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Abstract

Cet article présente la première étude systématique de tous les cartels condamnés par la Commission européenne depuis 1969. Il fournit une analyse de leurs caractéristiques permettant de tracer leur portrait robot - secteurs concernés, nombre de parties à l'accord, évaluation du rôle des associations professionnelles, dimension géographique du cartel et causes d'éclatement. Nous étudions ensuite la durée de vie de ces cartels et estimons économétriquement les déterminants de cette durée et la probabilité instantanée de détection. Nous comparons nos résultats avec les prédictions de la théorie économique.

This article presents the first systematic study of all the cartels convicted by the European Commission, from 1969 to the present date. It provides an analysis of their characteristics in terms of affected industry, number of undertakings - evaluating the role of trade association - recidivism, geographic scope and causes of breakup. It also studies cartel lifetime, providing econometrical estimates of the determinants of cartel duration and of the instantaneous probability of detection. We present preliminary evidence on whether our findings corroborate the predictions made by economic theory.

* The opinions expressed in this paper are those of the author and do not necessarily reflect the views of its institutions.

1. Previous research offers several surveys on contemporary cartels[1]. However, these works are mostly based on international cartels or cartels convicted in the United States. To date, there is no complete analysis of cartels operating in the European Union[2]. The aim of this paper is to bridge this gap, as we present the first systematic study of all the cartels convicted by the European Commission, ranging from *the Quinine Cartel* in 1969 to *the Lifts and Escalators Cartel* in February 2007[3]. First, we analyze their characteristics and draw their profiles (I). Second, contrary to other purely descriptive works and in line with other recent studies[4], we also provide an econometrical analysis of the determinants of cartel duration (II). Finally, we estimate the probability of detection and discuss the contribution made by leniency programs to the improvement of cartel detection (III).

I. Cartel characteristics

2. Although often difficult to uncover, cartels are far from rare. From 1969 to February 2007, 86 cartels were convicted by the European Commission[5]. Starting from an exhaustive review of these cases we will put forward stylized facts and compare them to the findings of other studies and to the predictions of economic theory. We thereby rely on the analysis of the main mechanisms behind collusion and factors that facilitate it[6]. We will study the affected industries, the number of undertakings, recidivism, geographic scope and causes of breakup.

1. Affected industries

3. Table 1 summarizes the characteristics and incidence of cartels by affected sectors. Cartels affect a broad range of industries, whereby some sectors are more affected than others. The most affected industry is the chemical sector, with more than one cartel in four operating within this sector. Economic theory predicts that the occurrence of cartels is higher in industries with high barriers to entry, as in the case of chemical products[7]. Manufacturing of intermediary products is well represented – two thirds of the sample – with 20% of cartels involved in the metals and minerals sector (with multiple cartel convictions in steel products); 7% of cartels relate to machinery and equipment (among them carbon and graphite products) and 10% to wood, paper, rubber and plastic products. A significant number of cartels (20%) have also been discovered in the service industry (mainly transport and banking, but also fine art auctions). Cartels in the food, beverage and tobacco industry make up most of the

1 For a review of this literature, see Levenstein & Suslow [2001] and [2006].

2 We have not identified any other studies of international cartels focused on Europe.

3 This paper is part of a broader research work on cartel profiles and the determinants of cartel duration in the European Union that should be available by the end of the year 2007.

4 Levenstein & Suslow [2006] and Zimmerman & Connor [2005].

5 Cases for which fines have been imposed.

6 For a complete review of these factors see Motta [2004].

7 The lower the entry barriers, the more difficult to sustain collusion, as when profits are high, new firms will be driven into the industry, which tends to break collusion.

remaining part of the sample with 20% of the cases. In most cases, cartels included firms primarily selling to intermediaries and wholesale dealers. These results are consistent with economic theory according to which cartels primarily affect sophisticated and intermediate manufactured goods[8]. Hence, the only categories of products that are not well represented in our study are final retail goods and services. Levenstein & Suslow [2006], studying a sample of 72 international cartels[9], find essentially the same results: chemical products top the list (42%) the other categories being other manufacturing (38%) water transport (14%) followed by construction (4%) and services (3%).

See Table 1: Characteristics and Incidence of Cartels by Affected Sectors

2. Number of undertakings

4. In our sample, the number of undertakings across the industries varies from 4 to 42 firms, with an overall mean of 9 firms. Most of the cartels involved fewer than 10 members (two third of the cases). The number of firms is an organizational variable that previous studies and economic theory have analyzed. Theoretical models suggest that the fewer the number of firms, the more likely it is that collusion will occur. A large number of undertakings can lead to coordination problems and generate transactions costs. It also increases the incentive to cheat and makes the members' behavior more difficult to control. This reasoning is supported by the following result: when cartels included a large number of firms, trade or professional associations were involved (one third of the cases implying more than 10 firms and all cartels with more than 17 members relied on the involvement of a trade association)[10]. Finally, in the light of the results of our econometric testing, it would appear that the number of undertakings is positively correlated with the involvement of a trade association[11].

3. Recidivism

5. We define the percentage of recidivism as the proportion of cartels including at least one firm already convicted by the European Commission for its participation in a previous cartel[12]. In our sample, recidivism is significant. Indeed, in 22% of the cases, there was at least one firm part of the conspiracy that was a recidivist. More precisely, recidivists intervened in half of the cartels in the machinery and equipment industry sector. More than one third of the convicted cartels in the chemical sector were formed of at least one firm already convicted for its participation in another price fixing agreement. Overall, 32 firms were recidivists (and 19 cartels involved such firms). The average number of recidivists by cartel case was 1.6. 50% of the cases involved only one recidivist, 25% two and the remaining 25% three. Some undertakings turned out to be multi-recidivists, which is worrying, such as Solvay, Shell, ICI, Hoffman-Laroche, Degussa. The undertakings most often convicted for cartel offences are Arkema, which took part in four cartels condemned by the European Commission between 2003 and 2006, Hoechst convicted for its implication in four cartels between 1986 and 2006, and BASF. According to our econometric findings, there is no clear correlation between industry and recidivism, which means that one specific industry is not significantly more prone to recidivism than any other. Nevertheless, it is interesting to note that all cartels consisting of three recidivists belong to the chemical industry. And almost all multi-recidivists operated in this industry. Hence, the problem seems to be more severe in this industry (even if it is not more frequent). Recidivism is an important factor to analyze as it reflects the dissuasive efficiency of antitrust policy. Hence, these numerous examples of recidivism could reflect the fact that antitrust policy is not sufficiently effective in deterring cartels, implying that penalties are lower than illegal profits[13].

4. Geographic Scope

6. A cartel can be defined as international either in membership or in geographic scope. We have chosen the second definition as we consider it more accurate. Indeed, we regard the reach of cartels more relevant than their membership structures. In this respect, a global cartel is defined as a cartel operating in the European Union and, at least, one other continent (North America or Asia for instance)[14]. European cartels affect at least two countries in the European Union[15]. National cartels have a national scope, but "may affect trade between member states"[16]. In our sample, although most cartels are international in membership, they do not all have a global reach. Many of them appear, primarily, to be active in the European Union (about half of the cases) such as *the Cement Cartel*, *the Needles Cartel* and *the Lifts and Escalators Cartel*. 26% of the cases confined their activity to one country (*the French Beef Cartel* and *the Bitumen Cartel in Netherlands* for instance). Global cartels, some of which having worldwide effects, represent another quarter of the sample (such as *the Vitamins Cartel*, *the Graphite Electrodes Cartel* and *the Lysine Cartel*).

See Figure 1: Geographic Scope

8 Elasticity being lower, collusive profits are higher, and the collusive outcome is easier to reach.

9 Their study is based on cartels convicted either in the United States or in the European Union, all cases included member firms from more than one country.

10 Levenstein & Suslow [2006] found that 29% of the cases in their sample involved a trade association.

11 The greater the number of firms, the more likely a trade association will be involved in the agreement.

12 We excluded cases in which a firm was previously convicted for an abuse of a dominant position.

13 See Combe & Monnier [2007].

Connor & Lande [2005] found that 46% of the cartels in their sample[17], were national and 54% international (20% of which were global and 34% regional). Nevertheless, their methodology is different, and our results are not directly comparable. They defined a cartel as global if a significant share of the cartel's membership hails from two or more continents, and as international if members are from two or more countries. Zimmerman & Connor [2005] found that global cartels represented about 20% of their sample, defining dimension as we did. Therefore, it seems reasonable to conclude that one convicted cartel out of four (by the Department of Justice (DOJ) or the European Commission) has a global reach.

5. Causes of Cartel Breakup

7. By systematically examining breakups, we can categorize the reasons for cartel failure. Over the whole period, investigations were the first cause of cartel breakup ahead of leniency applications, complaints[18] and notifications. In our sample, there are 15 cases where a customer complaint triggered the investigation and the breakup of the cartel. The most common situation is investigations arising from any remaining sources of information (other than leniency applications, customer complaints or notifications). Leniency applications caused the termination of almost one cartel in three. What is outstanding is that since 2002[19] two thirds of cartels fined by the European Commission broke up due to leniency applications. Overall, very few of them broke up because of natural causes (such as cheating, irreconcilable disagreements among undertakings, growing fringe or a new entrant). Contrary to what economic theory suggests, our sample includes mainly convicted cartels that remain active until the Commission starts its investigations, and that subsequently put an end to their illicit agreement. Only 6 cartels[20] and 10 sub-agreements[21] out of 86 convicted cartels are dead due to natural causes. Levenstein & Suslow [2006] found that 12% of cartels terminated from natural causes, 15% from leniency application. Investigations (including follow-on investigations[22] and whistleblowers) led to the end of one cartel in two[23].

See Table 2: Causes of Cartel Breakup

14 In our sample, most global cartels operated in the triad - North America, Western Europe and Eastern Asia.

15 Except if the cartel affects only the Benelux. In this case, it is categorized as national.

16 Guidelines on the effect on trade concept contained in articles 81 and 82 of the Treaty, *OJ* C 101, 27 April 2004, p. 81.

17 Cases drawn from U.S, Canada, Europe and other continents.

18 Official complaints only.

19 This year corresponds to the introduction of the new leniency program in the European Union, with the 2002 Commission Notice on immunity from fines and reduction of fines in cartel cases (Official Journal C 45, 19.02.2002, p. 3-5), replacing the 1996 Commission Notice (Official Journal C 207, 18.07.1996, p. 4-6) which was considered insufficiently efficient.

20 *The Quinine Cartel* convicted in 1969, *the Zinc Producer Group Cartel* convicted in 1984, *the FENEX Cartel* convicted in 1996, *the Ferry operators Cartel* convicted in 1996, *the Citric Acid Cartel* convicted in 2001 and *the Hydrogen Peroxide and Perborate - PBS - Cartel* convicted in 2006.

II. Cartel Duration

1. Methodology

8. Our calculation of cartel lifetime in days is based on the estimates made by the European Commission in order to calculate the amount of the fines. These durations are reported in the Commission's decisions. In most of the cases, it is presumed that the cartel lasted longer than the duration that served to calculate the fine. Hence, durations used in our empirical work are probably underestimated and must be seen as lower bounds. The beginning date of the cartel corresponds to the date at which the first proofs of collusion were found (secret meetings, etc…) and not necessarily to the true starting date of the cartel. Therefore it is likely that the cartel's date of birth is in fact earlier than the date put forward by the firms. As the fine is positively correlated to cartel duration, firms have no interest in disclosing the true starting date of collusion[24]. In the same way, the end date of the cartel does not always correspond to its date of detection. Some cartels break up before being detected. In such cases, firms can prove that the cartel has been inactive for many years. These cartels are naturally dead. It can also happen that collusion goes on after detection[25] but we will not consider this hypothesis, as it is very hard to assess. Therefore, we suppose that detection triggers the end of the cartel. As the duration of each firm's own participation in the cartel is not necessarily the same, we use the global duration of the cartel, as indicated in the Commission's decision. Last, we must explain how we dealt with intertwined cartels with several sub-agreements. Usually, the Commission decision only contains the global duration of the cartel and there is no distinction made between the different sub-agreements. Nevertheless, in the three following cases: *the Vitamins Cartel*, *the Special Graphite Cartel*, and the *Peroxygen Cartel*, the Commission distinguished between the sub-agreements on different markets, dividing up their durations. For these cartels,

21 In a lot of cases, firms have agreed to collude on several markets, these agreements being regrouped under the aegis of a sole cartel. For instance, the *Vitamins Cartel* lasted for 10 years and relates to agreements on nine vitamins and four chemicals, and the 22 producers involved did not participate to all the agreements. Nine sub agreements of *the Vitamins Cartel* are dead before their detection because of the increase in Chinese imports, and one sub agreement of *the Specialty Graphite Cartel* is dead before its detection.

22 A follow-on investigation relates to an antitrust authorities-initiated investigation followed from the investigation of another cartel.

23 This work is not based on the same sample, which can explain the differences with our results.

24 For more details, see Levenstein & Suslow [2001].

25 For instance, in its decision 94/599/CE relating to *the PVC Cartel* in 1994, the Commission explains that (§49 of the decision):"*in the absence of information from the producers, it is not even possible to establish whether or not the collusion (in some form or other) has ever ended. Clearly the cartel continued after the Commission carried out its first investigations into the PVC sector in late 1983. The document found at Atochem shows that monitoring of sales quotas was being operated and information exchanged. as late as May 1984. The phenomenon of initiatives involving several producers simultaneously attempting to raise price levels to a particular level was still being reported in the trade press at the time of the investigation in 1987*". The final date used by the Commission being May 1984. Levenstein & Suslow [2006] also mention the case of *the Organic Peroxides Cartel*.

we have calculated the mean duration of the various agreements. For all other intertwined cartels, we took the global duration, as reported in the Commission's decisions.

Most decisions contain precise start and end dates (day, month, year). But for some cases, the most precise identification is to the month, in other cases only the year is given[26]. We therefore use two methods to calculate cartel duration. The first method defines a minimum duration to be the period from the latest start day to the earliest end day (for instance if the decision indicates that the cartel began in 1971 and continued to at least October 1975, the latest beginning day is December 31, 1971 and the earliest end day is October 1, 1975). The second method defines the maximal duration to be the period from the earliest begin day to the latest end day. In the above example, the earliest start day is January 1, 1971 and the latest end day is October 31st, 1975.These two measures give us a range of values.

2. Results

See Table 3: Cartel Duration

9. In our study, the average cartel lasted a relatively long time, between 7.4 and 7.8 years. A significant fraction of theses cartels lasted more than 10 years (22%) and a great majority more than five years (66%). The standard deviation of cartel duration is about 6 years, implying that there is a huge variability in cartel duration. Examining individual cartels reinforces this assessment. The cartel with the shortest duration survived only a few months (*the French Beef Cartel*) and the longest lasted 30 years (*the Industrial Bags Cartel*)[27]. The median lifespan is 5.8 years[28], lower than the mean duration. The existence of a small number of cartels with very large durations rises the mean duration of our sample. If we compare the mean and the variance obtained by previous studies, it highlights the reliability of our results. As shown in table 5, cartel duration found in other studies of international or American cartels is comparable.

See Table 4: A Comparison with Other Studies on International Cartel Duration

From this analysis, we can conclude that the Chicago argument, based on Stigler's assertion is not empirically verified[29]. Indeed, the mean duration is 7 years (cartels do occur) and the standard error is high, with a median lower than the average duration (cartels can last for a very long time). Hence, there is no doubt that cartels can be stable, which implies that members have managed to solve the incentive problem[30].

3. Determinants of Cartel Duration

10. In order to better understand the determinants of cartel stability in Europe, we explored the correlation between cartel duration and four explaining variables – number of undertakings, professional organization involvement, cartel dimension (global, European or national) and industry specific conditions – which economic theory and empirical studies[31] suggest should be related to cartel duration.

See Table 5: Determinants of Cartel Duration

There are a number of reasons to expect that cartel duration is negatively related to the number of undertakings in the cartel. A large number of firms creates coordination problems and increases the likelihood that a firm is willing to cheat. Empirical results, however, are inconclusive, as the potential intervention of a trade association (solving these organizational problems) releases the tie between duration and number of undertakings. We find that cartel duration is increasing with the number of firms, but the coefficient is not significantly different from zero. Zimmerman & Connor [2005] found that a large number of firms make disagreements more likely. As cartel dimension increases, the cartel should be more stable and should last longer (as multi-market contacts help to stabilize cartels). In our study, global cartel duration is typically long, their mean duration being 8.5 years, whereas the overall average is 7.5 years. Connor [2005] also finds that global cartel duration is longer than other cartel duration[32]. We do not find that industry specific conditions affect cartel duration, as our coefficient is not significant. Zimmerman & Connor [2005] underline that industry specific conditions may determine cartel duration. Particularly, they find that belonging to the chemical sector is positively related to cartel duration. Last, the intervention of a professional organization should positively influence cartel lifetime (organizational issues being solved). Neither our study, nor that of Zimmerman & Connor [2005] confirm this statement (the coefficients being non significant)[33].

26 Particularly for decisions not yet published.

27 Other short-lived cartels include the Ferry Operators Cartel, the Maritime Transport Cartel, the Vegetable Parchment Cartel, the Preserved Mushrooms Cartel. On the other hand, there are numerous examples of long-lived cartels, such as the Organic Peroxides Cartel, the Peroxygen Products Cartel, the Sorbates Cartel, the Vitamins Cartel etc…

28 This means that 50% of the cartels lasted more than 5.8 years.

29 Stigler [1964] was the first to argue that cartels are instable as that once firms have decided to form a cartel, each undertaking has an incentive to cheat, lowering its price. It would imply that average duration should tend to zero. See also Armentano[1996].

30 Among other things, monetary transfers between members and credible punishment for cheaters can help cartel members to stabilize their collusive agreement.

31 See Zimmerman & Connor [2005] and Levenstein & Suslow [2006]. They regressed the probability for a cartel to break up (not duration) on explanatory variables. Nonetheless, economic predictions based on the theoretical model of collusion are the same, as an increase in the probability of cartel break up should reduce cartel duration.

32 He found that modern area private international cartels endured a mean of 6.4 years and that the average global cartel lasted 7.6 years.

33 While these hypotheses of correlation are clear for natural cartel duration (i.e. for cartels terminating from natural causes) it is less obvious that they apply to cartel terminating because of prosecution. However, as Levenstein & Suslow [2006] pointed out, the key instrument used by antitrust authorities in uncovering cartels since the mid-1990s has been the offer of leniency programs. A shock (a growing fringe for instance) that would cause a colluding firm to defect from the cartel, could also drive the firm to report the cartel. Therefore, a naturally dead cartel would also be categorized as a cartel terminating because of a leniency application.

III. The Probability of Getting Caught

1. Cartel Detection Process

11. Some cartels are never detected and remain unknown. Therefore, the whole population of cartels, which comprises detected cartels and cartels that went undetected, can be divided into two. Furthermore, cartels that will ultimately be detected, can be caught after their natural death or while they are still alive[34].

Hence, we can classify cartels into three subpopulations:

- undetected cartels: denoted population

- cartels detected *ex post* (after their natural death): denoted population

- cartels detected while they are alive: denoted population

We consider that cartels appear according to a random variable ı (the birth process). Second, we suppose that each cartel has a natural lifetime (Di=D). For each cartel born, two events can occur. Either, it will finally be detected at a given time by the antitrust authorities (with probability q) or it will escape the detection process, and ultimately belong to the undetected cartels (with probability 1-q). For these cartels, the detection process (that can be viewed as the intensity of the detection process)[35], is specified by the parameter Ï. Hence, if Li (detection duration) is shorter than Di (natural lifetimes) then the cartel terminates while being uncovered.

See Figure 2: Cartel Birth, Death and Detection Processes

2. The Instantaneous Probability of Detection

12. Bryant & Eckard [1991] were the first to estimate the probability of cartel detection. Their estimation was based on an American sample of cartels indicted by the DOJ between 1961 and 1988. Their paper became the most quoted work on this issue. Nevertheless, the results were often improperly quoted. Indeed, in the literature related to optimal fines[36], the authors often refer to a value of 15%, as the average probability of getting caught, as Bryant & Eckard estimated a probability that falls between 13% and 17%. But this 15% rate is the annual probability of getting caught for cartels which will eventually be caught. Bryant & Eckard showed that the average cartel lasts about five to seven years, and that a new one (ultimately detected) emerges about every 54 days (seven per year on average).

Using the same framework, Combe & alii [2007][37] calculate the detection duration and the probability of detection (if all cartels were eventually be convicted) over our sample of cartels condemned by the European Union, as there is no data regarding undetected cartels or on cartels detected but not convicted. The detection duration is about 7 years and a new cartel, which will eventually detected, is born every 6 months. The probability of getting caught in a given year, conditional on being detected, is between 12.9% and 13.2%, which represents an upper boundary to the global probability of detection[38]. Therefore, the probability of detection in a given year is at most between 12.9% and 13.2%.

See Table 6: Parameter Estimates

3. The Introduction of Leniency Programs

13. If we focus on cartels born after 1996[39], it appears that the number of detected cartels has increased. After 1996, the European Commission detected, on average, 5 cartels per year, whereas before 1996, only 1.64 cartels were uncovered[40] annually. It could imply that the intensity of detection is higher than it used to be[41]. It also could result from an increase in the birth rate of cartels after 1996[42]. We do not know how many cartels appeared during the whole period (as some remain unknown) therefore this hypothesis cannot be verified.

34 In this case, we suppose that cartel detection leads to the end of the collusive agreement.

35 Indeed, if the Ï parameter is high, detection intervenes rapidly and cartel duration is reduced.

36 Starting from Becker [1968].

37 Our methodology is slightly dissimilar, as we selected more precise data and focused on detection duration (whereas Bryant and Eckard used cartels lifetime, as a proxy for this duration). Detection duration corresponds to the duration between the birth of the cartel and its detection.

38 Buccirossi & Spagnolo [2005] were the first to explain that Ï would be the global annual probability of detection if all cartels were eventually detected. But if 10% of cartels are ultimately detected, the annual probability of detection would amount to one tenth of Ï, if 1% of cartels are detected ultimately, the annual probability would amount one hundredth of Ï.

39 Introduction of leniency programs in the European Union.

40 There is not enough data to estimate our parameters after 1996, but it will be crucial to do so later on.

41 Economists and lawyers have put forward that leniency programs should lead to an increase in the number of detected cartels, which is empirically observed.

42 Motta & Polo [1996] show that leniency programs could induce an increase in cartel formation, as the average expected fine decreases. Aubert & alii [2006] demonstrate that these programs, if well designed, reduce the incentive for a firm to form a cartel. Therefore, in the first step, we should observe an increase in the number of detected cartels (dissolution of cartels formed before the introduction of leniency programs). And later on, one should observe a decrease in the number of detected cartels as a result of a smaller number of cartels alive (as fewer cartels form).

Conclusion

14. We surveyed all the cartels convicted by the European Union from 1969 to 2007. We presented preliminary evidence on whether these stylized facts regarding cartels characteristics' corroborate economic theory predictions. Cartels can form in any industry sector and can encompass many undertakings. Our examination of cartel duration concludes that cartels are neither short-lived nor long-lived; they are both, and the average duration is quite long, which is in contradiction with Stigler's assertion. Unfortunately, recidivism is frequent, which could imply that fines imposed by the European Commission have been under their optimal level as regards dissuasion[43]. In our examination of cartel breakdowns we find, as suggested by recent theoretical literature, that whistle blowing has became the common cause, thanks to the introduction of leniency programs. We also estimate the instantaneous probability of detection, showing that it rises after 1996, which implies that the European Commission has enhanced its efficiency in catching firms that form cartels. Leniency programs, in particular, would appear to have contributed to this improvement. ■

43 See Combe & Monnier [2007].

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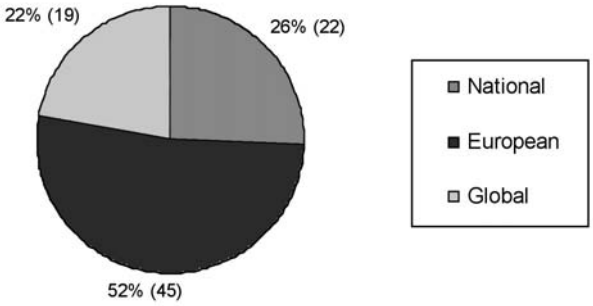
TABLE 1: Characteristics and Incidence of Cartels by Affected Sectors

Industry	Number of cases (86)	Percentage	Number of undertakings (mean)	Recidivism (% of cases)
Metal and non-metallic mineral products	17	20%	12.6	29%
Machinery and equipment	6	7%	9	50%
Wood, paper, rubber and plastic products	9	10%	15.7	11%
Textile, construction	3	3%	15	0%
Chemicals and chemical products	22	26%	5.5	36%
of which:				
Basic chemicals	*12*	*14%*	5	*42%*
Pharmaceutical preparations	*1*	*1%*	4	*0%*
Other chemicals	*9*	*10%*	6.4	*44%*
Services (business activities, banking and transport)	17	20%	6.6	0%
Food products, beverage and tabacco	12	14%	5.7	17%
TOTAL	86	100%	8.8	22%

FIGURE 1: Geographic Scope



Number of cases in brackets

TABLE 2: Causes of Cartel Breakup

Causes of Cartel Breakup	Total number of cases	Percentage	Number of cases since 2002	Percentage since 2002
Leniency Application	25	29%	21	68%
Customer or Client Complaints	15	17%	1	3%
Notifications	6	7%	0	0%
Investigations	34	40%	8	26%
Other (Natural Causes)	6	7%	1	3%
Total	**86**	**100%**	**31**	**100%**

TABLE 3: Cartel Duration

Sector	Min duration (years)			Max duration (years)		
	Median	Mean	Standard error	Median	Mean	Standard error
Metal and non-metallic mineral products	5.65	7.51	4.29	6.00	7.78	4.45
Machinery and equipment	7.99	8.46	4.19	8.98	9.19	4.82
Wood, paper, rubber and plastic products	4.76	7.37	8.78	6.00	7.93	8.65
Other (textile, construction)	11.67	13.28	8.88	11.67	13.28	8.88
Chemicals and chemical products	6.50	8.43	6.60	7.04	9.04	6.50
of which:						
Basic chemicals	*7.23*	*9.55*	*8.10*	*7.23*	*10.12*	*8.06*
Pharmaceutical preparations	*8.6*	*8.6*		*8.75*	*8.75*	
Other chemicals	*5.00*	*6.91*	*4.51*	*7.00*	*7.62*	*4.31*
Services (business activities, banking and transport)	4.84	6.01	5.35	4.99	6.14	5.54
Food products, beverage and tabacco	5.25	5.79	3.71	5.25	5.80	3.71
TOTAL	5.50	7.46	5.82	5.98	7.80	5.90

TABLE 4: A Comparison with Other Studies on International Cartel Duration

	Mean Duration	Median	Standard Error	Nb of cases
Combe & alii [2007]	7.6	5.7	6,0	86
Bryant & Eckard [1991]	6.25	4.705	na	184
Zimmerman & Connor [2005]	6.3	4.4	na	166
Levenstein & Suslow [2006]	7.5	na	5.4	72

n/a : non available

Table 5: Determinants of Cartel Duration

	Economic theory predictions	Combe & Monnier (2007)	Levenstein & Suslow (2006)	Zimmerman & Connor (2006)
Dependent variable				
Number of undertakings	(-)	(-) ns	(-) ns	(-)
Geographic scope	(+)	(+)for global cartels	(-)	n/a
Industry-specific conditions	(+) if entry barriers, concentrated industry	(+) for chemicals ns	(+ for chemicals) ns	(+) for chemicals, machinery and equipments & electronical products)
Trade Association	(+)	(-) ns	n/a	(-) ns

ns: non significant at a 10% threshold.
n/a: non available.
(+) positive relation between the variable and cartel duration
(-) negative relation between the variable and cartel duration.

FIGURE 2: Cartel Birth, Death and Detection Processes

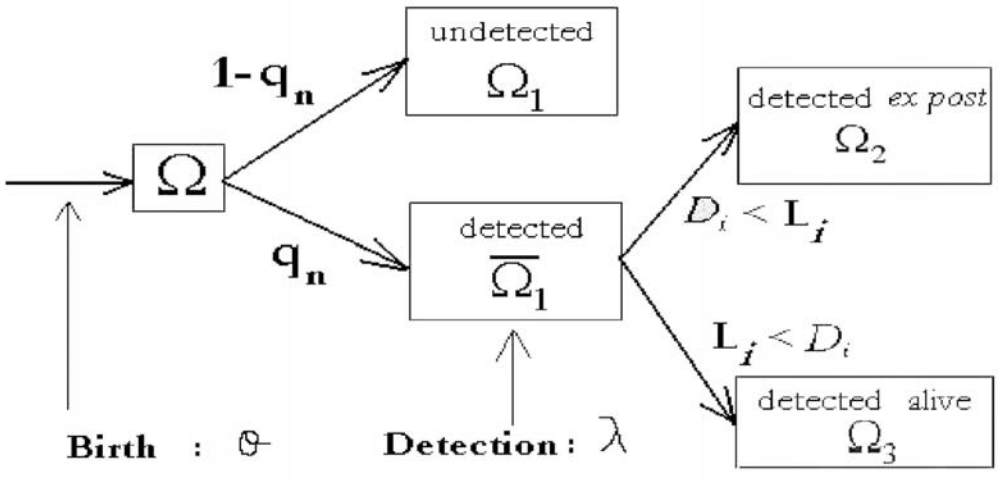


TABLE 6: Parameter Estimates

	ë*	1/ë**	è***	1/è****
Combe & alii [2007]				
DUR Min (years)	0.132	7.533	7.3	0.137
DUR Max (years)	0.129	7.702	7.3	0.137
Bryant & Eckard [1991]				
DUR Min (years)	0.191	5.235	6.825	0.147
DUR Max (years)	0.138	7.267	6.825	0.147

* Probability of cartel detection on a given year
** Mean detection duration
*** Probability of cartel birth on a given year
**** Mean interrarival times

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