?

The answer could be "no" because the hypothetical scenarios clearly stated that the cartel was strongly suspected to be illegal. No knowledge was therefore required to understand that the scenario described an illegal situation. This somewhat puzzling result could arise because the calculated response to the information presented could differ by manager type. As put forward by Parker, business people differ in "their understanding of their social relationship with the law, and how their interpretations and responses, in turn, influence the way the law relates to them".[35] Parker distinguishes between "legally innocents" and "players" and argues that:

> business people who do not understand themselves to "know" the law see themselves as legally "innocent" in the sense that the calculations about penal risk (likelihood of detection, enforcement, and jail) that deterrence expects

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[35]Parker (n 7) 179.

them to make are irrelevant and meaningless to them. Those who do know the law see themselves as "players" in the law in the sense that they can strategically engage with the law to influence its outcomes. This also makes the assumptions of simplistic deterrence policy irrelevant and meaningless to this group.[36]

The respondents who did not understand cartel law in the survey could coincide with Parker's "legally innocents". Within this explanation, the "legally innocents" do not understand cartel law and are less inclined to comply when confronted with a clearly illegal scenario. They consider themselves distant from the law and therefore immune from its consequences. They deny the law's normative capacity to apply to them. The results in Section III suggest that this "bad compliance manager" type could be negatively correlated with firm size, which would coincide with Parker's analysis of small business people and line managers. We doubt that Parker's legally innocents would increase their compliance when they would somehow be "treated" with information or guidance about cartel law.

The answer could alternatively be "yes" because the vignettes did not fully specify all the information a rationally deciding prospect offender would need. The scenarios specified the foregone extra turnover and the loss after a finding of infringement, but the probability of a finding of infringement was merely indicated by the attribute "industry listed in NCA work plan". The managers in the survey who understand cartel law could systematically assign a higher probability of detection than the managers who lack this knowledge. This explanation for the observed result fits within the rational optimal deterrence theory that requires managers to calculate the expected costs and benefits of compliance. If uninformed but rational managers could upgrade their beliefs on the probability of detection, compliance would increase. However, the link between manager type and the perceived probability of NCA detection has not been researched. Hence, further research is necessary to test the explanations raised.

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[36]ibid 175.

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Appendix. Screenshot of conjoint question

Figure A1. A pair of vignettes (Dutch original).

Situation A

Publicity after infringement	only on the NCA website
Personal fine	€650,000
Leniency	you expect to be the first applicant
Company fine	2% annual turnover
Industry in NCA work plan?	your industry is listed

Situation B

Publicity after infringement	all newspapers and television news
Personal fine	€650,000
Leniency	you expect to be the first applicant
Company fine	2% annual turnover
Industry in NCA work plan?	your industry is listed

What is the probability that you would give instructions to terminate the price fixing agreement?
Please indicate with a score on a scale from 1 to 10, 1 being the lowest probability and 10 the highest.

Score situation A

Score situation B

Figure A2. A pair of vignettes translated to English.