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Effects of different cartel policies: Evidence from the German power-cable industry

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Effects of Different Cartel Policies: Evidence from the German Power-Cable Industry*

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September 2013

Abstract

We analyze the effects of cartel policies on firm behavior using data from the German power-cable cartel. Antitrust authorities affected the cartel under two different legal regimes: penalizing the cartel in some years, and exempting it for ten years from the general cartel prohibition. While penalties did not reduce prices or profits, making collusion legal raised profits by at least 16% each year, compared to the time when the illegal cartel was not prosecuted. The threat of penalties was sufficient to reduce profit from collusion. The intended efficiency gains from rationalization, which was the justification for legalizing the cartel, did not materialize.

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1 Introduction

Do cartel laws prevent collusion? Evidence on the effect of laws against price-fixing agreements is ambiguous. For the United States, the introduction of the Sherman Act and its impact on the railroad cartels is a prime example. However, no consensus has been reached: some researchers suggest the Act caused a permanent breakdown of the cartels while others find there was hardly a noticeable effect (see Binder 1988, Grossman (2004), Levenstein and Suslow 2006 and the literature therein). Similarly, Stigler (1966) argues that the Sherman Act generally reduced the frequency and extent of collusion, but he finds no effect of several specific clauses.[1] The Webb-Pomerene Act (1918-1965) legalized export cartels, while the National Recovery Act (1933-1935) freed industries from many antitrust prohibitions. In both cases, some industries colluded successfully but other attempts failed (e.g., Alexander 1997; Baker 1989; Dick 1996, 2004). Evidence from Europe is also conflicting. Voigt (1962) studies the effects of cartel prohibition in Germany after 1945. He observes drastic negative effects on a large number of relatively weak cartels. However, cartel-like behavior reappeared in industries with a stable history of cooperation. In the United Kingdom, Symeonidis (2002) finds an intensification of price competition across a range of manufacturing industries after the introduction of the 1956 Restrictive Trade Practices Act. On the other hand, an equally large number of industries were unaffected by the legislation.

A related issue is the effectiveness of penalties in reducing the prices and profits of convicted cartels. Empirical studies do not suggest a definitive conclusion. Stigler and Kindahl (1970) find an average 2% price reduction in nine industries after a conviction for price fixing. Feinberg (1980) and Choi and Philippatos (1983) find a reduction of profits by a similarly moderate amount. Sproul (1993) analyzes a sample of 25 industries penalized for cartel law infringements, and finds increased prices after indictment.[2]

Given the ambiguity of the evidence, it is hardly surprising that scholars disagree on the effects of cartel laws. Contributions to a symposium in the Journal of Economic Perspectives drew contradictory conclusions. Crandall and Winston (2003) challenge the effectiveness of cartel laws in improving welfare and competition. They claim that "[r]esearchers have not shown that government prosecution of collusion has led to ... declines in consumer prices". Baker (2003), on the other hand, concludes positively in favor of antitrust enforcement, pointing out substantial potential losses from lax cartel law enforcement. Both papers concluded that more empirical work would be useful. (See also Werden 2003 and Kwoka 2003 on this debate.)

We aim to contribute to this literature by using data on the German high-voltage electricity

[1] Such as the Panama Canal clause or the directorate interlocking clause.

[2] See Werden (2003), who argues that the data and methods in Sproul (1993) are inappropriate.

cable cartel from 1958 to 1990. Our data span a period during which antitrust authorities first penalized, then legalized, the cartel. From 1958 to 1974, and again from 1985 to 1990, the cartel was illegal. It was convicted in 1959, 1972 and 1974 for violations of cartel law. Thus, for most of this period, the illegal cartel operated under a threat of prosecution. The policy to exempt the cartel from prosecution in 1975-84 provides a rare natural experiment.[3] The exemption legalized the cartel for ten years with the aim of permitting the industry to rationalize during a period of decline. One interesting question is whether an exemption from antitrust law made any difference. With the exception of Baker (1989), we are not aware of any study examining the effects of both penalties and exemption on a single cartel with detailed industry-level data, [4, 5] while controlling for other explanatory factors. An important aspect of the cable cartel is that there was no entry and competition from non-cartel members during the period of our analysis. Therefore, the data are likely to be free of confounding effects from actual or potential competitors, which is advantageous when we measure the effect of cartel policies.

The case of the cable cartel became publicly known in 1997 when the German Federal Cartel Office (Bundeskartellamt, henceforth FCO) fined 17 producers a total of DM300 million. Amazingly the investigation revealed that the cartel had existed since 1901 (see FCO Press Release 1997).[6] Our dataset spans 1958-1990 when cartels were per se illegal in Germany. During this period, industry and FCO reports provide a comprehensive view of the cable cartel.

[3]There were numerous legal cartels in Germany but only very few were allowed explicit price agreements (for legal German cartels, see also Audretsch 1989 and Haucap et al. 2010). Explicit price agreements could not be legalized any more following the 1998 revision of German antitrust law.

[4]Baker (1989) analyzes the US steel industry when collusion was legal during the National Recovery Act. He compares the legal phase from mid-1933 and mid-1935 to the post-1935 period, arguing that the industry used marketplace punishments to enforce collusion only when it was illegal. Importantly, the analysis does not allow Baker to differentiate between competition and perfect collusion both before 1933 and during the NRA phase. Hence, the conclusions about the impact of cartel laws depend on the assumption that the industry was competitive during this time. For a recent case study of a legal cartel, see Roeller and Steen (2006). See Stigler (1966), Dick (1996), and Symeonidis (2002) for cross-sectional approaches.

[5]Recently, Buccirossi et al. (2011) tackled a similar research question with a different approach. They empirically investigate the impact of competition policy (not only cartel policy), as measured by newly created indexes, on total factor productivity growth for many industries in several OECD countries. They find a positive and significant effect of competition policy.

[6]See also Eißfeldt (1928) and Saffran (1928). The cable cartel is probably one of the longest lasting cartels known. It formally existed for 96 years, including a 39-year period of illegality. Levenstein and Suslow (2006) note that about half of cartels lasted under five years, although some persisted for more than ten years. The organic peroxides cartel, with its duration of more than 29 years, is the longest running cartel detected by the European Union Commission. The DeBeers diamond cartel has presumably existed for more than 100 years. Cartel duration, however, should not necessarily be equated with cartel success (Levenstein and Suslow 2006).

The analysis of the different cartel policies constitutes the main part of this paper. We run two-step efficient generalized method of moments regressions of a simultaneous-equations model to estimate the effect of each policy. We also report how the cartel responded to the business cycle, and we provide anecdotal evidence about the post-1990 decline of the cartel.

Our results are as follows. Industry profits were at least 16% higher each year during the ten-year exemption phase (around DM700 million in total), compared to the counterfactual case of the cartel remaining illegal. While industry profit increased, there was no corresponding reduction in capacity, hence the intended efficiency gains from rationalization did not materialize. This finding indicates that legalization merely protected the industry by increasing their profits and did nothing to increase productivity. A third finding is that antitrust intervention to convict and penalize the cable cartel failed to lower prices and profits. As fines were either rather low or, in one case, not imposed at all, penalties or their threat did not change cartel behavior. Overall, our results suggest that outlawing collusion in connection with rigorous fines and other anti-cartel actions would have improved competition and efficiency in the cable industry.

The paper is organized as follows. The next section describes the industry and its products, and Section 3 discusses the legal situation and cartel organization. Section 4 presents the empirical model and its findings. Section 5 briefly summarizes the development of the cartel and the reasons for its decline after 1990. Section 6 concludes.

2 Products and Markets[7]

The cable industry produces high-voltage electricity cables. The electric tension of the cables ranges from one to 400 kilovolts. These cables can be distinguished from cables with less than one kilovolt and from low-tension wires for telephone communication. Some firms in the industry produce the low-voltage cables and wires as well but the high-voltage segment is the most concentrated one. Cables are mainly made of copper and aluminum. Other inputs, like rubber, plastic, and paper for insulation and coating, are of minor economic importance. Cable production is labor intensive.

There are a large number of types of cables, about 1,895 on average. Typically, 10-12% of all types account for 80% of industry revenue. All cable types are standardized, making them homogenous products from the buyers' perspective. In our data, we measure only the metal input used in the production of cables but not the distribution of inputs across types. This is because the main function of cables, to transport electricity, is determined by the conductivity of metal

[7]This section is based on the annual industry reports of the cable industry (Industry Reports, 1960-1997).

input. Our data account for the different conductivities of aluminum and copper.[8]

In our 1958-1990 dataset, the number of producers in the cable industry varies between 21 and 34. There were 32 firms in 1958 and single firms entered only in 1966 and 1969. The number of firms then monotonically declined from 34 in 1969 to 21 in 1990. Exiting firms were minor and their exit did not significantly reduce the industry's capacity. A few producers operated more than one plant. The largest were Siemens, AEG (Alcatel from 1991 on) and Felten and Guilleaume. We do not have comprehensive market share data, but there is evidence that the four-firm concentration ratio is about 84% and the Herfindahl index is about 2,300 in the early to mid-1990s. (This calculation assumes that the 1997 fines are proportional to market share, which is consistent with the regulations of German competition law on fines.) Buyers were mainly electricity producers and public transport companies, whose contribution to industry revenue rose from 59.6% in 1960 to 70.0% in 1990. Other buyers included the primary industry, with a share of 13.2% in 1960 declining to 7.8% in 1990, and wholesale firms, with a share between 9% and 12%.

Imports and exports did not play a major role in the cable market. Imports were insignificant, accounting for a minimum of 1% in 1960 and a maximum of 9% in 1985. Perhaps most importantly, an international cartel agreement prevented effective international competition in the cable market.[9] Another reason for the lack of foreign competition could be technical and commercial differences. Finally, the main buyers in the markets were public utility monopolies at the time, and their procurement might have been biased towards national suppliers.[10]

3 Cartel Law and Organization

For the period of our analysis, cartels were per se illegal in Germany. Allied decartelization laws from 1947 introduced the first outright prohibition of restraints of competition in Germany, and the

[8]Specifically, copper's conductivity is roughly 1.7 times bigger than aluminum's. Since the density (relative weight) of copper is 3.4 times larger, it follows that a ton of aluminum can conduct roughly twice as much electricity as a ton of copper. This measure is also used in the Industry Reports.

[9]The International Cable Development Corporation (ICDC) was formed in 1928 and involved virtually the producers of all European countries (Kartellrundschau 33, 1935, pp. 202-3). The activities of the ICDC were renewed in the "Lausanne Agreement" of 1948 (Monopolies and Restrictive Practices Commission, 1952). When the FCO penalized the cartel in 1974 it noted that the lack of international trade could be explained only by collusive behavior.

[10]Deregulation in these industries occurred only recently and not within the 1958-1990 period we analyze. Since 1992, public utilities have to make their calls for bids public at the EU level. There was at least one electricity producer that was vertically integrated with a cable producer. This may facilitate collusion (Nocke and White 2007, Normann 2009).

enactment of German competition law in 1958 confirmed the illegality of cartels. Nevertheless, it is evident that the cable cartel existed throughout the period of our analysis.[11] The FCO regularly reported on the industry from 1958 onwards. It presumably monitored the cable industry closely because the firms made an unsuccessful attempt to get permission to form a legalized cartel in 1957. The FCO had already concluded in 1960 that there was "no competition whatsoever on prices, trading or service conditions and quality in the market" (Industry Report, 1960; our translation).

The cable cartel was a price and quota cartel. The organization of the cartel reflected the tendering procedure. For each call for bid, the cartel decided which firm would get the contract. Firms would be informed whether to "normal" prices or whether they should bid a higher price in order not to get the contract.[12] Due to the public tendering procedures, we can assume that the cartel was perfectly informed about demand as well as the distribution of specific orders among the members. (Stigler 1964 argues that this stabilizes collusion.) Quota adjustments were made at the end of the year. Whenever a firm ignored a cartel decision to bid for a contract in excess of its quota, its allocation the following year would be reduced by twice the revenue gained through deviation.

The cartel facilitated collusion through a system of intra-cartel sales (or cross supplies) in connection with a common list of "prevalent" and "non-prevalent" cable types. The system of intra-cartel sales was based on a scheme under which each firm produced only a subset of all existing cable types. If a firm received an order for a cable type that it did not produce, it ordered from the cartel member that did produce it. The intra-cartel sales hence effectively reduced the number of cable types an individual firm had to produce. The motive for reducing the number of types is that switching production from one cable type to another was labor intensive. The price list suggested higher prices for non-prevalent types. The excess prices caused demand for those non-prevalent types to decline, often to zero. The cartel also operated with list prices and intra-cartel sales after 1985 because the FCO decided that a "recommended policy" with the same effect was legal. Therefore, the list of prevalent types and the system of cross supplies were effective throughout the period 1958-1990.

We now turn to the exemption period from 1975 to 1984. German competition law allows for exemptions from the general cartel prohibition in order to promote efficiency or technical progress. Among the exceptions are specialization, standardization, and rationalization cartels.

[11] The first cartel agreement in the cable industry was concluded in 1901 (Eißfeldt 1928, Saffran 1928). Cartels were per se legal in Germany until 1945 although, from 1928-1933, cartel contracts were subject to rule of reason (with little impact). See Hahn and Normann (2001) for a detailed account of the years 1901 to 1945.

[12] This way of operating the cartel is reported both for the early cartel phase after 1901 (Eißfeldt, 1928, 81-82) as well as the post 1945 period (FCO, 1997).

The law presumes that rationalization cartels involve severe restraints of competition and therefore requires that the rationalization effect should be sufficiently beneficial socially in order to justify the restraint. In particular, consumers have to benefit, too. Prior to 1998, explicit price agreements could be allowed as part of a rationalization cartel whereas mere price agreements were not possible.

In our case, the purpose of the exemption was to reduce capacity and the number of cable types when the industry was in decline. To this end, firms were allowed to maintain the system of intra-cartel sales and the common list of prevalent types. Explicit price agreements were part of the rationalization cartel, which was permitted for four years from 1975 (FCO Report 1976), and extended in 1979 (FCO Report 1979) until the end of 1984. Another extension after 1984 (FCO Report 1983) was not granted because, according to the FCO, no more efficiency gains could be expected in the future.

The FCO took action against the industry for violations of cartel laws three times prior to 1997 – in 1959, 1972 and 1974. Details of these decisions are reported below. In remaining years, FCO took the default of no-action against the illegal cartel.

4 Effects of FCO Policies

4.1 Hypotheses

We first derive hypotheses on how the different policies would affect the industry. To this end, we use the following simple model of antitrust enforcement. When firms engage in illegal price fixing they face a fine if they are detected and convicted (Connor 2001, 2005). Firms will collude only if the gains from cartelization outweigh this expected fine. Accordingly, firms will attempt to cartelize the market only if:

$$[1] \qquad \pi^c - \rho\sigma F - C > \pi^n$$

where π^c is the cartel profit, ρ is the probability of being prosecuted, σ is the probability of being convicted given a prosecution, F is the penalty (such as monetary fines, withholding of privileges etc.) after a conviction, C is the cost of organizing the cartel, and π^n is the non-cooperative profit attained without explicit coordination. The cartel additionally needs to resolve external and internal stability. That is, [1] is necessary but not sufficient for successful collusion.

If the cartel can operate legally, we have $F = 0$ and [1] will hold unless C is prohibitively high. By contrast, when cartels are illegal, depending on the magnitude of $\rho\sigma F$, some cartels will be deterred while others may not. The ρ, σ, F (and possibly even C) will typically be functions

of π^c (Harrington 2005). Suppose the cartel chooses a level of cartel profits between π^n and the joint-profit maximum. Under the exemption policy, it may choose the joint-profit maximum because $F = 0$. For an illegal cartel, it is straightforward to see that maximizing expected profits often implies a corner solution; that is, either setting up a cartel is not worthwhile at all, or firms cartelize at the joint-profit maximum. A sufficient condition for a corner solution is that the expected penalty increases linearly in π^c. Interior solutions may, however, also occur. A necessary condition for an interior solution is $\frac{\partial^2 \rho\sigma F}{\partial(\pi^c)^2} > 0$. On top of that, the cost of organizing the cartel, C, will be lower under legality because in that case the cartel members do not have to exert efforts to conceal their behavior. To sum up, a legal cartel will be (weakly) more profitable than an illegal cartel.[13]

The expected penalty may change as a result of the legal exemption phase. Usually, the likelihood of prosecution increases with higher cartel profits, not least because customers are more likely to notify the authorities when the cartel price is high. During the ten-year exemption period, buyers may, however, become accustomed to the higher price level. Summarizing, we have

Hypothesis 1 *When the cartel can operate legally during the exemption period, profits will be higher than during the period of illegality.*

The purpose of the exemption policy was to promote rationalization in the industry.[14] The cable industry was expected to cooperate to reduce the number of types which, in turn, should reduce labor input. Cooperation is needed if the firms are in a dilemma regarding the reduction of types. It is conceivable that supplying additional types is a profitable strategy for a firm but the industry as a whole is better off when fewer types are offered. This will be the case if providing an additional cable type imposes a negative externality on existing types due to a business stealing effect. However, as noted above, the system to reduce the number of types (intra-cartel sales and types list) existed throughout in our data set. The only difference the exemption period makes is that explicit price agreements were allowed to support cooperation at the rationalization stage. In an infinitely repeated game, the additional threat of abandoning the price-fixing agreements may help to deter firms from defecting at the rationalization stage.[15] If this were true, rationalization

[13]There may be reasons not captured by this model for the cartel to charge a price below the joint maximum, but such reasons will apply to both the legal and the illegal cartel.

[14]The numerous cables types (each associated with fixed costs) suggest that a model of monopolistic competition would accurately describe the industry in the absence of a cartel. With labor costs increasing and demand stagnating, firms were forced to reduce the number of types in order to maintain cartel profits. A cartel will always provide fewer types than a monopolistically competitive industry. Without knowledge about the degree of substitutability between types, it is not possible to estimate how many types a cartel would supply.

[15]Suppose a firm's profit is A if all firms adhere to cooperation at the rationalization stage as opposed to a profit

efforts would be more effective during the exemption phase. In any event, we would not expect firms to do worse during exemption. Hence we have:

Hypothesis 2 *Under the exemption policy, labor input will be lower than under cartel prohibition.*

Our last hypothesis concerns the effect when a cartel is actually convicted. If a cartel is detected, we know that [1] was met before the detection. The incident of convicting and penalizing a cartel will usually increase the expected punishment $\rho\sigma F$ of future violations. For example, a conviction typically implies a higher probability of future detection due to increased monitoring, and penalties are usually higher for recidivists. An FCO prosecution may affect cartel behavior even if it does not punish the cartel as long as it increases $\rho\sigma F$. However, the expected punishment may not increase significantly, and [1] may still hold after detection.[16] In that case, firms will still collude after the conviction or penalty. Whether or not convicting the cartel has an impact depends on how much the expected sanction for future violations increases. Finally, the hypothesis also presumes that the cartel is at least partly effective in charging above-competitive prices. This presumption also has to be checked since penalties can only work if the cartel is able to effectively raise prices and profits in the first place.

Hypothesis 3 *Penalizing an effective cartel will deter future price-fixing agreements only if the expected fine for future violations increases after the penalty.*

4.2 Empirical Model

We test the effect of the policies (exemption, penalties, no action) on the cartel's profit and capacity. As price, quantity, profit, and capacity are endogenous, we use the following system of simultaneous equations to estimate the policy effects. The number of instruments is kept small because of limited data.

$$[2] \qquad Q_D = \alpha_i \left(P_D, CON, POP\right)$$

of $N < A$ without such cooperation. Defecting yields profits of D, where $D > A$. Assume explicit price agreements become legal, which yield additional gains of ΔA, whereas defecting from the price agreements yields an additional $k\Delta A$. In a simple trigger strategy equilibrium with Nash reversion of the infinitely repeated game, the minimum discount factor is $\frac{D-A+(k-1)\Delta A}{D-N+k\Delta A}$. It follows that $\Delta A > 0$ reduces the minimum discount factor as long as $k < \frac{D-N}{A-N}$. In other words, cooperation at the rationalization stage will facilitate collusion as long as defection profits at this stage are not disproportionally larger than the collusive gains from cooperation at the rationalization stage.

[16] The reason is that it may not always be the case that the antitrust authorities can commit to allocating resources for monitoring the industry closely. They may not be able to credibly threaten the industry with significantly higher sanctions in case of recurrence either, in particular, if upper limits on penalties apply.

[3] $P_S = \beta_i (Q_S, P_I, W, PEN, EX)$

[4] $M = \gamma_i (P_S, PEN, EX)$

[5] $L = \lambda_i (Qs, W, PEN, EX)$

[6] $Q_e = Q_S = Q_D$

[7] $P_e = P_S = P_D$

PEN and EX are indicator variables for cartel policies of penalty and exemption, respectively. PEN is equal to one in the years where the FCO investigated and convicted the cartel (1959, 1972, and 1974). EX is included to test the effects when the cartel was exempted from prosecution over two consecutive five-year periods from 1975-1984 inclusive. The baseline is the years when the cartel was illegal, but no action was taken against it.

The demand function [2] is defined with exogenous variables of real value of construction permits (CON), and population (POP). As cables are needed when new construction is undertaken, demand is derived and shifts in demand will be picked up by changes in the construction industry, CON, which also tend to reflect wider macroeconomic changes. We expect the number of permits, which is a proxy for the growth of the electricity network, to be an important and exogenous determinant in cable demand. To account for the demand due to wear and tear of existing cables, we use population size, POP, as a proxy for replacement of old power cables. Population growth is exogenous to cable supply and is an important determinant of demand for new cables and is, therefore, an appropriate instrumental variable.

The cartel's supply price relationship is [3], and is endogenous to supply (Q_S). It is determined by the input costs of raw materials (P_I) and labor (W), as well as the cartel policy. We assume the cartel to be price-takers in their input markets, so P_I and W are exogenous.

The profit (M) function of the cartel, [4], is endogenous to price and is also a function of the prevailing legal regime. As cable production is labor-intensive, one interpretation of L (the number of workers) is the capacity of the cartel. Equation [5] models the capacity relationship with capacity determined endogenously by supply through hiring decisions, and exogenously by FCO policy and the real wage rate (W). We assume that cable producers are price-takers in the unskilled labor market.

Finally, [6] and [7] are market equilibrium identities. To test Hypothesis 3, equations [3] to [5] are re-specified with lagged PEN to see if output price, profit, and capacity are influenced by the FCO penalty the year before.

4.3 Data

To estimate the system of equations, we use annual data from 1958 to 1990 when the cartel was operating within West Germany. Comprehensive data prior to 1958 are unavailable, and major structural changes to the German economy after the fall of communism and reunification make an analysis of post-1990 data impossible. All exogenous country data are taken from international surveys and the Industry Reports. The data sources are reported in the appendix. Table 1 reports the summary statistics.

FCO reports the cartel's annual aluminium and copper inputs in tons, from which we calculate cable output in tons (where we note again that the data take into account the different conductivity of aluminium and copper input). The cartel's nominal total revenue each year is also found in FCO reports, which is deflated by the industrial price index. Average prices each year are obtained using the real total revenue and output. One limitation of annual data is that price and quantity responsiveness is likely to be underestimated as within-year variation is not captured. Profit is defined as total revenue minus total variable costs, which include costs of raw materials (aluminium and copper input) and total wage bill. The cartel's total wage bill is calculated by multiplying the number of employees by the total hours worked in a year, which is taken as 40 hours a week over 40 weeks.[17] Hourly wage is that of unskilled male labor. Sources and further descriptions are found in the appendix.

4.4 Results

Table 2 reports the single-equation, two-stage least-squares efficient generalized method of moments regression results, for models with PEN and lagged PEN. Taking the lag of FCO penalty does not change the main results.

The general fit of the models is good with high F and R^2 statistics. Standard errors are corrected for heteroskedasticity, serial correlation and small-sample bias. Hansen statistics show that, at the 99% significance level, the null hypothesis of valid instruments cannot be rejected, indicating that restrictions are not over-identifying, and instruments are uncorrelated with the error term and are excluded correctly. Null hypotheses of underidentification and weak identification are rejected by the partial R^2, rank Wald and rank F statistics respectively. Estimation using full-information, three-stage least-squares techniques does not change the results.

From the estimated demand function, demand is downward-sloping, but the price coefficient is

[17] This assumption of hours worked a year is a scaling exercise. As hours worked did not change significantly during this period, the scale factor does not introduce bias into our data.

insignificant. This result is consistent with the costs for cables constituting only a small proportion of the total investment (for example, connecting a new power plant to the electricity network). In addition, cost-based regulation gave cable buyers little incentive to reduce demand in response to a price increase. As expected, growth in new construction permits and population were significant demand shifters.

The cartel's inverse supply function is upward-sloping. FCO penalty did lead to output price falling in the year of the penalty, but the effect was very small and statistically insignificant. The penalty also had no price effect a year later—as it should have had if the cartel expected high fines for recidivism or a higher chance of being detected and penalized in the future.[18] Cartel prices were chiefly determined by demand conditions and input prices, with legalization during the exemption having no effect.

The capacity equations show no significant effect of FCO policy. Penalties did not cut capacity in contemporaneous and following years. More importantly, protecting the cartel from prosecution did not lead to capacity reductions. The purpose of the exemption policy was to reduce the number of cable types which, in turn, should reduce L. From Table 2, after accounting for market size, there was no decrease in labor input during the years of exemption at the 95% significance level.

Looking at cable types directly, the number fell by 2.25% per year during the 1975-84 exemption, but was also declining throughout the entire period our data covers. It fell more quickly before 1975 at 3.57% per year and more slowly after 1985 at roughly 1% per year. Hence, the reduction of types during exemption appears to have been part of a trend independent of the FCO exemption policy.[19] Exemption coincided (in fact, was justified) with declining demand. Therefore, the fall in the number of cable types in 1975-84 was likely to be facilitated by a shrinking market size. Our analysis thus suggests that excess labor input would have been cut even without the state temporarily legalizing the cartel. Hence, we conclude that the rationalization program failed to achieve its targets. We find no support for Hypothesis 2 and thus maintain the null hypothesis that the rationalization scheme may have had no effect.

The exemption policy, however, did increase profits by 18-21% for each year the cartel was

[18] When the penalty in 1972 (against which the cartel successfully appealed) is excluded, we found some effect on capacity, but this result is not robust to the lagged specification. This suggests that, even if the penalties in 1959 and 1974 did reduce capacity, it was very small and short-lived, and cannot be detected a year later. Our results also do not change significantly when we specify the 1972 decision as encouraging collusion (as though it were an exemption) since the decision may have suggested a lower probability of future conviction.

[19] One hypothesis is that the number of cable types did not decline much because the number of types was simply optimal. While we cannot exclude this possibility, it is at odds with the Industry Reports and the FOC reports regarding this issue.

legalized, depending on the model specification, when quantity supplied was held constant. In the first-stage regression (not reported), exemption reduced quantity supplied by about 4% each year at the 90% significance level. This indirect effect of exemption – through quantity reduction – was therefore to decrease profit by 2%. If this is taken into account, the total effect of the exemption policy was to increase cartel profit by 16-19% a year. This confirms Hypothesis 1 that profits are not lower under exemption, and were in fact at least 16% higher in our estimation.[20] As demand was inelastic, the FCO exemption policy did not cause a deadweight loss.

One issue related to collusion is the pricing response of cartels to fluctuations in the demand for their output. Our results suggest that profit was pro-cyclical to the business cycle. When demand shifts outwards by 10%, cartel price increases by 5.7%, with profits increasing by 4.5%. This is consistent with the view that pricing behavior is pro-cyclical (Scherer and Ross 1990) rather than counter-cyclical (Rotemberg and Saloner 1986). The explanation is that during booms, prices are unlikely to be lowered because firms that may operate at the capacity limit cannot gain much additional business by defecting. By contrast, during a recession, firms hold idle capacity and a defection is profitable.[21] Procyclical cartel pricing has also been found in Cowley (1986), Dick (1996), and Suslow (2005); and in Domowitz et al. (1986) for non-cartel data.

Penalizing the cartel neither resulted in efficiency gains from reduced labor input nor made any impact on cartel profits. This result is consistent with Hypothesis 3 if the expected sanction did not increase sufficiently after the convictions. In 1959, the industry was convicted for running a rebate scheme designed to restrain price competition. The rebate system had to be abandoned but no fine was imposed. In 1972, the four largest firms were fined for jointly acquiring a smaller firm according to specific share quotas but the firms successfully appealed against the fine. In 1974, eleven firms were fined a total of DM850,000 for price conspiracies. The 1974 penalty was in connection with the above mentioned system of intra-cartel sales and the list of prevalent types and the "agreement on market statistic." The fine amounted to under 0.1% of revenues that year and was therefore small by most standards. Fines were also relatively low compared to the average excess profit of DM50 million per year from collusion the illegal cable cartel made in real terms. It is therefore unsurprising that cartel behavior in determining prices or capacity did not change a year after these small penalties were levied.

[20] McCutcheon (1997) argues that the opposite should happen, that cartel prohibition actually facilitates price-fixing agreements, but our results do not support this hypothesis.

[21] Another reason for lower collusive prices during slumps is that, when firms observe demand imperfectly, price cuts in phases of low demand may be misinterpreted as cheating by other firms and so collusion breaks down (Green and Porter 1984). As mentioned above, there are good reasons to assume that the cable cartel firms perfectly observed demand in the cable industry.

FCO experience with other cartels suggests the same lenient approach. Although systematic and comprehensive data are not available from FCO reports, and published fines are not related to the revenues or profits of the convicted firms, a fairly clear picture emerges nevertheless. In the 1960s, fines were generally rare. The frequency of penalties increases in the 1970s and fines were up to DM3 million. The highest fine given before 1989 was DM57 million. Whereas fines increased more rapidly than the price index for investment goods, they were still small in absolute terms compared to the 1997 fine against the cable cartel.

If the FCO was lenient at least until the late 1980s, it likely changed its policy later. Possibly, it identified the detection of cartels as a new agenda, not least because some of its power and responsibilities had been taking over by DG Competition in the 1990s. The first cartel prosecution, in a series that would follow, occurred in 1989 when the FCO imposed a fine of DM220 million on the cement industry. If at all, this rather high fine could have affected the cable cartel only in the last year of our analysis, 1990, but this was not the case. Hence, it remains unclear why the power cable cartel remained unchallenged from 1985 to 1996.

Finally, we consider the possibility that collusion was not effective prior to 1975 and that the industry was competitive. In that case, penalties cannot reduce profits. Unfortunately, we cannot evaluate the cartel's effectiveness based on the price elasticity of demand (as it is zero) and neither have we been able to calculate a counterfactual competitive price as penalty (or lagged penalty) was not significantly correlated with lower cable prices. Therefore, strictly speaking, we cannot exclude the possibility that the industry was competitive when the cartel was illegal. It seems rather unlikely that a cartel operating illegally for nearly twenty years and which was penalized three times, was in fact charging competitive prices. In the mid-1990s, cable prices dropped by an amount that suggests the pre-1990 prices were supra competitive (see below). Further, structural arguments also suggest that the industry was collusive before 1975: as seen in Sections 2 and 3, concentration was high, the industry as a whole did not face any competition through substitutes or imports, and firms made use of facilitating practices. All this suggests that the industry charged cartel prices, to the detriment of the consumer.

To summarize, first, the actions against the cartel were not particularly harsh and did not indicate a tougher penalty for future violations. Second, FCO penalties against other industries did not appear to deter cartelization in the cable industry. Third, it is very likely that the industry was not competitive. We conclude that, consistent with Hypothesis 3, firms found it profitable to keep fixing prices either in the same year or a year later, because penalties were not harsh enough.

4.5 The Industry after 1990

With German unification in 1990, five East German cable producers became members of the trade association, and all but one of them were fined as cartel members in 1997. However, from 1993 to 1996, nominal prices dropped by 37% (Industry Reports). This unprecedented decline of prices is inconsistent with the idea of a functioning cartel. The FCO first notes the presence of a non-cartel firm in 1995 (FCO Press Release 1997). According to the Industry Report, prices dropped further in the following years but precise data are unavailable from the mid-1990 onwards. It is therefore likely that the cartel broke down in late 1992 or 1993, prior to the 1997 penalty.[22] A series of takeovers had started in 1991 in which the largest firms were acquired by European companies.

Why did the cartel eventually break down? One main reason was the expansion of excess capacity due to the entry of new firms after German reunification. An indicator of excess capacity is labor productivity, measured as tons of output per worker. Labor productivity was virtually constant from 1976 to 1989, with values between 11.03 and 12.02. Additional former East German plants reduced labor productivity to 9.50 in 1991. The cartel was probably no longer able to maintain price discipline with more firms and increased excess capacity. Accordingly, with prices dropping substantially, firms were forced to exit, leading to the post-1992 consolidation of the industry. From 1992 onwards, labor productivity increased rapidly to 24.63 in 1997. This suggests a substantial amount of idle labor force and welfare cost throughout the collusive period.

A second factor contributing to the decline was probably the liberalization of European electricity markets from the early 1990s on. This put pressure on previous public monopolies to procure more cheaply. The Industry Report (1991) indeed angrily notes the presence of a new "spirit of competition" in the procurement of public utilities.

5 Conclusion

Do cartel laws actually improve competition? Our analysis of the high-voltage power-cable cartel suggests the answer is yes. One of the most interesting aspects of our data is that we observe a rare natural policy experiment where an industry is temporarily exempted from cartel laws. We find that the cartel earned significantly higher profits when it was legal. In the cable-cartel case, when the government failed to prohibit collusion, firms cooperate better. This result is obtained

[22] We do not doubt the 1997 FCO decision that the cartel was still formally operating that year, not least because all fines were accepted without appeal. However, based on our analysis, it is likely that the cartel was no longer effective by that time. Legally, fines for illegal explicit collusion can apply for a maximum of five years before the detection.

even though the prohibition was poorly enforced throughout the period of investigation. The mere presence of the prohibition and its implied threat was significant in reducing profits from collusion.

The cartel failed to achieve efficiency gains during the legal phase despite such rationalization gains being the justification for the exemption. Dick (1996, p. 246) lists functions of cartels beyond price fixing and market allocation, and some of these may improve efficiency. In our study, while the cartel may indeed have performed some of these functions,[23] our results indicate the exemption did not improve efficiency, as measured by product types and output per worker once shrinking demand is controlled for in the model. The exemption only served to increase cartel profits. Given the decline in the industry on the whole, it is likely that without the exemption the cartel would have ceased operations sooner.

Finally, penalties did not have a significant impact on the cable cartel. Similar results are sometimes interpreted as the failure of anti-cartel policy as a whole (Sproul 1993). However, our results offer a different explanation. Sanctions did not reduce the effectiveness of the cartel because they were too lenient, and firms found it worthwhile to keep fixing prices despite the punishments. Punishments also have a positive externality in that they may deter collusion in some cases which are by definition unobservable, and may hinder cooperation in other cases. The positive effect can be seen from the default policy of inaction pursued by the FCO. When the cable cartel remained illegal, its profit was lower than when it was legalized. This is consistent with Voigt's (1962, p.204) early conclusion that "[e]ven in those areas of the economy where the effects of [new anti-cartel] legislation were generally small it nevertheless exercised an influence ... on the character of competition through the mere existence of state supervisory authorities."

Antitrust authorities in the United States and the European Union have imposed spectacularly high fines on a number of cartels, with the highest fines ever, $900 million in the US and €850 million in the EU, against the firms of the vitamins cartel in 2001 (Hammond 2001; EU Commission 2001). Whereas Conner (2005) argues that these fines may still be too low, Easterbrook (1986) and Cohen and Scheffman (2000) contend that high fines may be supra deterrent and have adverse effects. In retrospect, the measures against the cable cartel appear rather soft and, in particular, the threat of significantly higher fines in the case of recidivism was not credible. If the cartel members had actually expected higher fines (like those imposed in 1997), the penalties would have reduced the likelihood and consequences of collusion.

[23] Dick's (1996, p. 246) lists applies to export cartels which operate differently than the cable cartel. Still, factors like "market research and information", "publications" and "statistical services" apply to both Dick's export cartels and our cartel.

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