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Editor:

Prof. Dr. Hans-Theo Normann
Düsseldorf Institute for Competition Economics (DICE)
Phone: +49(0) 211-81-15009, e-mail: normann@dice.uni-duesseldorf.de

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Legal and Illegal Cartels in Germany between 1958 and 2004*

Justus Haucap, Ulrich Heimeshoff and Luis Manuel Schultz**

Abstract

This paper offers a new and broad insight into the landscape of German cartels, utilizing a unique dataset of all illegal horizontal cartels detected by the German Federal Cartel Office (FCO) between 1958 and 2004 and all legal cartels authorized during the same time period. We also provide the first comparison of legal and illegal cartels in Germany. Legal cartels tend to last longer and to have more members than illegal cartels, while there are little differences with respect to the industries involved. The construction industries are the most cartelized sectors in Germany (29.8% of all legal cartels, 43.2% of all illegal cartels) followed by manufacture of metals and machinery (21.9% of all legal cartels, 30.6% of all illegal cartels). How the number of cartel members affects the duration of cartels is ambiguous. Cartels with no more than 12 members tend to last longer than cartels with more than 12 members. However, cartels with 5 to 12 members also tend to last longer than cartels with less than 5 members.

* we would like to thank our discussant, Lieselotte Locher, and other seminar participants at the 39th economic seminar at Ottobeuren for most helpful comments and discussions.

** Heinrich-Heine-University of Düsseldorf, Düsseldorf Institute for Competition Economics (DICE), Universitätsstr. 1, D-40225 Düsseldorf, Germany. Fax: 0211-81-15499, email: haucap@dice.uni-duesseldorf.de, heimeshoff@dice.uni-duesseldorf.de, schultz@dice.uni-duesseldorf.de.

1. Introduction

While Germany used to be the “land of the cartels” until World War II, it was also the first European country that introduced serious anti-cartel laws in 1958, following an intense debate in the public arena, the press and also in its parliament, the “Bundestag”. Moreover, one of the most independent cartel authorities, the Federal Cartel Office (FCO), in German: “Bundeskartellamt”, was established. The FCO is organised in a court-like manner so that no even its president can overturn a decision of any of the Office’s chambers. While Germany does have the longest tradition of anti-cartel policy and enforcement in Europe, there is surprisingly little empirical work on cartels and cartel policy in Germany after World War II. Notable exceptions are Audretsch (1989), Dönnebrink (1995), Schwalbach and Schwerk (1999), and Lauk (2003). Among these papers, the first three exclusively focus on legal cartels that have been exempted from the general cartel prohibition enshrined in §1 of Germany’s Law against Restraints of Competition (“Gesetz gegen Wettbewerbs-beschränkungen (GWB)”).

In fact, one of the particularities of the GWB was not so much that it generally prohibits cartels in its §1, but rather that it explicitly named various exemptions from its general cartel prohibition in §§ 2 to 7. Until the GWB was changed in 2005, firms were given the opportunity to formally apply for a legal exemption from the general cartel prohibition. The various exemptions are explained in more detail in the next section of our paper.

An overview over different exemptions from the general cartel prohibition is also provided by Audretsch (1988) who focuses on the so-called rationalization cartels, concluding that they tend to increase prices and to reduce quantities, thereby lowering allocative efficiency. In contrast, Schwalbach and Schwerk (1999) focus on the stability of legal cartels in Germany, analyzing the cartels’ survival probabilities. Finally, Dönnebrink (1995) examines various types of exemptions and analyses how often various types of cartels are exempted from the general prohibition.

To our knowledge the only economic analysis dealing with a cross-section of illegal cartels in Germany has been provided by Lauk (2003) who examines cartels that have been detected and fined by the FCO between 1985 until 2000. The focus of her analysis is on the question whether the cartels fined by the FCO share certain

characteristics. To be more precise, Lauk (2003) finds that the markets in which cartels have been detected share a number of market characteristics.[1]

Finally, Hahn and Normann (2001) have provided an in-depth case study of a long-lasting cartel of power cable producers, explaining the exact working mechanism of that cartel.

While the empirical literature about cartels in Germany is rather thin, there has been, quite in contrast, a growing body of economic literature that empirically analyses international cartels. Two developments can be distinguished here. While a number of papers have used extensive datasets to analyse factors that determine the success and/or duration of cartels (see, e.g., Hay and Kelley, 1974; Levenstein and Suslow, 2006; Harrington, 2006), the forensic analysis of cartels has focused on specific cartels, analysing the exact mechanisms of a cartel or calculating the overcharge or the damage for consumers (see, e.g., Schinkel, 2008; Connor, 2008).

The scarcity of empirical literature about cartels in modern Germany results in large parts from the lack of easily accessible information, as neither the courts nor the FCO systematically collect data on cartels. There has been no database on German cartels after World War II, while cartels before World War II are reasonably well documented.[2] Moreover, while decartelization measures were introduced directly after World War II (see Emmerich, 2006), the cartel authorities remained rather inactive and did hardly apply the new cartel law (Ortwein, 1998; Schmidt, 2005). Consequently, there is virtually no information about cartels between 1945 and 1958 when the new competition law, the GWB, was enacted. Therefore, our analysis starts in 1958.

This paper adds to the rather thin economic literature on cartels in modern Germany and empirically describes and analyses legal and illegal cartels in Germany. The main purpose of this paper is to shed some light on cartels in Germany and their characteristics from an empirical perspective. Hence, this paper aims at closing a gap within the economic literature on cartels in Germany.

[1] Similarly, Lorenz (2006) focuses on market characteristics that can be used to screen markets in order to detect cartels more easily.

[2] Driven by the belief that cartels are beneficial as they lead to price stability by avoiding price fluctuation in times of economic instability (Schmoller, 1906), cartels were legal and price fixing contracts enforceable in the courts. It has been estimated that some 2000 to 4000 cartels existed at the end of the 1920s (Kling & Thomas, 2007). Also see Richter (2007) for a description of cartels in Germany before World War I.

For this purpose, we have created a unique dataset consisting of all 864 legal cartels approved by the FCO from its foundation in 1958 until the GWB was changed in 2005 to switch from a system of official approval to a system where firms have to self-assess the legality of their eventual cooperation. Furthermore, our dataset includes all of the 95 illegal horizontal cartels that have been detected and fined by the FCO over the same period. This dataset allows us to obtain some first insights into the development and economic history of cartels in Germany since World War II.

The remainder of this contribution is now organized as follows: In the next section we briefly describe the exemptions from the general cartel prohibition that have been enshrined in Germany's competition law until 2005. Section 3 then briefly describes our dataset, before sections 4 and 5 provide some detailed descriptive statistics over legal and illegal cartels in Germany, respectively. In section 6, we provide some more in-depth empirical analysis of factors (a) affecting cartel fines for illegal cartels and (b) cartel duration for both legal and illegal cartels. Finally, conclusions are drawn in section 7.

2. Legal and Illegal Cartels in Germany

The cartel prohibition enshrined in §1 of the GWB is a central part of Germany's competition law since 1958. According to §1 GWB any agreement, arrangement or coordinated behavior that prevents or restrains competition is prohibited. However, as mentioned above, until 2005 Germany's competition law used to be characterized by several exemptions from this general prohibition. To be more precise, firms had the possibility to obtain an authorization for their cartel, as long as the firms could demonstrate (or argue) that their cartel lead to an efficiency gain for the participating firms that was sufficiently large to also benefit consumers in the form of lower prices (see Audretsch, 1989, and Dönnebrink, 1995). The following exemptions were enshrined in §§2 to 8 GWB until 2005:

Condition cartels: According to the old (pre 2005) §2 GWB, agreements about general terms and conditions of business, delivery and payment were permissible, as long as they did not concern prices or price elements. The ground for this exemption was the idea that condition cartels are likely to improve market transparency, thereby improving the efficiency of market transactions (by reducing search and bargaining costs) so that they have been considered to be precompetitive.

Rebate cartels: According to the pre 2005 §3 GWB, agreements about rebates and discounts were permissible The ground for this exemption was also the idea that rebate cartels are likely to improve market transparency, thereby improving the efficiency of market transactions (by reducing search and bargaining costs) so that they have been considered to be precompetitive. In addition, they were thought to prevent undesirable forms of "cut-throat competition" and unfair price discrimination.

Crisis cartels: According to the pre 2005 §4 GWB the coordinated adjustment of productive capacity in consequence of a non-temporary reduction of demand (i.e., in shrinking industries) was permissible. Hence, in times of structural change industries were allowed to collectively agree on how to reduce excess capacities. The idea was that market forces may not be sufficient to eliminate excess capacity in an efficient manner.

Rationalization cartels: According to the pre 2005 §5 GWB various forms of agreements were permissible if the arrangement served to rationalize economic activities and would lead to an increase in productive efficiency and an improvement in consumer welfare. The pre 2005 §5 (1) GWB allowed for the uniform application of standards, while old §5 (2) GWB allowed for arrangements that lead to an increase in "technical, organizational, or economic efficiency". Finally, the old §5 (3) GWB made rationalization in conjunction with price agreements or the establishment of joint purchasing or selling organizations admissible. Hence, there have been three types of rationalization cartels: Standardization cartels concerned the uniform application of norms. The second type of rationalization cartel, (i.e., "simple rationalization cartels") involved agreements to reduce transport and inventory costs, and to stabilize "excessive" demand fluctuations. And, finally, "syndicate" cartels involved agreements on prices, production quotas, exclusive territories, customers, and marketing and procurement facilities.

Specialization cartels: In addition to the pre 2005 §5 GWB, the old §5a GWB allowed for specialization cartels in order to rationalize economic activities if a substantial degree of competition was expected to continue to exist in the relevant market.

Cooperation cartels: Finally, cooperation cartels on variables other than specified in the old §5a GWB were admissible under the pre 2005 §5b GWB. As with the old §5a GWB "competition must not be substantially impaired" for a cooperation cartel to be

admissible. The intent was to allow small and medium-sized enterprises to cooperate to achieve critical production quantities in order to facilitate competition of smaller and larger firms and to reduce barriers to entry, thereby increasing effective competition in the long run.

Export cartels: First of all, pure export cartels that had no effect on the domestic market were not under the jurisdiction of the GWB. Secondly, export cartels were permissible by the FCO under the old §6 GWB as long as they did not violate trade agreements or other international treaties. The objective of export cartels was to ensure competitiveness of German exporters in foreign markets without any or with less strict antitrust laws.

Import cartels: Under the pre 2005 §7 GWB import cartels could be permitted in order to support German importers by bundling domestic demand in order to create buyer power to obtain price reductions and to be more competitive compared to foreign importers.

Minister (emergency) cartels: Under the old §8 GWB the Federal Minister of Economics had the power to authorize any type of cartel that did not satisfy the conditions for exemption under §§ 2 to 7 GWB if it was considered to be in the public interest and if there were no other legislative or economic measures to avert a danger to the continued existence of a majority of the enterprises in an economic sector.

When the 7th amendment of the GWB was enacted in 2005, the numerous exemptions outlined above, where cartels could be authorized ex ante, were replaced by a general legal exemption system where firms have to self-assess the legality of nay cooperation. This has brought Germany's competition law (GWB) in line with then article 81 (3) of the European Treaty (now: article 101 (3) of the Treaty on the functioning of the European Union). Hence, legal agreements are no longer authorized by the FCO and, therefore, also not documented in its files. For this reason our database ends in 2004.

3. The Dataset

As mentioned above, almost all legal cartels had to be authorized by the FCO, with the particular exception of export cartels that did not affect German customers at all.

Until 2004, the FCO published information on authorized cartels in its annual reports. Our dataset of legal cartels contains all authorized legal agreements and is, therefore, complete (apart from export cartels). For our dataset the information contained in the annual reports is completed by data of around 5000 decisions taken by the FCO between 1958 and 2004. The dataset contains the *name of the cartel*, the *industry* concerned, the *type of cartel*, the *number of its members*, the *duration of the FCO's investigation* and the *duration of the cartel*.

In contrast, out dataset of illegal cartels is obviously not complete. There are two types of problems. Firstly, illegal cartels try to conceal their existence, exactly because they are illegal. Since the antitrust authorities' detection rate is below 100 percent, our dataset cannot contain every single illegal cartel that has existed in Germany since 1958. Secondly, even the information about the cartels detected by the FCO is not complete. As cartels try to minimize their fines when detected, they do not reveal all details of their agreements that may proof their guilt. At the same time, antitrust authorities face limited resources and often stop their investigations as soon as they have collected sufficient information in order to win the case even if they have not documented all details of a cartel's working. In addition, the FCO does not publish all information gathered during the investigation as some corporate data is classified as confidential. Hence, our dataset only contains information revealed by the FCO during the investigations and published by the FCO after closing the file. The data is, therefore, not complete. However, the dataset contains the *name of the firms and persons fined (with their position in the firms)*, the *fines against firms and persons*, the *domicile of firms and persons*, the *industry*, the *duration of the cartel*, the *year of detection*, the *type of agreement* and some information on the *demand side*.

A full description of our variables and some descriptive statistics can be found in Tables A1 and A2, respectively, in the Appendix.

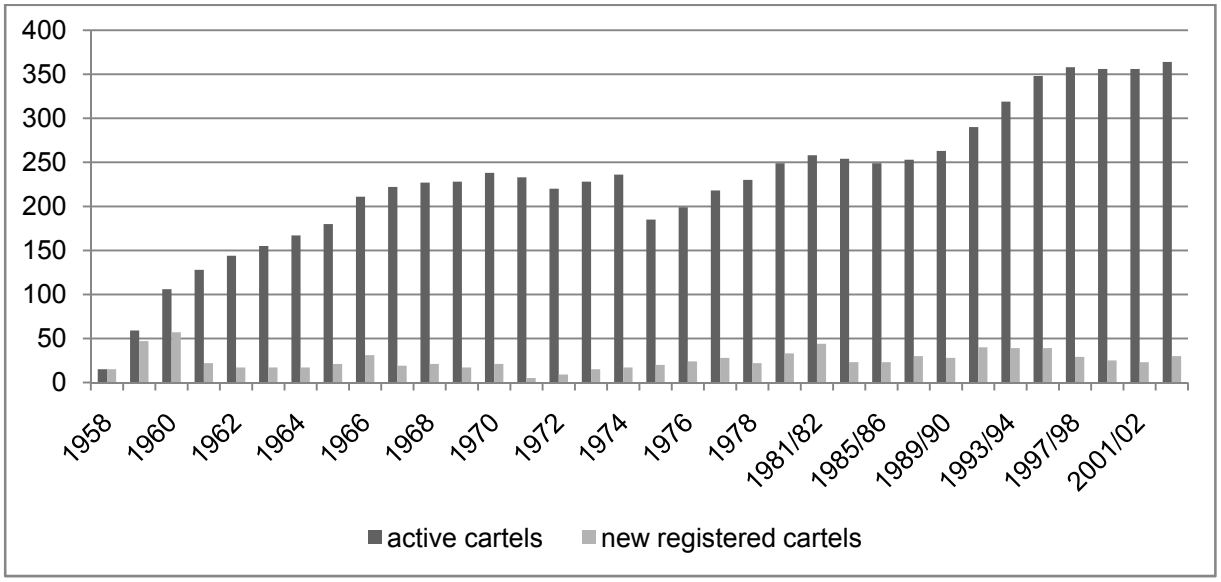
4. Legal Cartels in Germany

4.1 Number of Legal Cartels

Between 1958 and 2004 the FCO registered 864 legal cartels, of which 187 were authorized by State Cartel Offices (SCO). Furthermore, another 204 cartels applied for an authorization which was denied by the FCO.

While only 15 cartels were registered in 1958, in 1959 and 1960 there were 47 and 57 cartels authorized, respectively. Some of them had already existed for decades then. During the 1960s the number of authorized agreements grew by around 18 new cartels per year. How the number of cartels has developed over time, is illustrated in Figure 1.

Figure 1: New and Active Legal Cartels



At the end of the 1960s a relatively stable level of 230 active legal cartels was reached. In 1974, however, the number of published legal cartels was reduced to 190, as the number of legal export cartels has not longer been published, following the 2nd amendment of the GWB in 1973, in order to better protect export cartels against foreign sanctions[3]. In the following, the number of new cartels was quite constant around 15 to 20 new cartels per year, and in the 1980s the number of authorized cartels reached again 250 registered cartels. After the German

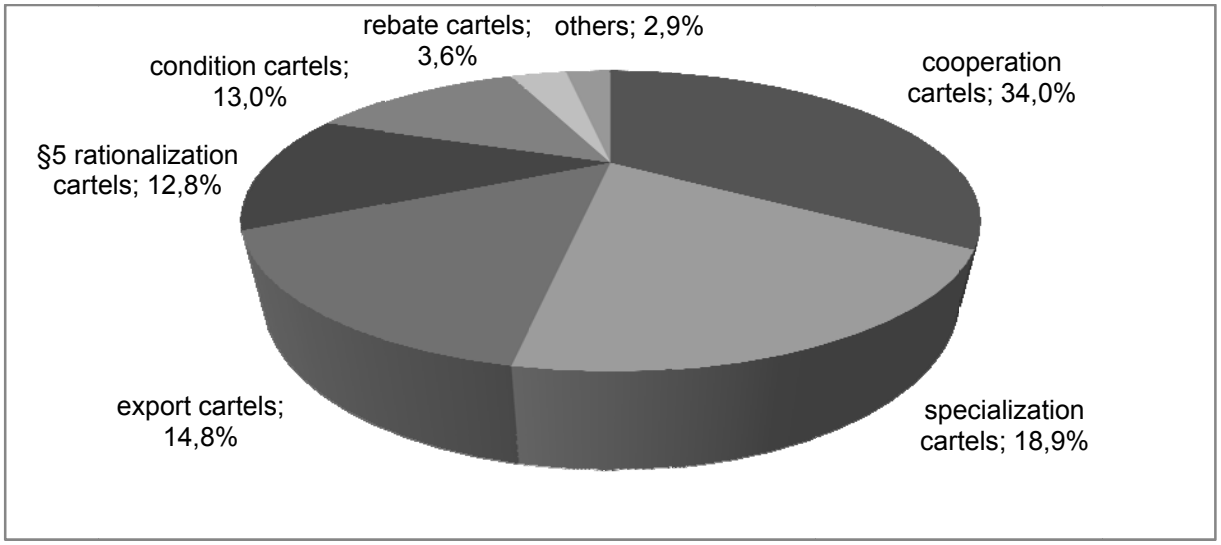
[3] Until 1974 export cartels were published without the names of the companies involved.

reunification the number of registered cartels increased up to 350 and stayed at this level until 2004.

4.2 Types of Cartels

Considering the several exemptions of the general cartel prohibition it is rather obvious that the freedom to compete was never the only goal of German competition law. In order to promote German businesses and in particular small and medium-sized enterprises the GWB allowed for an exemption for *rationalization cartels*. In facts, in our database two thirds of all legal cartels had been authorized as some sort of rationalization cartel. While 52.8% of the cartels are specialization and cooperation cartels under §5a and §5b GWB, respectively, another 12.8% are rationalization cartels authorized under the old §5 GWB.[4]

Figure 2: Types of Legal Cartels



Some of these cartels are rather cumbersome. For example, since 1987, around 460 driving schools in Baden-Württemberg formed a total of 29 rationalization cartels, most of which still existed in 2004. According to information from the SCO in Baden-Württemberg these driving school cartels agreed on minimal class sizes in order to increase their profitability. Furthermore, the legalization of these cartels was

[4] For a detailed analysis of rationalization cartels see Audretsch (1989)

apparently especially supported by the former director of the SCO, following the notion that driving schools had structural problems. Interestingly enough, driving schools in other federal states did not face the same problems, as Baden-Württemberg was the only federal state where this type of cartel was registered.

The *export cartels* registered until 1973 represent 14.8% of all legal cartels in our database. They include agreements for the export of products ranging from mesh wire fences to submarines. The actual number of export cartels is not available.

12.2% of all legal cartels are agreements about *conditions*, *types* and *standards* such as agreements on flour classification or about the introduction of a bottle deposit system. Other interesting agreements include condition cartels of several cemetery gardeners in Rheinland-Pfalz and Hessen. Unfortunately though, we have not been able on what the cemetery gardeners agreed.

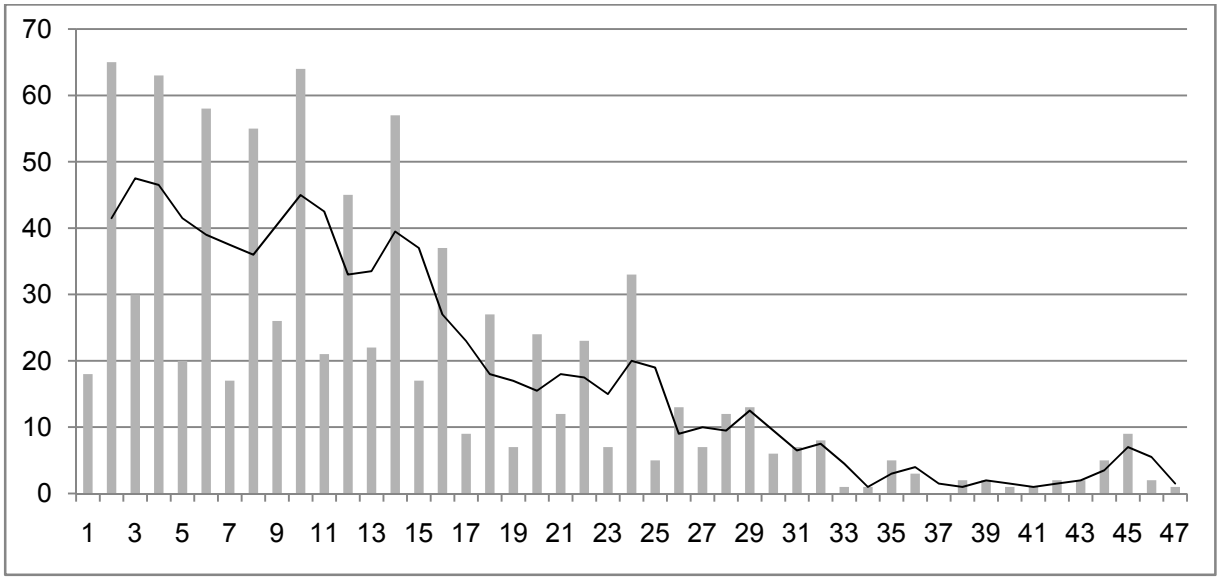
Legal *rebate cartels* have been less important and account for only 3.6% of all legal cartels while “other cartels” (2.9%) include *structural crisis*, *import* and *buyers cartels*.

4.3 Duration of Legal Cartels

The average duration of all legal cartels is 13.4 years, the median is 11 years and the 90-quantile is 27 years. As the annual report of the FCO has been published biannually since 1979, we cannot determine the starting point of all cartels published. As a consequence of this biannual publication frequency, the modus is not significant (2 years). To correct for this error the trend line shows the moving average over two years. The synthetic modus is 3.

In the textile sector we find particularly long lasting cartel agreements with a condition cartel of yarn producers being the only one that has been existing for the entire 47 year time span of our observation between 1958 and 2005. In addition, cartels of the German tie-fabrics weaving mills association, the German cotton weaving mills convention, the German drapery convention and the convention of German silk and velvet producers have all lasted for more than 40 years.

Figure 3: Duration of Legal Cartels



4.4 Distribution of Legal Cartels across Industries

Manufacturers of textiles and leather have formed 8.4% of all legalized cartels, while 14.4% of all authorized cartels have concerned manufacturers of machinery and equipment. Cartels between firms involved in the extraction and processing of soil and stones account for another 24% of all cartels. These firms usually supply the construction sector. Taken together these two industries account for 30% of all authorized cartels, which is rather interesting given the frequency of illegal cartels in these two industries.

The shares reported in Figure 4 obviously vary over time. While cartels in the chemical industry accounted for 20% of all authorized cartels in the 1960s, its share decreased to 5% in the 1990s. A similar trend can be observed for the textile industry. In contrast, the relative number of cartels between firms involved in the extraction and processing of soil and stones (including cement and concrete) has steadily increased since the 1970s. Finally, both the machinery and equipment industry and the metal and metal product industry have fewer registered cartels in both relative and absolute terms in the 1990s than in the 1960s.

Figure 4: Distribution of Legal Cartels across Industries

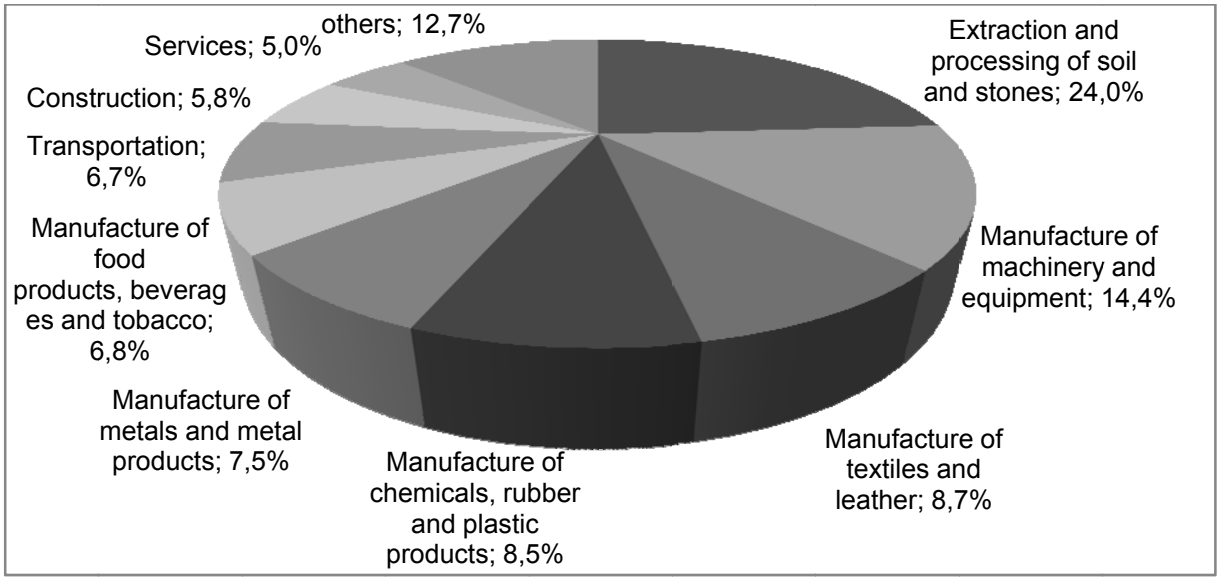
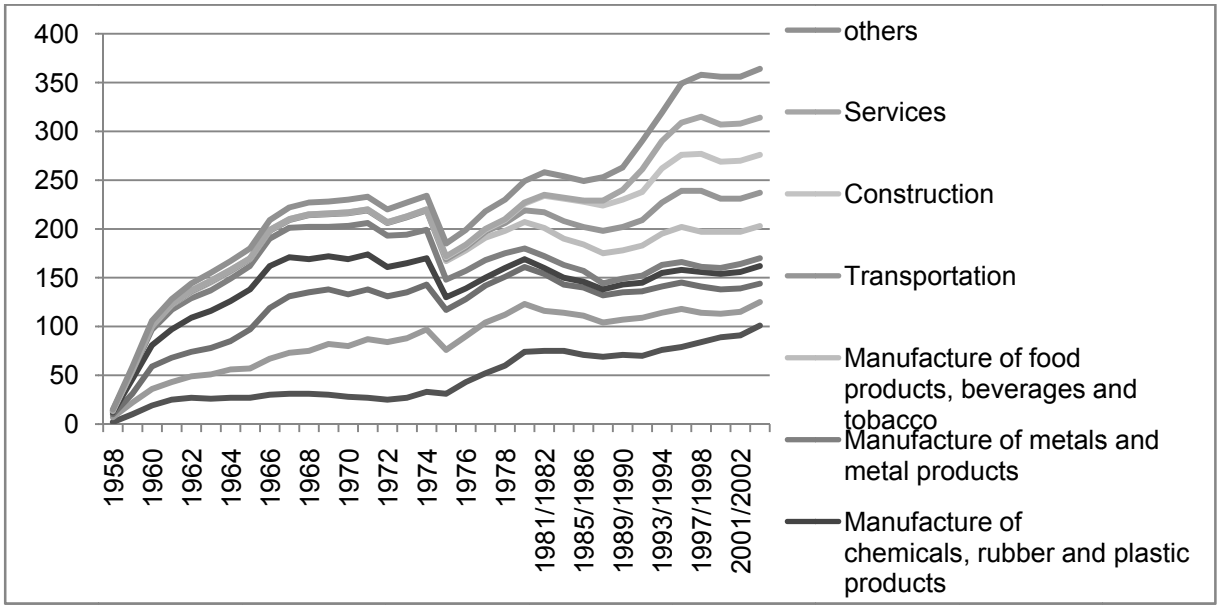


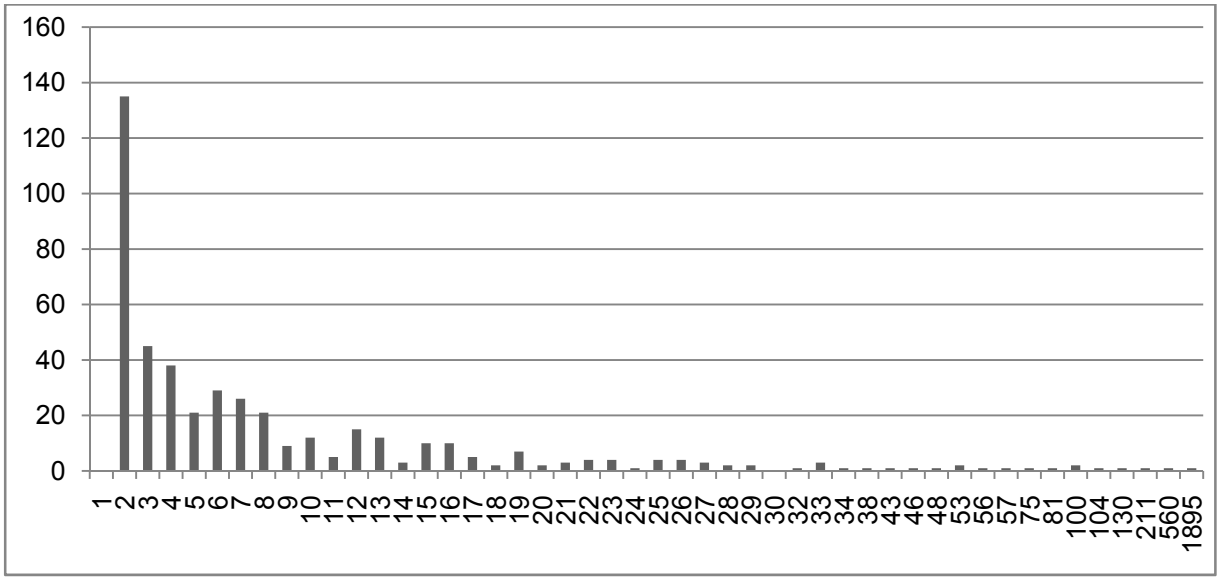
Figure 5: Relative Distribution of Legal Cartels across Industries over Time



4.5 Number of Cartel Members

The number of cartel members is available for 53% of all legal cartels. While the average cartel includes 15 members, this number drops to 10 if one rationalization cartel for the use of standardised beer-bottles with 560 members and another condition cartel formed by the central association of German watchmakers with 1,895 members are excluded. The median size is four and the modus two.

Figure 6: Number of Legal Cartel Members



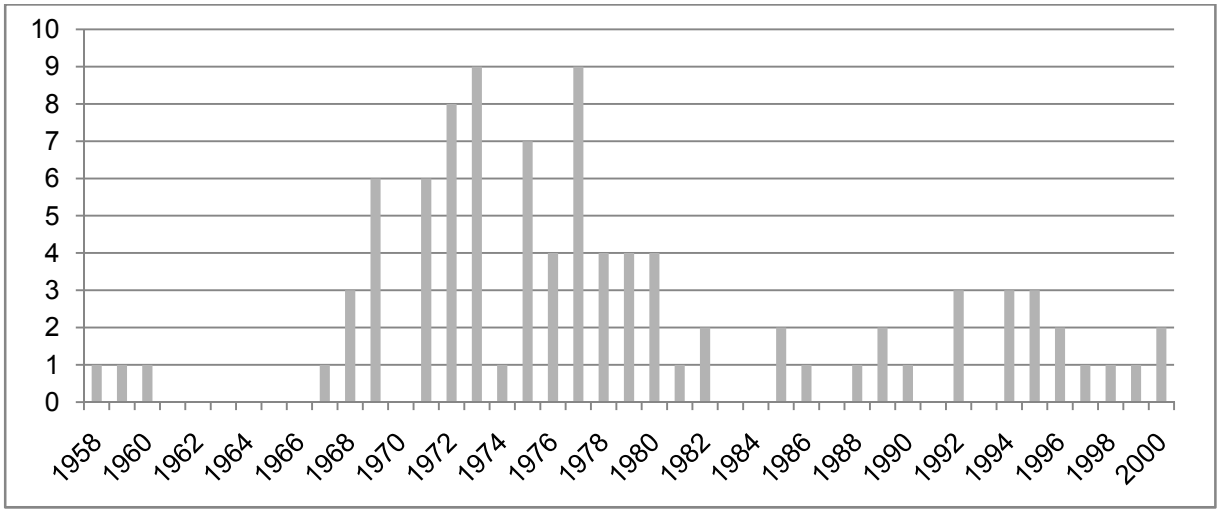
5. Illegal Cartels

Let us now turn to the provide some descriptive statistics about illegal cartels in Germany

5.1 Number of Illegal Cartels Discovered

Between 1958 and 2004 the FCO completed proceedings against around 800 firms and individuals involved in illegal cartels. This number does not only include horizontal cartels but also prohibited vertical restraints and other forms of coordinated behaviour such as coordinated delivery boycotts for rival firms. In total, there have been 95 horizontal cartels that are included in our database.

Figure 7: Number of Illegal Cartels Discovered

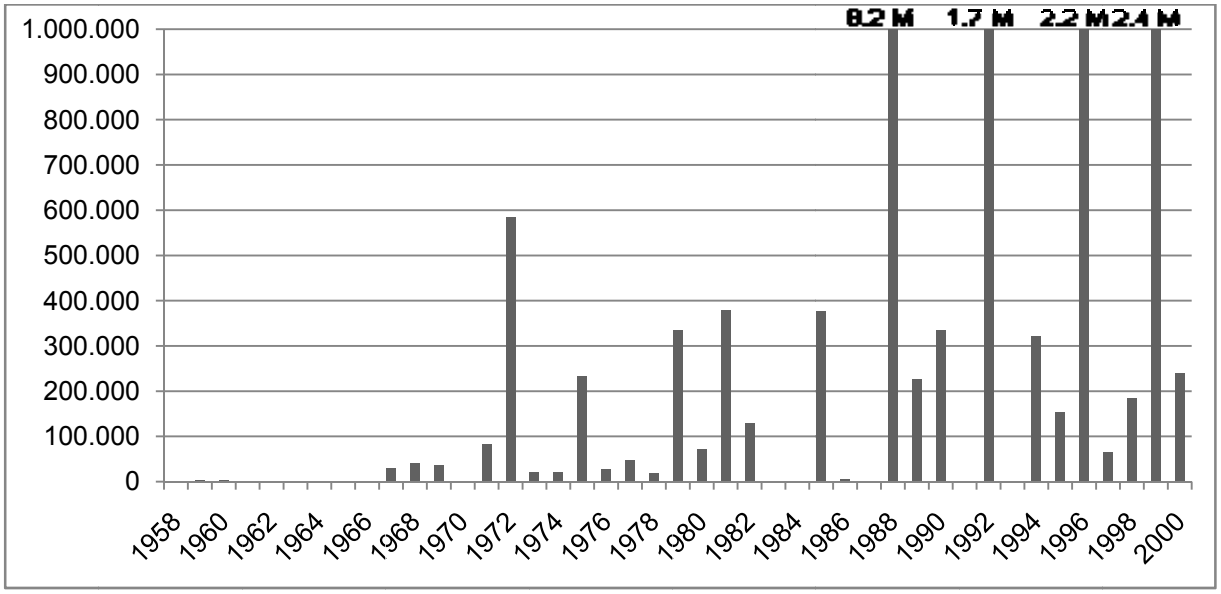


5.2 Fines

Cartel fines have increased continuously since the 1950s. An outstanding year has been 1972, where very high fines were handed out to two cartels. First, four firms involved in an import cartel for polyamid (nylon) had to pay fines of 21 million Euro. And secondly, seven breweries from Dortmund were fined 3.5 million Euro because of price fixing. In 1988, the FCO fined 14 cartel members involved in a cement cartel with the highest fine until then (115 million Euro). In contrast, fines for cartelists often amounted to only 200 Euro in the 1960s and the beginning of the 1970s, and fines did usually not exceed 50,000 Euro then.

The development of fines underlines a change in the attitude of the FCO towards cartelists. The FCO's rather lenient attitude towards cartels and a policy mainly focussing on information and advice about competition policy rather than deterrence and punishment came to an end with the second GWB amendment in 1973 after which the FCO started to seriously enforce its anti-cartel policy and to punish hardcore cartels through increased fines.

Figure 8: Development of Total Cartel Fines per Year



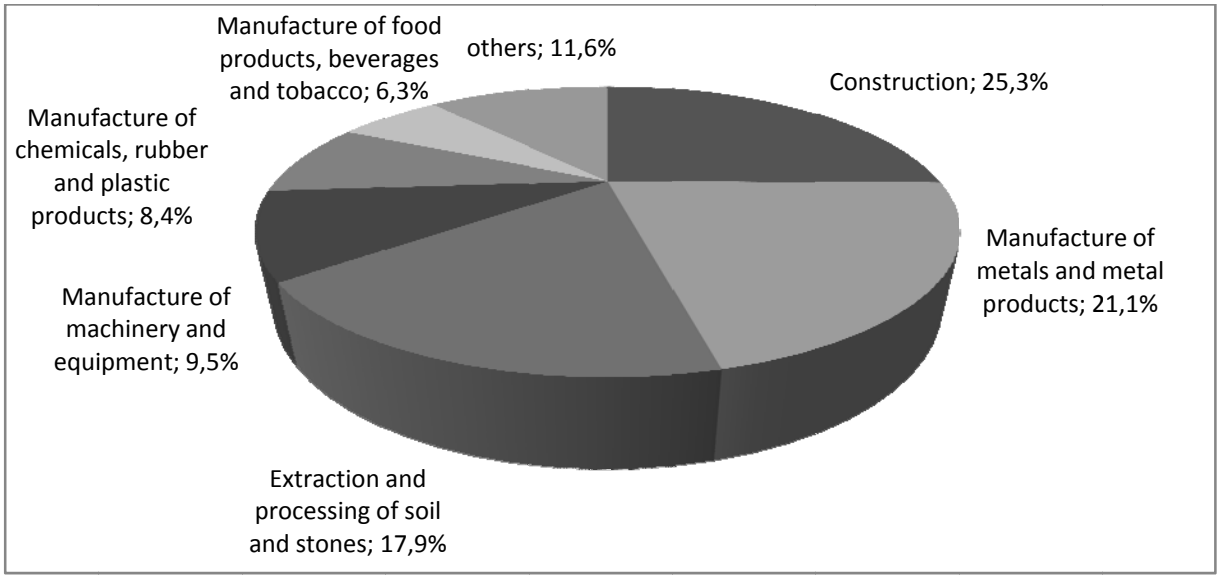
In 1992, two salt producers that had formed an import cartel were fined 10 million Euro, and in 1996, the FCO discovered the high-voltage power-cable cartel. According to various press reports, the cartel members were fined at least 130 million Euro, even though the FCO's official files only record 23 million Euro. The highest fines so far have been handed out in 1999 when 66 concrete producers had to pay an amount of 161 million Euro.

5.3 Distribution of Illegal Cartels across Industries

The construction sector and its sub-suppliers account for 43% of all illegal cartels discovered between 1958 and 2005, or 41 of the 95 illegal cartels discovered. The high number of illegal cartels in this sector may be an indicator for a "cartel tradition" and the traditionally very close relations between firms in this sector. In addition, the high number of legal cartels also indicates the sector's cartel affinity. In fact, the industry has attempted to justify its continued cartelization as an instrument to overcome the otherwise high uncertainty in the market (Bülow and Zubeil, 1977).

Other industries with relatively high numbers of legal and illegal cartels include the metal producing and manufacturing industry (accounting for more than 20% of all illegal cartels) and the machinery and equipment industry (with more than 10% of all illegal cartels discovered).

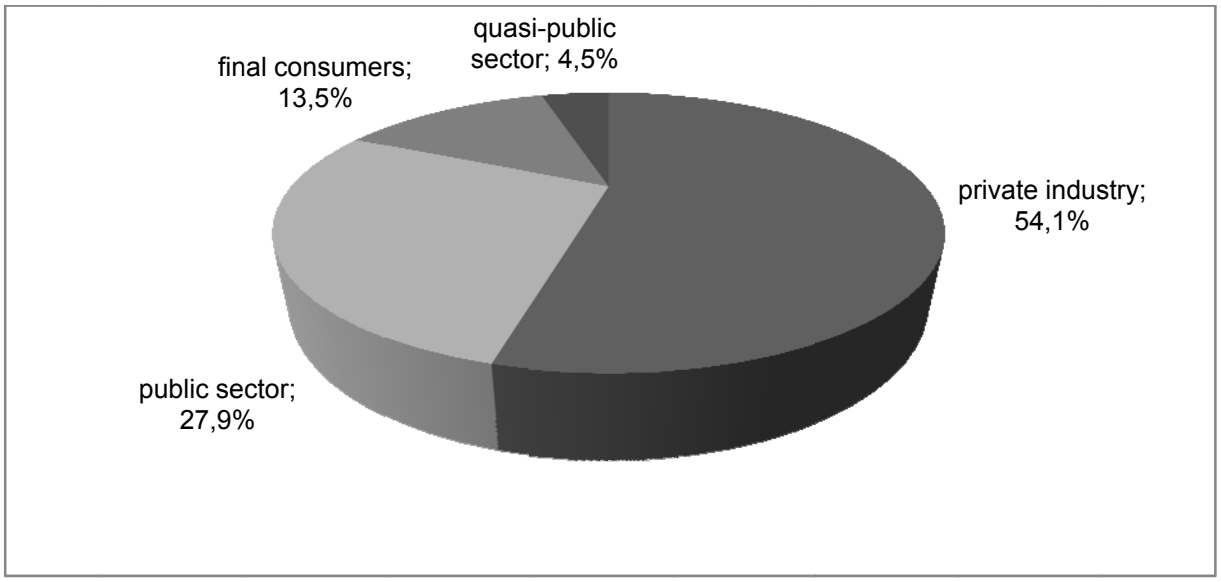
Figure 9: Distribution of Illegal Cartels across Industries



5.4 Demand Side

As mentioned above, one idea was to analyze how the structure of demand affects cartel success. As the FCO usually does not report about the structure of demand, we have deduced some information about the demand side from our knowledge about the cartelized products, the industry and typical buyers (Government versus private firms or final consumers). The distribution of different customer types is given in Figure 10.

Figure 10: Type of Consumers Harmed by Illegal Cartels



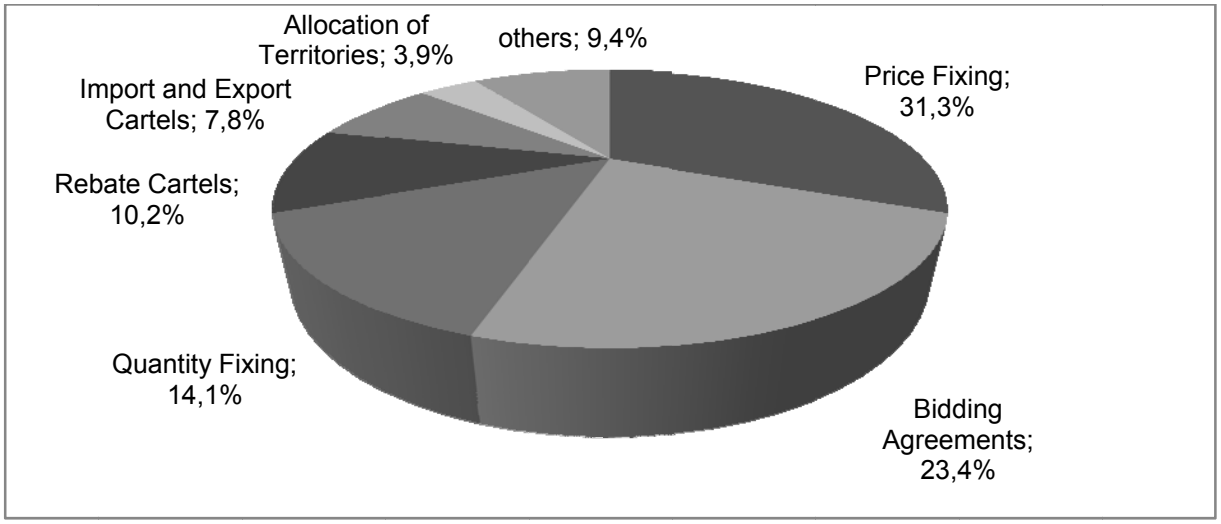
More than 50% of all consumers are private firms which should regularly act in at least imperfectly competitive markets. By contrast, firms from the public sector and the quasi-public sector are often monopolists themselves. Taken together they account for one third of the demand side in our database. In most of these cases local authorities were harmed by illegal cartels. Examples include cartels for school furniture and classroom flooring in the 1970s, for school gym separating walls in the 1980s and for learning aids or traffic signs in the 1990s. The German Postal Service ("Deutsche Bundespost") and the German Rail ("Deutsche Bundesbahn") have been part of the quasi-public sector and had protected monopoly positions until the end of the 1990s.

Final consumers were directly harmed by 13.5% of all cartels. Examples include butter, washing machine, beer and batteries. It is noticeable though that, in very recent times, the FCO has apparently put more emphasis on cartels in end user markets such as coffee, chocolate, sanitary products and others.

5.5 Cartel Types

The three cartel types discovered and fined most frequently are so-called hardcore price fixing cartels. Most of them are price-fixing-cartels (31.3%), while one quarter of all illegal cartels are bidding agreements. One bidding cartel included an average of over 200 single agreements. In order to handle the data we have aggregated the single agreements into one cartel following the FCO's approach. In 14.1% of our cases, firms agreed on quantities, and in 10.2% of the detected cartels firms illegally colluded over rebates.

Figure 11: Types of Illegal Cartels

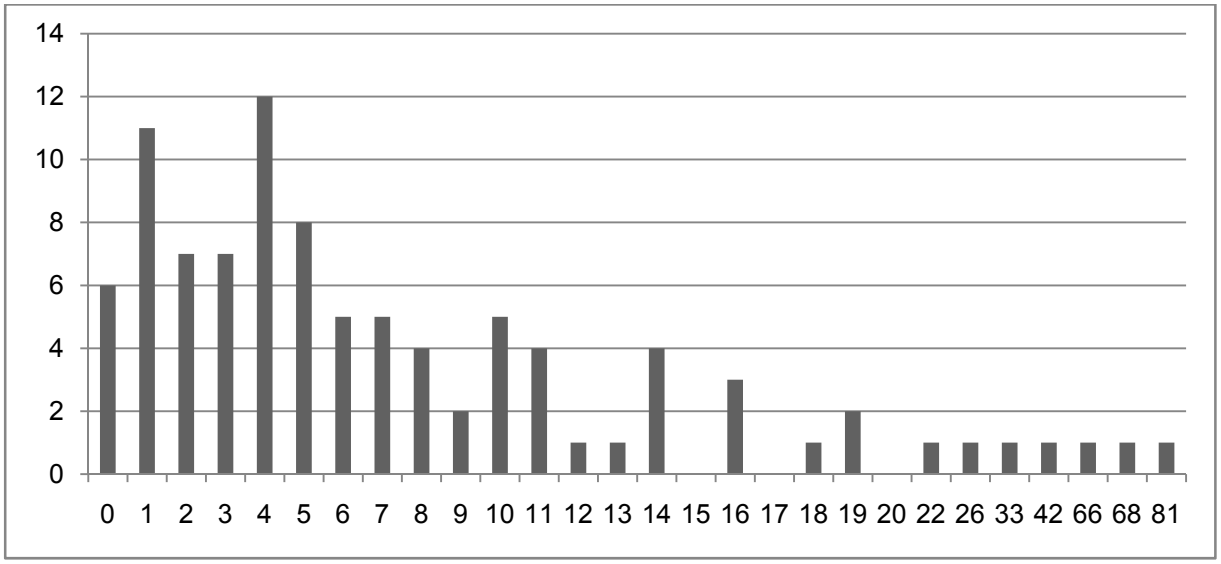


5.7 Number of Cartel Members

As mentioned above, our dataset is based on cases and information published by the FCO. Therefore, some detailed information is sometimes missing if it is not contained in the FCO's files. Moreover, the interpretation of the data can easily be misleading without knowledge of the German competition law. For example, according to German competition law, a firm can only be fined for competition law violations if the responsible individual within the firm is also charged. However, it is not strictly necessary to impose sanctions or fines against firms if individuals are fined. In fact, there is quite a number of cases in which individuals have been fined but not the respective company. Therefore, the number of cartel members reported in the FCO's files is systematically too low due to the fact that only the firms that are fined have been included in the files. For example, in Figure 12 there are six cartels without cartel members, i.e. the reported number of cartel members is zero while another 11 cartels had only one reported member. Hence, we have to keep in mind that the reported number of cartel members is systematically too low.

Taking this bias into account the difference between the number of members in legal (average: 10, median: 4, modus 2) and in illegal cartels (average: 9, median: 5, modus: 4) is surprisingly small. Since legal cartels are (a) more stable as they can be enforced in the courts and (b) easier to organize as they do not have to be kept secret, the number of members in legal cartels should be higher than in illegal cartels. However, from our data we cannot observe a significant difference.

Figure 12: Distribution of the Number of Cartel Members

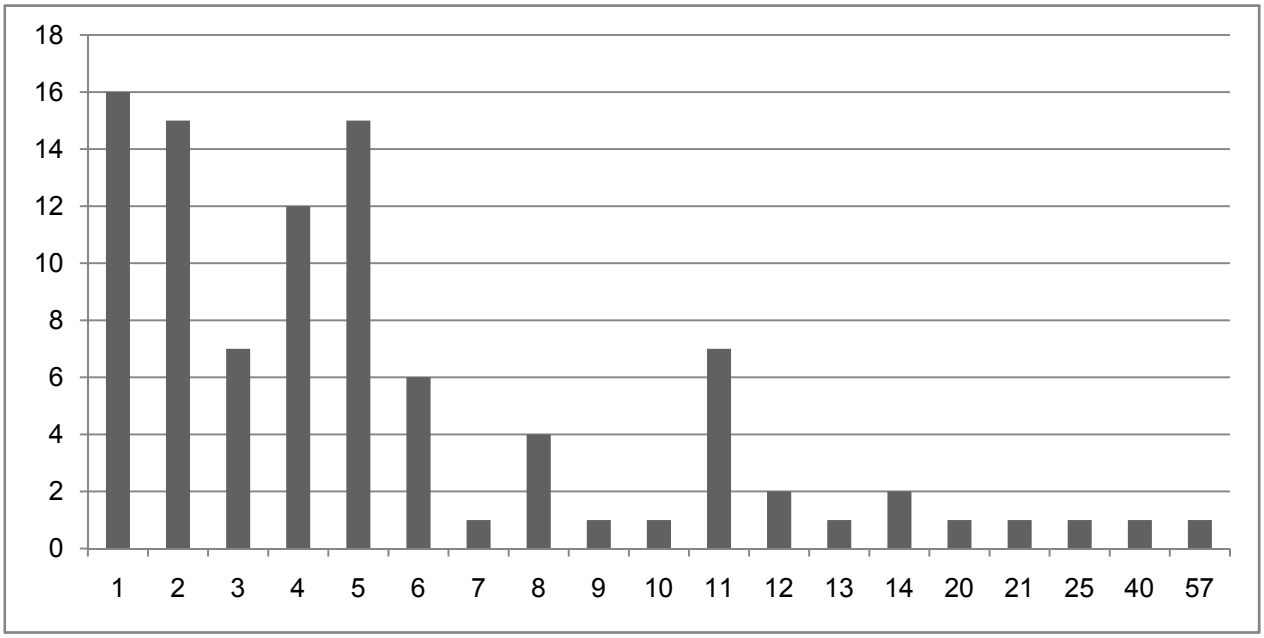


5.8 Duration of Illegal Cartels

Information about the duration of illegal cartels is unfortunately also biased due to the limited availability of public data. The FCO tends to end its investigation as soon as it has collected sufficient reliable information in order to bring and win a case. This means that the FCO may not fully investigate all details of a cartel including its true duration, so that cartels may have lasted for a longer period of time than can be proved by the FCO. The time of cartel duration depicted in Figure 13 is therefore systematically too short.

It is not very surprising that illegal cartels are of shorter duration than legal ones. On average illegal cartels last 6.2 years (legal: 13.4), the median is 4 years (legal: 11) and the modus is 1 year (legal: 3).

Figure 13: Duration of Illegal Cartels (in years)



6. Empirical Analysis

6.1 Econometric Strategy

The empirical analysis is divided into two parts. In the first step, we analyse the determinants of fines per firm. As a result, we can only use a subsample of our whole dataset because this question only applies to illegal cartels. As our variable fine per firm is continuous, we use standard OLS regressions with Huber-White robust standard errors to take into account possible heteroskedasticity problems (see White, 1980). The main concern applying OLS to the subsample of our dataset is its relatively small size of 64 observations. Fortunately, linear models estimated by OLS are reasonably robust to several deviations from textbook assumptions which also include small sample size.[5]

As a second step, we analyze the duration of cartels which enables us to use the whole sample for our empirical analysis. The dependent variable is the duration of cartels (in months). As a consequence, we have to apply count data models because our dependent variable counts the number of months from the creation to the break-up of a cartel. In econometrics a standard approach in the analysis of count data is the so called Poisson model (see Wooldridge, 2002: 646-656 for further discussion),

[5] See Ullah (2004) for further discussion of characteristics of OLS estimators in finite samples.

but this approach suffers several problems. The first is the well known over-dispersion problem. This means that the dependent variable has a variance greater than the mean which is not in line with the assumptions of the theoretical Poisson model. Furthermore, basic Poisson models do not account for the heterogeneity of observations.

To avoid these problems, we apply the negative binomial model which contains a parameter to absorb unobserved heterogeneity and is more robust towards over-dispersion.[6] The model is estimated using Quasi Maximum Likelihood techniques (see Wooldridge, 2002, 657-659 for detailed information). One should also mention an additional problem with regard to our dataset. Usually most statistical procedures assume that the dataset is a random sample from the overall population. In case of our dataset this is clearly not the case. Since the cartels in our dataset are illegal cartels discovered by the FCO or legal cartels authorized by the FCO, it is straight forward that our dataset is not a random sample of the overall population of cartels. As a result, our estimations may suffer sample selection problems (see Heckman, 1978). While we are aware of this problem, we have to leave it unresolved for the moment. The results should therefore be interpreted with the necessary caution.

6.2 Results

Table 1 contains the results for the regressions using the subsample of illegal cartels. This first set of regressions analyzes the determinants of fines per firm. We find that an “agreement on areas”, which means that firms do not compete with other cartel members in their regional market, has a statistically significant positive effect on fines. Positive effects on fines are also estimated for the second and the sixth amendment of the German competition law. Since we cannot included a time trend in our regression due to the limited sample size, these coefficients may also reflect the fact that fines have increased over time.

Quite generally, it should be noted that our sample is rather small (64 observations) so that our results should be interpreted with the necessary caution. Fortunately though, the standard linear regression model is quite robust with respect to

[6] Note that this parameter is not comparable to controlling for unobserved heterogeneity in panel data, but it is a first step to overcome such problems. Additionally, while one should note that the negative binomial model cannot include under-dispersion, it seems very unlikely that under-dispersion will occur in our case.

deviations from basic assumptions (see Krämer and Sonnberger, 1986 for a detailed discussion).

Table 1: Determinants of Fines per Firm

OLS Regressions				
Fine per Firm	**Coefficient**	**Std. Err.**	**Coefficient**	**Std. Err.**
Construction	-17.92	15.08	-17.92	15.08
Price Agreement	-4.09	13.74	-4.09	13.74
Agreement on Areas	-38.27**	19.09	-38.27**	19.09
Duration	1.71	1.76	1.71	1.76
Less than 5 Members	7.79	12.17	-	-
5 to 12 Members			-7.79	12.17
More than 12 Members	-19.71	12.66	-27.49**	14.13
Public Sector Customers	-12.69	11.41	-12.69	11.42
2nd GWB Amendment (1973)	30.95*	16.12	30.95*	16.12
3rd GWB Amendment (1976)	16.39	10.66	16.39	10.66
4th GWB Amendment (1980)	9.18	12.00	9.18	12.00
5th GWB Amendment (1989)	10.50	15.69	10.50	15.69
6th GWB Amendment (1998)	73.54**	30.76	73.54**	30.76
Cons.	15.44	12.63	23.23*	12.18
Obs.	64		64	
R^2	0.23		0.23	

***, **, * statistically significant at the 1, 5, and 10% level. Standard errors are heteroskedasticity robust.

The analysis of fines per firm provides a first step in our analysis, but unfortunately we can only use a small subsample of our dataset, namely the illegal cartels. For the analysis of the duration of illegal and legal cartels we avoid this shortcoming and use our whole dataset of 959 cartels. The estimations for the determinants of cartel duration for legal and illegal cartels can be found in the following table.

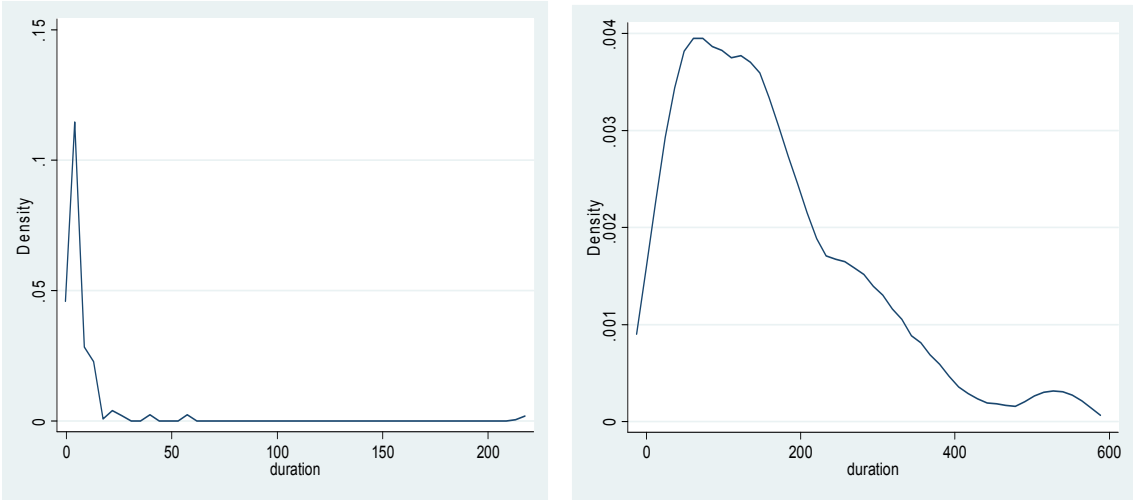
Table 2: Determinants of Cartel Duration I

Negative Binomial Count Data Regressions				
Duration	**Coefficient**	**Std. Err.**	**Coefficient**	**Std. Err.**
Public Sector Customers	-0.02	0.11	-0.02	0.11
Construction	0.03	0.06	0.03	0.06
Materials	-0.05	0.04	-0.05	0.04
Mining	-0.65	0.91	-0.65	0.91
Chemicals	0.06	0.08	0.06	0.08
Forest	-0.48	0.35	-0.48	0.35
Car- Manufacturing	-0.01	0.19	-0.01	0.19
Transport	-0.02	0.10	-0.02	0.10
Food Sector	0.59***	0.11	0.59***	0.11
Less than 5 Members	0.21***	0.06	-	-
5 to 12 Members	0.34***	0.07	0.14*	0.08
More than 12 Members	-	-	-0.21***	0.06
Legal Cartel	3.09***	0.10	3.09***	0.10
Cons.	1.83***	0.10	2.04***	0.10
Obs.	958		958	
R^2	0.05		0.05	

***, **, * statistically significant on the 1, 5, and 10% level. Standard errors are heteroskedasticity robust.

Obviously, a cartel's legal authorization has significant positive effects on its duration, which should result from the cartel contract being enforceable in court. This result can also be obtained from a non-parametric kernel density estimation of the duration of legal and illegal cartels in months. As can easily be seen legal cartels (on the right side of Figure 14) last much longer on average than illegal cartels (on the left side). The following figures are obtained from kernel density estimates of the probability density functions of the duration of cartels for illegal and legal cartels (see Härdle, 1990).

Figure 14: Cartel Duration for Illegal (left) and Legal Cartels (right)



Furthermore, how the number of cartel members effects cartel duration is not linear. If the number of cartel members lies between 5 and 12 there is a stronger positive effect on cartel durability than a cartel size of below 5, while cartels are less stable (or durable) with more than 12 members, which has a statistically significant negative effect on cartel duration. We also find that cartels in the food sector tend to be more stable than their counterparts in other industries.

Table 3: Determinants of Cartel Duration II

Negative Binomial Count Data Regressions				
Duration	**Coefficient**	**Std. Err.**	**Coefficient**	**Std. Err.**
Customers in Public Sector	-0.11	0.11	-0.12	0.11
Less than 5 Members	0.18**	0.06	-	-
5 to 12 Members	0.31***	0.07	0.13*	0.08
More than 12 Members	-	-	-0.18***	0.06
Legal Cartel	2.96***	0.10	2.96***	0.10
Cons.	2.02***	0.10	2.20***	0.10
Obs.	958		958	
R^2	0.04		0.04	

***, **, * statistically significant on the 1, 5, and 10% level. Standard errors are heteroskedasticity robust.

Table 3 provides the same negative binomial regressions as Table 2, excluding the sector dummy variables as a robustness check. Despite smaller changes in sizes of

coefficients, our results remain qualitatively unchanged so that these regressions demonstrate our results' robustness.

7. Summary and Conclusion

This paper has offered a completely new and broad insight into the landscape of German cartels. We have provided the first comparison of legal and illegal cartels in order to use legal cartels as a comparison to illegal ones. Legal cartels tend to last longer and to have more members than illegal cartels, while there are little differences with respect to the industries involved.

The construction industries are the most cartelized sectors (29.8% of all legal cartels, 43.2% of all illegal cartels) followed by manufacture of metals and machinery (21.9% of all legal cartels, 30.6% of all illegal cartels). While we have not established any relationship between legal and illegal cartels, we believe that this may be a fruitful and interesting topic for future research

How the number of cartel members affects the duration of cartels is ambiguous. Cartels with no more than 12 members tend to last longer than cartels with more than 12 members. However, cartels with 5 to 12 members also tend to last longer than cartels with less than 5 members. This may be due to two countervailing effects. On the one hand, cartels with fewer members face lower transaction and monitoring costs which should increase a cartel's stability. On the other hand though, cartels with fewer members may face more outside competition, decreasing the cartel's stability. Since we have no data about the cartels' market shares, we cannot control for this, unfortunately. Furthermore, in highly concentrated markets (with less than 5 participants) it may be not as necessary to form or to maintain a cartel, as tacit collusion may emerge even without cartelization. Tacit collusion, however, is more difficult to establish and to maintain in markets with many participants so that the "necessity" to establish and to maintain formal cartels is stronger than in highly concentrated markets.

The fines imposed by the FCO are positively related to the 2nd and 6th amendment of the GWB. The effect of these two amendments can be possibly explained by their meaning for German competition law. The 2nd GWB Amendment in 1973 meant a change in cartel prosecution. The 6th amendment in 1999 was also very important,

since the GWB was adjusted to European cartel law, including new handling of cartel prohibition.

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12/5200 (1991/1992), 13/1660 (1993/1994), 13/7900 (1995/1996), 14/1139 (1997/1998), 14/6300 (1999/2000), 15/1226 (2001/2002), 15/5790 (2003/2004) und 16/5710 (2005/2006).

Appendix

Table A1: Description of Variables

Variable Name	Description
Legal Cartel	Dummy-Variable: Value 1 if cartel is legal and 0 else
Fine per Firm	Average fine against a cartel member
Duration	Duration of the cartel in months.
Price Agreement	Dummy Variable: Value 1 if cartel had a price agreement.
Agreements on Areas	Dummy Variable: Value 1 if cartel had an agreement on areas.
Construction	Dummy Variable: Value 1 if cartel belongs to the construction sector.
Materials	Dummy Variable: Value 1 if cartel belongs to the materials sector.
Mining	Dummy Variable: Value 1 if cartel belongs to the mining sector.
Chemicals	Dummy Variable: Value 1 if cartel belongs to the chemicals sector.
Forest	Dummy Variable: Value 1 if cartel belongs to the wood and forest sector.
Car Manufacturing	Dummy Variable: Value 1 if cartel belongs to the car manufacturing sector.
Transport	Dummy Variable: Value 1 if cartel belongs to the transportation sector.
Food Sector	Dummy Variable: Value 1 if cartel belongs to the food sector.
Less than 5 Members	Dummy Variable: Value 1 if cartel has less than 5 members.
5 to 12 Members	Dummy Variable: Value 1 if cartel has more than 4 and less than 13 members.
More than 12 Members	Dummy Variable: Value 1 if cartel has more than 12 members.
Public Sector Customers	Dummy Variable: Value 1 if cartel's customers mainly belong to the public sector.
2nd GWB Amendment	Dummy Variable: Value 1 if cartel was fined after 2nd GWB Amendment came into force.
3rd GWB Amendment	Dummy Variable: Value 1 if cartel was fined after 3rd GWB Amendment came into force.
4th GWB Amendment	Dummy Variable: Value 1 if cartel was fined after 4th GWB Amendment came into force.

5th GWB Amendment	Dummy Variable: Value 1 if cartel was fined after 5th GWB Amendment came into force.
6th GWB Amendment	Dummy Variable: Value 1 if cartel was fined after 6th GWB Amendment came into force.

Table A2: Descriptive Statistics

Variable	Observations	Mean	Min.	Max.
Legal Cartel	959	80.59	0	655.66
Fine per Firm	64	37.72	1.60	299.96
Duration	958	145.45	1	564
Price Agreement	95	0.41	0	1
Agreements on Areas	95	0.04	0	1
Construction	959	0.09	0	1
Materials	959	0.14	0	1
Mining	959	0.001	0	1
Chemicals	959	0.13	0	1
Forest	959	0.01	0	1
Car Manufacturing	959	0.02	0	1
Transport	959	0.06	0	1
Food Sector	959	0.06	0	1
Less than 5 Members	959	0.27	0	1
5 to 12 Members	959	0.18	0	1
More than 12 Members	959	0.73	0	1
Public Sector Customers	959	0.07	0	1
2nd. GWB Amendment	95	0.25	0	1
3rd GWB Amendment	95	0.18	0	1
4th GWB Amendment	95	0.22	0	1
5th GWB Amendment	95	0.12	0	1
6th GWB Amendment	95	0.17	0	1

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Düsseldorf Institute for Competition Economics (DICE)

Universitätsstraße 1 _ 40225 Düsseldorf
www.dice.uni-duesseldorf.de

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