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# What Next? Cartel Strategy After Getting Caught\*

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## Abstract

Once firms are being prosecuted for collusion, strategies remain available to them that have the potential to reduce the penalties they face. Settlement negotiations offer opportunities to negotiate restricted pleas that limit penalties from follow-on litigation, and leniency programs such as Amnesty Plus offer opportunities to reduce fines associated with collusion in one product by revealing collusion in another. We offer implications for antitrust policy.

Keywords: Amnesty Plus, Cooperation Policy, Collusion, Multimarket Contact

JEL Classification Codes: K21, K42, L41

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# 1 Introduction

As stated by the U.S. Department of Justice (DOJ), “When competitors collude, prices are inflated and the customer is cheated. Price fixing, bid rigging, and other forms of collusion are illegal and are subject to criminal prosecution by the Antitrust Division of the United States Department of Justice.”<sup>1</sup> Furthermore, according to the DOJ, “In recent years, the Antitrust Division has successfully prosecuted regional, national, and international conspiracies affecting construction, agricultural products, manufacturing, service industries, consumer products, and many other sectors of our economy.”<sup>2</sup>

In many cases, the prosecution of a cartel is facilitated by the information provided by a leniency applicant. According to the DOJ website: “The Antitrust Division’s Leniency Program is its most important investigative tool for detecting cartel activity. Corporations and individuals who report their cartel activity and cooperate in the Division’s investigation of the cartel reported can avoid criminal conviction, fines, and prison sentences if they meet the requirements of the program.”<sup>3</sup> In a 2001 speech, while he was Director of Criminal Enforcement of the Antitrust Division at the DOJ, Scott D. Hammond asserted that: “Since we expanded our Amnesty Program in 1993, there has been more than a ten-fold increase in amnesty applications. In the last two years, cooperation from amnesty applicants has resulted in scores of convictions and

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<sup>1</sup>“Preventing and Detecting Bid Rigging, Price Fixing, and Market Allocation in Post-Disaster Rebuilding Projects: An Antitrust Primer for Agents and Procurement Officials,” p.1, available at [http://www.justice.gov/atr/public/guidelines/disaster\\_primer.pdf](http://www.justice.gov/atr/public/guidelines/disaster_primer.pdf) (accessed July 31, 2013).

<sup>2</sup>“Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What To Look For: An Antitrust Primer,” p.1, available at <http://www.justice.gov/atr/public/guidelines/211578.pdf> (accessed July 31, 2013).

<sup>3</sup>United States DoJ website, <http://www.justice.gov/atr/public/criminal/leniency.html> (accessed October 22, 2012). In Australia, Chairman of the Australian Competition and Consumer Commission (ACCC), Graeme Samuel stated that the ACCC’s Immunity Policy for Cartel Conduct was “absolutely vital” in the Australian government’s efforts to crack cartels, and he credited it with exposing potential cases at the rate of about one a month. (Beaton-Wells and Fisse, 2011, p.379) See also Beaton-Wells (2008a, 2008b) and Wils (2007).

well over \$1 billion in fines.”<sup>4</sup>

Once a firm is being prosecuted for participation in a cartel, a number of things can affect the penalties ultimately imposed on the firm. In many jurisdictions, firms being prosecuted for collusion may negotiate a settlement with the government.<sup>5</sup> There appears to be some flexibility for cartels to negotiate settlement terms that favor them in terms of limiting future penalties, for example from civil litigation, in exchange for concessions to the competition authority, which may include the amount of criminal fines, the number of individuals receiving prison terms, or the total length of prison terms.<sup>6</sup> In addition, programs such as the DOJ’s Amnesty Plus program,<sup>7</sup> which was implemented in 1999 in response to concerns about offending firms being involved in price fixing conspiracies in multiple product markets, allow a firm being prosecuted for collusion to qualify for reduced fines by applying for leniency in a separate product in which it is also engaged in collusion.

In this paper, we consider firms’ strategies related to settlement negotiation and leniency applications once they are being prosecuted for collusion. Our focus is on the implications for antitrust policy.

In Section 2, we discuss the effects of settlement negotiations on deterrence through their impact on follow-on litigation. In Section 3, we present a simple model of settlement negotiation. In Section 4, we discuss how leniency programs can affect incentives for multi-product colluders, potentially decreasing deterrence and creating incentives

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<sup>4</sup>“When Calculating the Costs and Benefits of Applying for Corporate Amnesty, How Do You Put a Price Tag on an Individual’s Freedom?” presented at the ABA’s Criminal Justice Section’s Fifteenth Annual National Institute on White Collar Crime, March 8, 2001, available at <http://www.justice.gov/atr/public/speeches/7647.pdf> (accessed October 30, 2012).

<sup>5</sup>See Beaton-Wells (2008b) and Wils (2008b).

<sup>6</sup>Policies vary in terms of the flexibility for settlement terms. For example, the Australian Director of Public Prosecutions’ (DPP) Prosecution Policy states that the charges should bear a reasonable relationship to the nature of the criminal conduct of the accused.

<sup>7</sup>See Marshall, Marx, and Mezzetti (2013) and Lefouili and Roux (2012) for discussion and theoretical models of Amnesty Plus. See also Wils (2008, Chapter 5.4.4).

for the formation of sacrificial cartels. Section 5 concludes.

## 2 Settlement terms affect follow-on litigation

Many corporate crimes damage individuals or other purchasers. For example, fraud and price fixing hurt purchasers while insider trading damages shareholders. When purchasers are damaged, criminal penalties are just one part of deterrence. In addition to criminal penalties, there is often civil litigation by either a class, opt-out plaintiffs, or both. The civil litigation can be a substantial part of the financial penalty, and thus a substantial part of deterrence. In the United States, the absence of a criminal finding can complicate plaintiffs' efforts in civil litigation and potentially reduce plaintiffs' expected recoveries. Even when there is a criminal finding, civil litigation can be significantly affected by the scope of the criminal finding in dimensions such as the time period, products, geography, suppliers' behavior, and affected purchasers. Generally, more limited criminal findings can reduce a supplier's potential exposure in civil litigation.

The parameters of the plea agreement also matter to enforcement authorities, but it appears that some parameters are given more attention than others. A review of recent DOJ press releases in cartel cases reveals an emphasis, in terms of what is reported, on the amounts of fines and the extent to which individuals received prison sentences.<sup>8</sup> These press releases do not appear to emphasize the comprehensiveness of the plea parameters, including the extent to which they encompass all relevant

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<sup>8</sup>DOJ press releases are available at [http://www.justice.gov/atr/public/press\\_releases/2013/](http://www.justice.gov/atr/public/press_releases/2013/) (accessed July 31, 2013). This emphasis is echoed in the press, with statements such as: "With this win under its belt, including the huge fines and the jail times sought and imposed, expect the DOJ going forward to seek bigger and bigger criminal fines and longer and longer sentences as a deterrent to future global price fixing conspiracies." ([http://www.antitrustlawyerblog.com/2012/09/doj\\_nets\\_huge\\_fines\\_and\\_jail\\_t\\_1.html](http://www.antitrustlawyerblog.com/2012/09/doj_nets_huge_fines_and_jail_t_1.html), accessed July 31, 2013)

time periods, products, buyers, and geographies. This is natural since the public has no information about a given cartel matter and will be unable to determine if, say, a plea length is small or large given the evidence, but the public will be able to observe that a criminal fine of hundreds of millions of dollars seems to be quite punitive and indicative that antitrust enforcement authorities are ‘doing a good job.’

The true parameters describing the conduct may be hard to infer from the documentary evidence. For example, whether a price fixing conspiracy had a duration of eight or ten years may be difficult for enforcement authorities to establish from the discovery record. Or the enforcement authorities may perceive differences in the cost and likely success associated with pursuing more expansive claims regarding the extent of the conduct, including factors such as the length of the conduct, the set of products, geographic scope, and purchasers affected.

In such an environment, there are tradeoffs to be considered in settlement negotiations. An enforcement authority might view the marginal gains from documenting all the fine details of a conspiracy as small relative to the expected resources required to accomplish that. For example, when considering such tradeoffs, an enforcement authority might look favorably upon pleadings that involve relatively shorter plea periods but relatively higher criminal penalties.

This is consistent with the Canadian experience:

Canada added that in its experience in negotiations of plea agreements and fines the competition authority might be willing to narrow the scope of the guilty plea in light of possible subsequent civil action, and might seek a relatively higher fine to compensate for the reduce[d] charge to ensure that the fine was adequate in light of the volume of affected commerce. In the consent agreement the level of the fine might appear distorted because

the trade off struck between lesser charge and higher fine might not be apparent to the outside observer.<sup>9</sup>

At the risk of redundancy, but to be clear, we are aware of no evidence that antitrust enforcement authorities restrict pleas when they have ‘bulletproof’ evidence in exchange for larger criminal fines. For example, if the DOJ has hard evidence that a cartel was in place from at least January 2005 through at least December 2008, then we are unaware of any evidence to suggest that the DOJ would ‘sell’ a reduced plea period, say, January 2006 through December 2007, for a larger criminal fine. But, it may be the case that the DOJ has good but softer evidence that the conspiracy started by at least January 2004, and yet softer evidence that it began as early as January 2000. Similarly there may be good but softer evidence that the cartel continued until at least June 2009, and even softer evidence that it lasted until December 2011. Furthermore, the DOJ may have hard evidence that the cartel affected ten related products, while the evidence is good but weaker that the cartel affected an additional five products beyond the ten. The DOJ could pour scarce enforcement funds into shoring up the most expansive time period and entire set of products in preparation for a trial, but given the limited resources of the DOJ, the costs and risk of trial, and numerous other cartel cases that need the attention of the DOJ’s scarce enforcement resources, the DOJ will naturally be drawn towards accepting a conspiracy plea for “from at least January 2005 through at least December 2008” and affecting “at least 10 products” in exchange for a criminal fine that is large and perhaps more commensurate with the longer periods and extended set of products. Counsel for cartel firms negotiate such pleas, gladly paying larger fines for

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<sup>9</sup>Organisation for Economic Co-operation and Development, Working Party No. 3 on Co-operation and Enforcement, October 13, 2006, “Private Remedies: Class Action / Collective Action; Interface Between Private and Public Enforcement,” Summary Record of the meeting held on June 7, 2006, at para. 45, DAF/COMP/WP3/M(2006)2/ANN3.

the restricted pleas, because such pleas reduce expected civil damages, and reduce the overall penalties – criminal plus expected civil penalties – faced by the cartel firms.

In what follows, we review two cases that raise questions as to whether the criminal pleading understated the full extent of the conspiracy. In the next section, we discuss the results of a simple model that illustrates the incentives at play.

## 2.1 Two examples

### 2.1.1 Vitamins Cartel

The primary manufacturers of vitamins admitted to participating in an international price fixing conspiracy for much of the 1990s.<sup>10</sup> However, for the individual vitamin products affected by the conspiracy, there are differences in the beginning and ending dates of the conspiratorial activity as identified in U.S. plea agreements versus the European Commission (EC) decision in *Vitamins*. For a summary of U.S. plea agreements, see the Expert Report of B. Douglas Bernheim (Bernheim Report, Table 6) in the Vitamins Antitrust Litigation.<sup>11</sup> For example, U.S. plea agreements in vitamin A for cartel members Roche and BASF identify a plea period from January 1990 until February 1999, but the EC decision finding begins in September 1989, four months earlier. Similarly, U.S. plea agreements in vitamin B5 for cartel members Roche and BASF identify a plea period from January 1991 until December 1998, but the EC

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<sup>10</sup>See, e.g., the European Commission Decision in *Vitamins*, available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:006:0001:0089:EN:PDF> (accessed July 31, 2013), and the DOJ press release “Two German Firms and Two U.S. Corporations Agree to Plead Guilty to Participating in International Vitamin Cartels,” available at [http://www.justice.gov/atr/public/press\\_releases/2000/4684.htm](http://www.justice.gov/atr/public/press_releases/2000/4684.htm) (accessed July 31, 2013).

<sup>11</sup>The Expert Report of B. Douglas Bernheim, MDL No. 1285, In Re: Vitamins Antitrust Litigation, Misc. No. 99–0197 (TFH), May 24, 2002, was submitted as exhibit number 243 in In re: Vitamins Antitrust Litigation, case No. 99–0197 (TFH) filed in the District Court of the District of Columbia. We obtained the document through a request to the law clerk to Chief Judge Thomas F. Hogan. The document was made available based on DC Local Civil Rule 79.2 and the United States District Court for the District of Columbia’s policy of not retaining exhibits that are admitted into evidence at trial in civil cases.



decision finding does not end until February 1999, two months later.

In addition, although there were no guilty pleas dating as far back as 1985, economic evidence related to coordinated price announcements suggests that the conspiracy may have begun in 1985 (Marshall, Marx, and Raiff, 2008).

We can illustrate the effect on overcharge estimates of this difference in the collusive period based on analysis provided in the Bernheim Report, which estimates overcharges to the associated plaintiffs to be approximately 33% greater when one views the conspiracy as starting in 1985 rather than only during the period to which the defendants pled guilty (Bernheim Report, Table 1).

Figure 1 shows the estimated but-for price for a particular vitamin product, Vitamin A Acetate 650 Feed Grade. As you can see from the figure, the but-for price line (i.e., the price series that would have been observed in the absence of collusion) is estimated under the assumption that the period prior to 1990 is non-collusive.

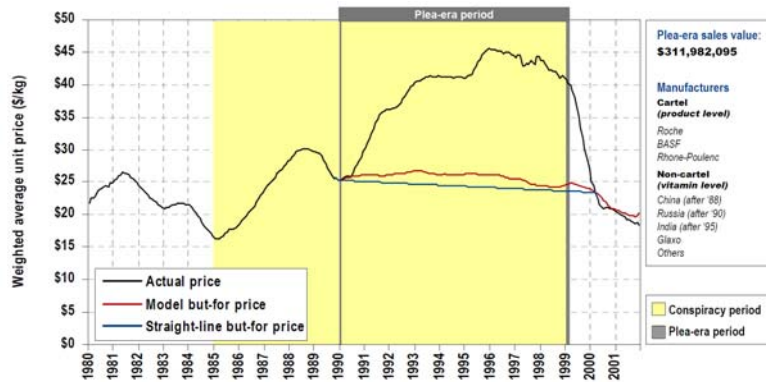


Figure 1: Vitamin A Acetate 650 Feed Grade price and but-for price (Source: Bernheim Report, Figure 12-6)

We can contrast this to the but-for price line that would result if one assumes that the conspiracy began instead in 1985. As shown in Figure 2, substantial incremental overcharges result from this change.

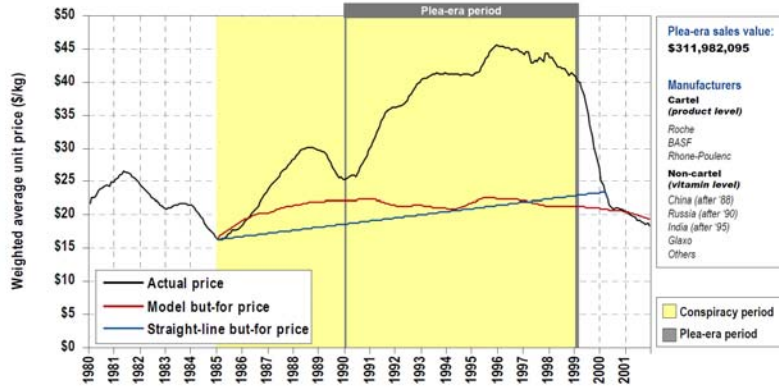


Figure 2: Vitamin A Acetate 650 Feed Grade price and but-for price (Source: Bernheim Report, Figure 14-5)

If, in fact, the conspiracy began in 1985, then the restricted plea in the criminal case may have substantially reduced civil penalties if civil litigants based overcharge estimates only on the restricted plea period. The approach taken by the enforcement authorities may have been reasonable given resource constraints and the tradeoffs they faced, including the consideration of whether the burden of establishing the existence of the conspiracy in the earlier time period was substantial; however, it is important to note that limiting pleas in this way can lead to a substantial reduction in deterrence.

### 2.1.2 DRAM Cartel

In the dynamic random-access memory (DRAM) conspiracy, firms pled guilty to a conspiracy that affected only “certain original equipment manufacturers (OEM) of personal computers and servers.”<sup>12</sup> According to the plea agreements, “The conspiracy directly affected these OEMs in the United States: Dell Inc., Hewlett-Packard

<sup>12</sup>See, e.g., the Plea Agreement of Samsung Electronic Company, Ltd. and Samsung Semiconductor, Inc., U.S. District Court, Northern District of California, San Francisco Division, Case No. CR05-0643PJH, p.2 (Samsung Plea Agreement).

Company, Compaq Computer Corporation, International Business Machines Corporation, Apple Computer Inc., and Gateway, Inc.” (Samsung Plea Agreement, p.4) (The same sentence appears in the Hynix Plea Agreement<sup>13</sup> and in the Infineon Plea Agreement.<sup>14</sup>) In addition, the Elpida Plea Agreement identifies Sun Microsystems as having been affected by the conspiracy.<sup>15</sup>

These plea agreements are striking in light of evidence that DRAM is largely a commodity product. For example, testimony before the U.S. International Trade Commission stated that, “DRAMs are a global commodity product and, in fact, all of the major DRAM customers insist that their DRAM suppliers offer a single worldwide price.”<sup>16</sup> Given the commodity nature of the product and the “single worldwide price,” it seems unlikely that the conspiracy’s effects could have been limited to only seven OEMs in the United States; indeed, it is likely that the conspiracy affected prices more generally.

This restriction on the plea creates an incremental burden on purchasers of DRAM other than the seven named OEMs in order for them to recover damages, to the benefit of the colluding firms.

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<sup>13</sup>Plea Agreement of Hynix Semiconductor Inc., U.S. District Court, Northern District of California, San Francisco Division, Case No. CR 05-249 PJH, p.4 (Hynix Plea Agreement).

<sup>14</sup>Plea Agreement of Infineon Technologies AG, U.S. District Court, Northern District of California, San Francisco Division, Case No. 04-299 (PJH), pp.3-4 (Infineon Plea Agreement).

<sup>15</sup>Plea Agreement of Elpida Memory, Inc., U.S. District Court, Northern District of California, San Francisco Division, Case No. CR 06-0059 (PJH), pp.2-3, 4-5 (Elpida Plea Agreement). The Elpida Plea Agreement states: “For purposes of forming and carrying out the conspiracy charged in Count Two of the Information, Defendant’s employees had discussions and reached agreements with employees of its coconspirator on how it would allocate and divide a bid offered by Sun Microsystems in an auction on or about March 26, 2002. The Defendant and its coconspirators submitted bid proposals to Sun Microsystems for a bid on a 1 GB NG DIMM lot to achieve that result, including submitting complementary bids to ensure the success of their agreement.” (Elpida Plea Agreement, pp.4-5) However, the Infineon, Hynix, and Samsung Plea Agreements make no mention of the conspiracy having an effect on Sun Microsystems.

<sup>16</sup>U.S. International Trade Commission Hearing in the Matter of DRAMs and DRAM Modules from Korea, Investigation No.: 701-TA-431, p.32.

### 3 Model

In this section, we provide a model of settlement negotiation between an enforcement authority and a firm that has engaged in collusion. We assume that the enforcement authority behaves so as to maximize criminal fines net of enforcement costs (as opposed to minimizing anti-competitive behavior). We assume that the firm behaves so as to minimize the sum of criminal and civil penalties.<sup>17</sup> We allow the possibility that a firm could agree not to contest a criminal fine in exchange for adjustments by the enforcement authority of the parameters on which the fine is based.

For simplicity, we focus on plea length as the key parameter of the plea agreement.

#### 3.1 Setup

We model the criminal fine as being calculated as follows. We assume that  $\underline{t}$  is the earliest date and that  $\bar{t}$  is the latest date for the conspiracy that can be argued given the evidence. The enforcement authority must choose a defensible plea period, defined by a starting date  $t_0 \in [\underline{t}, \bar{t}]$  and an ending date  $t_1 \in [\underline{t}, \bar{t}]$ , with  $t_0 < t_1$ . Given the plea period, the volume of affected commerce is  $\sum_{t=t_0}^{t_1} \pi^t$ , where  $\pi^t$  is the volume of affected commerce in period  $t$ . The enforcement authority must assign a culpability score  $s \in S$  to the firm,<sup>18</sup> where  $S$  is the set of culpability scores that can be argued credibly given the evidence. Finally, the enforcement authority must select a fine from within the allowable range, given the volume of affected commerce and the culpability score. We let  $\lambda \in [0, 1]$  denote the scale factor determining the fine's distance between the minimum and maximum fine. For example, if the enforcement

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<sup>17</sup>The threat of prison terms for individuals engaged in collusion also has a deterrence effect. A full analysis of this would require a model of agency issues within firms, the effects of individual versus corporate leniency, and the deterrent effects of the threat of prison for white collar criminals, which is beyond the scope of this paper. Thus, we focus on financial penalties.

<sup>18</sup>See U.S.S.G. Section 8C2.5(g)(3).

authority selects a scale factor of  $\lambda$  and if the minimum fine given the plea period and culpability score is  $a$  and the maximum is  $b$ , then the amount of the fine is  $a + \lambda(b - a)$ . We let the function  $f(t_0, t_1, s, \lambda)$  denote the fine; it is a strictly decreasing function of the starting period  $t_0$  and a strictly increasing function of the ending period  $t_1$ , the culpability score  $s$ , and the scale factor  $\lambda$ .

We let  $c(s, \lambda)$  denote the cost of enforcing the fine combined with any expected reductions in the fine. We assume that it is a strictly increasing function of both  $s$  and  $\lambda$ , taking into account the increased workload associated with a more aggressive fine. In general, one would expect  $c$  to increase as  $s$  approaches the upper bound for the culpability score that can be argued given the evidence and to increase as  $\lambda$  approaches one, indicating that the fine approaches the maximum amount given the volume of affected commerce and the culpability score. The cost may also depend on  $t_0$  and  $t_1$ , for example if the burden of proving existence of a conspiracy increases with the time period; however, we focus on the case in which  $c$  is independent of the plea period. While our model incorporates the effect on cost of the culpability score, capturing the increased complexity associated with further incorporating the effects of the plea period on costs to the enforcement authority is beyond the scope of this paper.

To summarize, an enforcement authority interested in maximizing the amount of the fine it collects net of enforcement costs chooses the plea period, culpability score, and scale factor to solve

$$\max_{t_0 \in [\underline{t}, \bar{t}], t_1 \in [\underline{t}, \bar{t}], t_0 < t_1, s \in S, \lambda \in [0, 1]} f(t_0, t_1, s, \lambda) - c(s, \lambda). \quad (1)$$

Let  $t_0^N, t_1^N, s^N, \lambda^N$  be the solution of (1),  $F^N = f(t_0^N, t_1^N, s^N, \lambda^N)$  be the fine,  $C^N = c(s^N, \lambda^N)$  the enforcement cost, and  $F^N - C^N$  the value of the difference between the

fine and the enforcement cost at the solution.

The firm's objective function is to minimize the sum of criminal and civil penalties. For simplicity, we assume that civil penalties depend only on damages during the plea period, and not on the culpability score, scale factor, or the amount of the criminal fine. Specifically, let  $d(t_0, t_1)$  be damages defined based on a plea period from  $t_0$  to  $t_1$ , where  $d(t_0, t_1)$  is less than or equal to the amount of affected commerce during the plea period. Civil penalties can be up to triple the damages amount. To avoid introducing additional parameters, we write the penalties as equal to triple damages, however, a scale factor can also be introduced to account for less-than-triple damages with no effect on the qualitative results:

$$p(t_0, t_1) = 3d(t_0, t_1).$$

Thus, the firm's payoff related to the enforcement action is

$$-f(t_0, t_1, s, \lambda) - p(t_0, t_1).$$

We assume that  $d$  and hence  $p$  are strictly decreasing in  $t_0$  and strictly increasing in  $t_1$ . Letting  $P^N = p(t_0^N, t_1^N)$ , the firm's payoff in the absence of negotiation with the enforcement authority is  $-F^N - P^N$ .

## 3.2 Results

It is immediate from (1) and the fact that  $f$  decreases with  $t_0$  and increases with  $t_1$  that, absent any negotiation with the firm, it is optimal for the enforcement authority to set  $t_0^N = \underline{t}$  and  $t_1^N = \bar{t}$  (recall that we assume the cost to the enforcement authority is not affected by the length of the plea period).

**Claim 1** *In the absence of negotiations with the firm, the enforcement authority maximizes the criminal fine by basing it on the maximum justifiable plea period,  $t_0^N = \underline{t}$  and  $t_1^N = \bar{t}$ .*

Now consider the possibility of negotiations between the enforcement authority and the firm being prosecuted. The enforcement authority has no incentive to accept a payoff that is less than the maximum value  $F^N - C^N$ , defined as the solution of (1). We assume that the firm can reduce the enforcement agency's costs to zero (our results continue to hold if costs are reduced but remain positive) by accepting the fine imposed on it. By refusing to negotiate with the firm, the enforcement authority obtains  $F^N - C^N$ . Thus, we can think of  $f(t_0, t_1, s, \lambda) - F^N + C^N$  as the enforcement authority's gain over the status quo of no negotiation from an agreement to settlement parameters  $(t_0, t_1, s, \lambda)$ . Similarly, we can think of  $F^N + P^N - f(t_0, t_1, s, \lambda) - p(t_0, t_1)$  as the firm's gain over no negotiation from agreeing to settlement parameters  $(t_0, t_1, s, \lambda)$ . We use the asymmetric Nash bargaining solution, with a bargaining power equal to  $\beta \in (0, 1)$  for the enforcement authority, as our solution concept. (A value of  $\beta = \frac{1}{2}$  corresponds to the standard Nash bargaining model.) That is, we assume that the bargaining outcome is given by the solution of the following problem:

$$\max_{t_0 \in [\underline{t}, \bar{t}], t_1 \in [\underline{t}, \bar{t}], t_0 < t_1, s \in S, \lambda \in [0, 1]} \left\{ \beta \ln (f(t_0, t_1, s, \lambda) - F^N - C^N) + (1 - \beta) \ln (F^N + P^N - f(t_0, t_1, s, \lambda) - p(t_0, t_1)) \right\}. \quad (2)$$

At an interior solution, the first order condition with respect to  $t_h$ ,  $h = 0, 1$ , is:

$$\frac{\beta}{f(t_0, t_1, s, \lambda) - F^N + C^N} \frac{\partial f(t_0, t_1, s, \lambda)}{\partial t_h} - \frac{1 - \beta}{F^N + P^N - f(t_0, t_1, s, \lambda) - p(t_0, t_1)} \left( \frac{\partial f(t_0, t_1, s, \lambda)}{\partial t_h} + \frac{\partial p(t_0, t_1)}{\partial t_h} \right) = 0. \quad (3)$$

Since  $f$  and  $p$  are both strictly decreasing in  $t_0$  and strictly increasing in  $t_1$ , it must be that at the solution

$$\frac{\beta}{f(t_0, t_1, s, \lambda) - F^N + C^N} > \frac{1 - \beta}{F^N + P^N - f(t_0, t_1, s, \lambda) - p(t_0, t_1)}. \quad (4)$$

Differentiating (2) with respect to  $\theta = s, \lambda$  gives:

$$\left( \frac{\beta}{f(t_0, t_1, s, \lambda) - F^N + C^N} - \frac{1 - \beta}{F^N + P^N - f(t_0, t_1, s, \lambda) - p(t_0, t_1)} \right) \frac{\partial f(t_0, t_1, s, \lambda)}{\partial \theta} > 0$$

where the inequality follows from (4) and the fact that  $f$  is strictly increasing in both  $s$  and  $\lambda$ . It is thus immediate that the solution to (2) is  $s^* = \max_{s \in S} s$  and  $\lambda^* = 1$ . In addition, the negotiations involve the selection of interior values of  $t_0$  and  $t_1$ , so that the plea period is reduced below the maximum period.

**Claim 2** *At an interior solution, the bargaining outcome is for the enforcement authority and the firm to negotiate a settlement that maximizes the culpability score and scale factor,  $s^* = \max_{s \in S} s$  and  $\lambda^* = 1$ , and reduces the plea period,  $t_0^* > t_0^N = \underline{t}$  and  $t_1^* < t_1^N = \bar{t}$ .*

In addition, since  $-f(t_0^*, t_1^*, s^*, \lambda^*) - p(t_0^*, t_1^*) > -F^N - P^N$ , the firm's payoff increases as a result of settlement negotiation and hence deterrence is reduced by the presence of such settlement negotiation relative to its absence.



**Claim 3** *Settlement negotiation that generates restricted pleas reduces deterrence by increasing the colluding firms' payoffs.*

### 3.3 Example

Consider the following example. Assume the volume of affected commerce is the same in each period and equal to  $\pi$ . Define the base fine as 20% of the amount of affected commerce, i.e., the base fine is  $0.2\pi(t_1 - t_0)$ . Let  $S = [0, 1]$ , so that the culpability score is between zero and one. Given the plea period, culpability score, and scale factor, define the fine to be the following function of the start and end dates, culpability score, and scale factor:

$$f(t_0, t_1, s, \lambda) = 0.2\pi(t_1 - t_0)(0.75 + 1.25s)(1 + \lambda).$$

As we have defined this function, the minimum fine (the fine when  $\lambda = 0$ ) can be as little as 75% of the base fine and the maximum fine (the fine when  $\lambda = 1$ ) can be as much as four times the base fine, depending on the culpability score. Given the culpability score, the minimum and maximum fines differ by a factor of 2, with the final amount of the fine depending on the scale factor.

Define the cost function so that a culpability score or scale factor close to the upper bound for its range imposes costs on the enforcement agency and/or may lead to later reductions in the level of the fine. Specifically, we let

$$c(s, \lambda) = 8\pi s\lambda.$$

This cost function is chosen so that the cost of choosing  $s = 1$  and  $\lambda = 1$  offsets any payoff to the enforcement authority from collecting a fine.

To model the firm's payoff, assume damages are a factor  $\alpha$  times the volume of affected commerce, so that civil penalties are

$$p(t_0, t_1) = 3\alpha\pi(t_1 - t_0).$$

In the absence of negotiations with the firm, the enforcement authority solves (1). Letting  $\underline{t} = 0$  and  $\bar{t} = 10$ , then the solution is  $t_0^N = 0$ ,  $t_1^N = 10$ ,  $\lambda^N = 0.45$ , and  $s^N = 0.27$ , with  $F^N = 3.17\pi$ ,  $C^N = 0.99\pi$  and  $P^N = 30\alpha\pi$ . In general, as stated in Claim 1, the plea length will always be chosen at its maximum, but the culpability score and scale factor will not necessarily be chosen at their maxima. Without negotiations, the enforcement authority's payoff is  $F^N - C^N = 2.18\pi$ , and the firm's payoff is  $-3.17\pi - 30\alpha\pi$ .

When the enforcement authority and the firm negotiate, they set  $s^* = 1$  and  $\lambda^* = 1$ , and the solution to the first order condition (3) of the bargaining problem (2) can be easily computed. Letting  $\alpha = 0.3$ , the optimal plea length is  $t_1 - t_0 = 7.16\beta + 2.73(1 - \beta)$  which is about 27% of its original length if the firm has all the bargaining power and 49% of its original length with equal bargaining power,  $\beta = 0.5$ . Indeed, even if the enforcement authority has all the bargaining power,  $\beta = 1$ , it finds it advantageous to reduce the plea length to 71% of its original length, as this allows it to substantially increase the fine paid by the firm.

Recall that the original penalty without negotiation is  $3.17\pi$ , while with negotiation it is  $2.18\pi$  if the firm has all the bargaining power,  $3.96\pi$  with equal bargaining power, and  $5.73\pi$  when the enforcement authority has all the bargaining power. When the firm has all the bargaining power, it is able to reduce the fine in exchange for eliminating the enforcement authority's enforcement cost. As the bargaining power of the enforcement authority increases, the firm is willing to pay a higher fine in order

to reduce the plea length and hence civil penalties.

## 4 Leniency for multi-product colluders

We now turn to a different set of strategies that colluding firms face after getting caught, namely strategies related to leniency applications. These strategies differ from the strategies surrounding settlement negotiation discussed above in that they suggest actions that colluding firms might take prior to getting caught that can reduce the probability of detection.

The theoretical economics literature on antitrust leniency has mostly focused on models of tacit collusion. For surveys, see Rey (2003) and Spagnolo (2008).<sup>19</sup> The general conclusion of these models is that the presence of a leniency program makes collusion more difficult. The literature has also addressed the potential for the strategic use of leniency by cartels; in particular, it has recognized that by reducing expected fines, a leniency program may reduce deterrence, e.g., see Chen and Rey (2012), Chen and Harrington (2007), Spagnolo (2004), and Motta and Polo (2003).

To the extent that the presence of leniency programs makes it harder for firms to sustain collusion, leniency programs may cause the cartels that do form to invest in more extensive preparatory work or more sophisticated concealment. This more sophisticated preparatory work might include reorganizing the corporate hierarchies of the firms in the cartel in order to limit the number of individuals in the firms that would need to know about the conspiracy. More sophisticated concealment might involve hiring an external consulting firm to organize meetings and maintain

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<sup>19</sup>See also Wils (2008, Chapter 5), Chen and Rey (2012), Choi and Gerlach (2012b), Lefouili and Roux (2012), Harrington (2008), Chen and Harrington (2007), Aubert, Rey, and Kovacic (2006), Buccirosi and Spagnolo (2005, 2006), Spagnolo (2004), Motta and Polo (2003), and Spagnolo (2000). Sokol (2012), Zhou (2012), Miller (2009), and Stephan (2009) contain empirical investigations of leniency; for experimental analyses see Bigoni et al. (2012a,b) and Hinloopen and Soetevent (2008).

sensitive cartel documents in a location out of reach of authorities.<sup>20</sup>

In some cases, however, leniency can potentially provide incentives for firms that are colluding in one product to extend the conspiracy to include another product. Given the ability of cartels to adapt in response to changing enforcement regimes, the possible existence of this or other “perverse effects” from leniency programs is a concern that has been raised in the literature. As stated in Wils (2008a):

[S]uccessful cartels tend to be sophisticated organisations, capable of learning. It is thus safe to assume that cartel participants will try to adapt their organisation to leniency policies, not only so as to minimise the destabilising effect, but also, where possible, to exploit leniency policies to facilitate the creation and maintenance of cartels. This raises the question whether there could be features of leniency programmes that risk being exploited to perverse effects. Wils (2008a, p.137)

There are many examples of firms engaged in collusion in more than one product, and even many examples of firms applying for leniency in more than one product. Table 1 from Marshall, Marx, and Mezzetti (2013) considers EC decisions in cartel cases for 2001–2012 and shows that 21 multi-product colluders have received a 100% fine reduction through the leniency program in at least one of the products in which they were prosecuted.<sup>21</sup>

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<sup>20</sup>For example, the Organic Peroxides Cartel hired a consulting firm, AC Treuhand, that maintained certain cartel documents in Switzerland: “[AC Treuhand] produced, distributed and recollected the so called ‘pink’ and ‘red’ papers with the agreed market shares which were, because of their colour, easily distinguishable from other meeting documents and were not allowed to be taken outside the AC Treuhand premises.” (EC Decision in *Organic Peroxides* at para. 92(b))

<sup>21</sup>Some EC decisions apply to more than one product. For example, the EC decision in *Vitamins* covers multiple vitamin products, with a separate application of the leniency program for each product.

Table 1: Multi-product colluders that received a complete fine reduction  
in at least one product in EC cartel cases 2001–2012

Firm	Number of products	No fine reduction	Incomplete fine reduction	Complete fine reduction
Akzo Nobel	9	2	4	3
Takeda	6	4	1	1
Aventis	5		2	3
William Prym	5	1	3	1
Bayer	4		2	2
KONE	4	1	1	2
Otis	4		3	1
Degussa	3		1	2
Merck	3	1	1	1
Samsung	3		1	2
Shell	3	2		1
ABB Ltd	2	1		1
Boliden	2		1	1
BP	2			2
Chemtura	2			2
Chiquita	2			2
DHL and Exel	2			2
GrafTech International	2			2
Kemira Oyj	2	1		1
Mueller	2			2
Siemens	2	1		1

Table 1 reflects a concern that has been raised regarding leniency that it is often the large firms that are the ones applying for leniency, again raising the concern that leniency programs are being exploited.

We review two papers, Choi and Gerlach (2012a) and Marshall, Marx, and Mezzetti (2013) that address the potential exploitation of leniency by multi-product colluders.

In the model of Choi and Gerlach (2012a), firms operate in a repeated oligopoly in each of two product markets.<sup>22</sup> For certain parameter values, when the firms engage in collusion in only one product, collusive equilibria may not exist or it may be that the only collusive equilibrium involves both firms applying for leniency whenever the antitrust authority opens an investigation. For such parameter values, a leniency program is effective at deterring collusion or at increasing the probability that a single-product cartel that comes under investigation will be successfully prosecuted and penalized.

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<sup>22</sup>See Choi and Gerlach (2012b) on the effects on multi-product cartels of demand linkages among products.

However, if firms engage in collusion in multiple products, additional equilibria exist in which a leniency program is less effective. As shown in Choi and Gerlach (2012a, Propositions 2 and 5), equilibria exist in which multi-product firms do not apply for leniency at all if there is an investigation in only one of the products affected by the conspiracy, and they only apply for leniency in one product when both products come under investigation. This type of collusive strategy increases the expected per-product profit for the multi-product cartel. For some parameter values, collusive equilibria exist only when firms collude in multiple products and not otherwise. Thus, leniency can provide an incentive for firms to extend collusive conduct to a larger number of products.

Some antitrust leniency programs explicitly link fine reductions across products for multi-product cartels. For example, in the United States, under the DOJ's Amnesty Plus program, a firm that is being prosecuted for collusion in one product but that is not the leniency applicant can still potentially receive treatment as if it were the leniency applicant by applying for leniency and thereby turning in another product. According to the DOJ:

The size of the Amnesty Plus discount depends on a number of factors, including: (1) the strength of the evidence provided by the cooperating company in the leniency product; (2) the potential significance of the violation reported in the leniency application, measured in such terms as the volume of commerce involved, the geographic scope, and the number of co-conspirator companies and individuals; and (3) the likelihood the Division would have uncovered the additional violation absent the self-reporting, i.e., if there were little or no overlap in the corporate participants and/or the culpable executives involved in the original cartel under investigation

and the Amnesty Plus matter, then the credit for the disclosure would be greater. Of these three factors, the first two are given the most weight.<sup>23</sup>

Marshall, Marx, and Mezzetti (2013) provide a model of the effects on multi-product colluders of different implementations of an antitrust leniency program by a competition authority. First, they show that an antitrust leniency program that requires convicted firms to attest to whether or not they are colluding in any other product markets can increase leniency applications in the first product investigated but reduce the probability of prosecution in the other products. This linkage can create incentives for firms to extend collusion to sacrificial products or markets. By applying for leniency in products where penalties would be limited, firms may be able to reduce the probability of conviction in more valuable products.

Marshall, Marx, and Mezzetti (2013) also study the Amnesty Plus program. They model Amnesty Plus by assuming that each of two firms colluding on a main product has the option to collude with some other firm in a separate, minor, product with limited antitrust liability. In this environment, Amnesty Plus can create both additional incentives for collusion in the main product and incentives for firms to collude in other products. To see why, note that collusion in the minor product gives each firm the ability to obtain reduced fines in the main product should the firm be prosecuted, even if it is not the leniency applicant. In turn, this reduces the incentives for firms to apply for leniency in the main product, which reduces detection and deterrence. As noted in Marshall, Marx, and Mezzetti (2013, p.30):

The negative effect of Amnesty Plus on detection and deterrence occurs because Amnesty Plus reduces the preemption effect. A firm has less

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<sup>23</sup>The U.S. DoJ's "Frequently Asked Questions Regarding the Antitrust Division's Leniency Program and Model Leniency Letters" (2008, p.9) (available at <http://www.justice.gov/atr/public/criminal/239583.htm>, accessed October 23, 2012).

incentive to apply for leniency if it can obtain a similar fine reduction through Amnesty Plus in the event that its co-conspirator applies for leniency. A similar reduction in the preemption effect occurs when the competition authority offers fine discounts for cooperating firms other than the first firm to apply for leniency.

In this way, leniency programs that link fine reductions across markets or products can create opportunities for strategic reactions that ultimately result in reduced detection and deterrence. In particular, Amnesty Plus, as well as other cooperation discounts, reduce concerns by colluding firms that they will lose the race to be first to apply for leniency, because these programs allow them to obtain discounts even if they are not first. When conspirators do not have a strong incentive to be first to apply for leniency, it may be that in equilibrium no firm applies at all. In this way, Amnesty Plus and cooperation discounts more generally reduce the incentive of firms to apply for leniency, dampening the effectiveness of a leniency program.

## 5 Conclusion

There appears to be some flexibility for cartels to negotiate settlement terms that favor them in terms of limiting expected future penalties, for example from civil litigation, in exchange for concessions to competition authority, which may include the amount of criminal fines, the number of individuals receiving prison terms, or the total length of prison terms.

Our model suggests that limited criminal pleas, for example in terms of plea length, customers affected, or geography, can handicap the ability of civil litigants to pursue damages and hence reduce deterrence. From an empirical research viewpoint, pleas must be viewed as identifying only a subset of the conspiratorial conduct, not



as a description of the full extent and exact nature of the conspiracy.

Furthermore, there are ways in which leniency policies can potentially create incentives for colluding firms to engage in collusion in additional products. As shown in Choi and Gerlach (2012a), firms colluding in multiple products may be able to coordinate their strategies across products, thereby insulating one of the products from the threat of leniency applications. Marshall, Marx, and Mezzetti (2013) show that the Amnesty Plus program, which provides fine reductions to colluding firms that reveal collusion in other products, also provides incentives for firms to engage in collusion in additional products. Extending collusion to other products provides the benefit of reducing the threat of leniency applications in the original product; colluding firms know they can obtain fine reductions through Amnesty Plus even if they are not the first to apply for leniency.

The results and discussion of this paper suggest that antitrust enforcement authorities should ensure that incentives for settlement negotiations recognize that deterrence relies on civil as well as criminal penalties and that antitrust enforcement authorities should consider the possibility of strategic abuse of leniency programs, especially the possibilities that arise when collusion in one product affects incentives for leniency applications in another product. The analysis presented here suggests value in additional case studies of cartel conduct, including internal studies conducted by enforcement agencies such as the DOJ. In addition, this analysis points to the need for enforcement agencies to continue to adjust and enhance the tools available to them, including potentially such changes as encouraging whistleblowers for collusive conduct (see Aubert, Rey, and Kovacic, 2006) or expanding the opportunities and benefits for individual leniency applicants.

## References

- Aubert, Cécile, Patrick Rey, and William E. Kovacic (2006), “The Impact of Leniency and Whistle-blowing Programs on Cartels,” *International Journal of Industrial Organization* 24(6), 1241–1266.
- Beaton-Wells, Caron (2008a), “Forks in the Road: Challenges Facing the ACCC’s Immunity Policy for Cartel Conduct: Part 1,” *Competition & Consumer Law Journal* 16, 71–113.
- Beaton-Wells, Caron (2008b), “Forks in the Road: Challenges Facing the ACCC’s Immunity Policy for Cartel Conduct: Part 2,” *Competition & Consumer Law Journal* 16, 246–285.
- Beaton-Wells, Caron and Brent Fisse (2011), *Australian Cartel Regulation: Law, Policy and Practice in an International Context*, Cambridge, UK: Cambridge University Press.
- Bigoni, Maria, Sven-Olof Fridolisson, Chloé Le Coq and Giancarlo Spagnolo (2012a), “Trust, Leniency and Deterrence: Evidence from an Antitrust Experiment,” Working Paper, University of Bologna.
- Bigoni, Maria, Sven-Olof Fridolisson, Chloé Le Coq and Giancarlo Spagnolo (2012b), “Fines, Leniency, and Rewards in Antitrust,” *RAND Journal of Economics* 43(2), 368–390.
- Buccirossi, Paolo and Giancarlo Spagnolo (2005), “Optimal Fines in the Era of Whistleblowers: Should Price Fixers Still Go to Prison?,” Lear Research Paper No 05-01.
- Buccirossi, Paolo and Giancarlo Spagnolo (2006), “Leniency Policies and Illegal Transactions,” *Journal of Public Economics* 90, 1281–1297.
- Chen, Joe, and Joseph E. Harrington, Jr. (2007), “The Impact of the Corporate Leniency Program on Cartel Formation and the Cartel Price Path,” in Vivek

- Ghosal and Johan Stennek, eds., *The Political Economy of Antitrust*, New York: Elsevier, 59–80.
- Chen, Zhijun and Patrick Rey (2012), “On the Design of Leniency Programs,” Working Paper, University of Auckland.
- Choi, Jay Pil and Heiko Gerlach (2012a), “Global Cartels, Leniency Programs and International Antitrust Cooperation,” *International Journal of Industrial Organization* 30(6), 528–540.
- Choi, Jay Pil and Heiko Gerlach (2012b), “Multi-Market Collusion with Demand Linkages and Antitrust Enforcement,” Working Paper, University of New South Wales.
- Harrington, Joseph E., Jr. (2008), “Optimal Corporate Leniency Programs,” *Journal of Industrial Economics* 56, 215–246.
- Hinloopen, Jeroen and Adriaan R. Soetevent (2008), “Laboratory Evidence on the Effectiveness of Corporate Leniency Programs,” *RAND Journal of Economics* 39, 607–616.
- Lefouili, Yassine and Catherine Roux (2012), “Leniency Programs for Multimarket Firms: The Effect of Amnesty Plus on Cartel Formation,” *International Journal of Industrial Organization* 30, 624–640.
- Marshall, Robert C., Leslie M. Marx, and Claudio Mezzetti (2013), “Antitrust Leniency with Multi-Product Colluders,” Working Paper, Duke University.
- Marshall, Robert C., Leslie M. Marx, and Matthew E. Raiff (2008), “Cartel Price Announcements: The Vitamins Industry,” *International Journal of Industrial Organization* 26, 762–802.
- Miller, Nathan H. (2009), “Strategic Leniency and Cartel Enforcement,” *American Economic Review* 99(3), 750–768.
- Motta, Massimo and Michele Polo (2003), “Leniency Programs and Cartel Prosecution,” *Journal of Industrial Organization* 21, 347–379.

- Rey, Patrick (2003), “Towards a Theory of competition Policy,” in M. Dewatripont, L.P. Hansen, and S.J. Turnovsky, eds., *Advances in Economics and Econometrics: Theory and Applications*, Cambridge, UK: Cambridge University Press.
- Sokol, Daniel D. (2012), “Cartels, Corporate Compliance and What Practitioners Really Think About Enforcement,” *Antitrust Law Journal* 78, 201–240.
- Spagnolo, Giancarlo (2000), “Self-Defeating Antitrust Laws: How Leniency Programs Solve Bertrand’s Paradox and Enforce Collusion in Auctions,” FEEM Working Paper 52.00, Fondazione Eni Enrico Mattei.
- Spagnolo, Giancarlo (2004), “Divide et Impera: Optimal Leniency Programs,” CEPR Discussion Paper No. 4840.
- Spagnolo, Giancarlo (2008), “Leniency and Whistleblowers in Antitrust,” Ch. 7 of P. Buccirossi (Ed.) *Handbook of Antitrust Economics*, Cambridge, MA: MIT Press.
- Stephan, Andreas (2009), “An Empirical Assessment of the European Leniency Notice,” *Journal of Competition Law & Economics* 5, 537–561.
- Wils, Wouter P. J. (2008a), *Efficiency and Justice in European Antitrust Enforcement*, Portland, OR: Hart Publishing.
- Wils, Wouter P. J. (2008b), “The Use of Settlements in Public Antitrust Enforcement: Objectives and Principles,” *World Competition* 31(3), 335–352.
- Wils, Wouter P. J. (2007), “Leniency in Antitrust Enforcement: Theory and Practice,” *World Competition* 30(1), 25–64.
- Zhou, Jun (2012), “Evaluating Leniency with Missing Information on Undetected Cartels: Exploring Time-Varying Policy Impacts on Cartel Duration,” Working Paper, Bonn University.