

INTERNATIONAL CARTELS THEN AND NOW

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I. INTRODUCTION

In this paper we compare a sample of contemporary international cartels with similar samples of cartels from the late 19th through the mid-20th centuries. First, we compare the duration of contemporary and historical cartels. Economists have long believed that, without government assistance, cartels would dissolve quickly as each firm was seduced by the temptation to increase its output and chisel its price to increase its own individual profits. We find that this generalization holds neither historically nor in the present period. While the temptation to cheat remains a constant problem for cartels, some cartels are able to develop sophisticated organizational devices that lessen this temptation or simply remove decision-making from individual firms altogether. Thus, while some cartels dissolve quickly, others endure for decades. We provide *very preliminary* estimates of the determinants of duration for a sample of 1990s international cartels.

Second, we compare the organizational techniques used by cartels to stabilize themselves. While there has been speculation that the development of modern information technology might diminish the need for or change the structure of collusion, we find that, at least among those cartels that left sufficient records for prosecution, the organization, monitoring, and communication techniques are remarkably similar to those of previous decades. Third, we discuss the factors that are most likely to undermine collusion. Finally, we discuss the impact of recent prosecutions on industrial structure and compare this to previous shifts in antitrust policy in the United States in the 1890s and Great Britain in the 1960s.

How are cartels today similar or different from cartels of previous periods? In order to shed light on this question, we use a sample of 52 private international cartels, all convicted of engaging in collusive behavior during the last decade of the twentieth century (Table 1). Each of the cartels in this sample was 1) convicted in either the United States or the European Union (and sometimes both) of illegal price fixing or market division agreements, 2) in operation at some point during the 1990s (and possibly before or after), and 3) includes member firms from more

than one country.¹ We argue that cartels today are fundamentally similar to cartels of the previous one hundred years. They face the same set of challenges: preventing entry and cheating. They conquer these challenges with the same sort of organizational techniques: complex and sophisticated measures to control not only prices, but various terms of sale and distribution, as well as investment and the use of technology. They develop sophisticated monitoring, compensation, and punishment mechanisms. Despite rapid technological change in communications in the late twentieth century, cartels still rely heavily on direct, face-to-face meetings and negotiations, perhaps because trust is undermined not only by the incentive to cheat but the illegality of the activity.² This trust dilemma has only been exacerbated by the amnesty policies of antitrust authorities around the world that have increased the incentives for individual members to defect to the authorities.

II. CARTEL DURATION THEN AND NOW

1. Cartel Duration

Following Stigler (1964), economists have long argued that cartels are fundamentally unstable. Cartels increase firm profits by restricting output below the individually rational profit maximizing level. The incentive to raise profits through collusion is a strong one: as Adam Smith (1776, p. 128) wrote, “People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.” However, economists have long argued that the cartel’s action will in turn give each firm an incentive to increase output beyond the agreed upon level. In other words, immediately after agreeing to collude, company executives will turn their backs on those conspiracies and pursue their own individual interests, to the benefit of consumers.

The reality is somewhat different. We find that while the incentive to compete constitutes a constant pressure on cartels, firms do manage to collude and many, though certainly not all, cartels endure for years and even decades. Over the last 150 years, more and more governments

¹ In some cases, the legally responsible firm is based in the same jurisdiction as its fellow conspirators but is a subsidiary of a foreign corporation. We have included such cases as international cartels.

² The relationship between cartel stability and trust is discussed in greater detail in Leslie (2004).

have come to see competition as an important mechanism for improving economic performance; as a result, formerly permissive attitudes toward collusion or even active state intervention in support of cooperative agreements have increasingly given way to policies in support of competition. Despite this, cartels continue to be formed and many succeed in influencing market outcomes over sustained periods.

In our sample of contemporary international cartels, the average cartel lasted just under six years (Table 2). In his classic study Posner (1970) found that the average duration of cartels prosecuted by the U.S. government between 1890 and 1969 was 7.5 years. A recent update of Posner's work (using a sample covering 1955 to 1997) found that the average duration of U.S.-prosecuted cartels had decreased to 5.4 (Gallo et al 2000). Given the large variance found in all cross-section studies of cartel duration (the standard deviation of our international cartel sample is 5.25), there does not appear to be any significant change in cartel duration over the last century. A comparison of our sample to international cartels from an earlier period leads to a similar inference. Suslow (2001) examines 71 international cartels active before World War II and finds an average duration of 8.3 years. Eckbo (1976) creates a sample of 52 international cartels spanning most of the 19th and the first half of the 20th centuries, and he finds an average duration of 5.3 years. Griffin (1989) examines 54 international cartels between 1888 and 1984 and finds an average cartel lifespan of 7.3 years. In each case where a measure of variance is included, the variance in cartel duration is high.³ As Stigler argued, there are cartels that dissolve quickly. Each of these samples includes cartels that barely lasted one year. But there are other cartels that endure, and average cartel duration does not appear to have changed substantially over the past century.⁴

2. Who Colludes?

The industrial distribution of cartels varies over time and geographic area, but these fluctuations do not appear to reflect any monotonic historical change in terms of which industries are collusion-prone. Rather, it seems to reflect the legal and institutional environment in which firms operate as well as the extent of market integration. Firms only collude in industries where

³ The standard deviation of cartel duration ranges from 2.4 years in one of Eckbo's sub-samples to 6.3 years in Griffin's study. See Levenstein and Suslow 2004b, Table 1.2 (p. 16).

they would otherwise be forced to compete. If legal or other barriers to competition exist, collusion does not arise. If the industry is sufficiently concentrated or even monopolized, explicit collusion may be unnecessary to achieve the “cooperative” equilibrium. If regulatory mechanisms exist which can be co-opted to limit competition, firms will often turn to these instead of cartels. Differences in the industrial distribution of cartels often reflect these institutional parameters rather than historical changes (such as economies of scale) in the industries themselves.

a. Which industries?

International cartels seem to occur predominantly in industries that are dominated by 5 or 6 firms. The median number of firms in our sample of cartels is 5.5; the mean is 7.8. Of the eleven cartels in our sample that had more than ten members, all but one had the active involvement of a trade association. In the interwar period, Suslow (2001) finds a similar pattern, with a median of 4 firms in her sample of international cartels and a mean of 7.4.

Cartels affect a remarkably broad range of sectors. Our 1990s international cartel sample includes firms in a variety of industries – from commodities like cement and citric acid to specialized services like fine arts auctions and wastewater treatment facility construction (Table 3). Chemical products top the list with sixteen different cartels. The next largest product category is water transportation, including both ocean shipping, various ferrying operations, and a variety of specialized oil and chemical transport (ten of the cartels in our sample), followed by steel and other metal manufacturing (6), carbon and graphite products (4), plastics (3) and paper (2). What does not appear in this sample are final, retail goods and services; rather these firms are almost exclusively providing intermediate goods or services.

The sectoral distribution of our contemporary international cartel sample is similar in its dispersion across intermediate manufacturing and service industries to that found by studies of cartels in other times and places. Three studies of legal cartels in Germany (Audretsch 1989), Sweden (Fölster and Peltzman 1997), and Great Britain (Symeonidis 2002) find a large proportion of cartels in the stone and glass and machinery industries. The other industrial

⁴ See Levenstein and Suslow 2004a, 2004b for further discussion of these studies as well as other studies of cartel duration.

groups which appear to be well-represented in these samples are food, textiles, chemicals, steel, and paper. Fraas and Greer (1977) find that more than half of all price-fixing cases prosecuted by the U.S. Justice Department between 1910 and 1972 were in manufacturing. In an interesting study that may say as much about who makes a good victim of price fixing – or perhaps who the U.S. Department of Justice was prosecuting – Joyce (1989) reports that over 50% of the U.S. DOJ cases between 1983 and 1987 were in just two industries: highway and street construction and electrical contracting.

Still, although there are some similarities in the sectoral composition of cartels, there is considerable variety in the particular products and services covered by cartels. In some industries – sugar, aluminum, potash – collusion is attempted repeatedly, and these industries can reasonably be thought of as collusion-prone. Others – especially un-concentrated retail sectors – rarely see cartel activity. But otherwise one must be quite cautious about making generalizations. First, some industries which seem to be frequently cartelized in a particular time or place are not the object of cartel activity in other periods. As mentioned above, almost a third of the 1990s international cartel cases are in the chemical industry (Table 3). There were also many cartels in the British and German chemical industries in the late 19th and early 20th centuries. But Symeonidis (2002) reports that these industries were relatively unlikely to be cartelized in 1950s Great Britain. Whether an industry is “collusion-prone” seems to depend on the particular country and time period, and the legal, institutional, and economic environment in which it operates.

In countries or time periods where collusion is legal and industry associations are allowed to help organize cartels, one does observe collusion in relatively un-concentrated industries. For example in his study of collusion in Great Britain, Symeonidis (2002) finds cartels in relatively unconcentrated industries prior to the 1956 Restrictive Trade Practices Act, followed by increases in concentration after 1956, when cartel registration was required and subject to review by the Restrictive Practices Court. Even in the U.S. context where cartels have been illegal for over a century, and where Posner finds that the average number of firms convicted of price fixing was quite high (29.9), if one breaks it down by time period one sees that it was highest during the period of greatest leniency and ambiguity in the legal status of price-fixing in the United States (during the 1920s and the early New Deal). This legal environment encouraged

trade associations to try – albeit sometimes unsuccessfully – to find ways to support collusion without violating the law (Alexander 1994, 1997 and Bittlingmayer 1995).

b. Concentration

Many contemporary international cartels exist in extremely concentrated industries. Of the 31 cartels for which we were able to obtain *any* measure of concentration, *twelve operated in industries with a global C4 of over 90%*. Even with this limited data, it seems clear that this is higher than the industry concentration found in most previous samples of cartels, whether international or domestic, legal or illegal. One might expect that it would be easy to establish that cartels are most common in highly concentrated industries, but the empirical relationship is more complicated.⁵ This is partly because concentration is endogenous; especially where collusion is legal, cartels may allow more firms to remain in the industry than would be sustainable in a more competitive environment (Sutton 1991, 1998, and Symeonidis 2002). Where collusion is illegal, one might expect that explicit conspiracies to fix prices would be unnecessarily redundant for firms in highly concentrated industries. (This is the “idiot test” influencing our selection criteria; we are collecting cases of firms who got caught. Firms in highly concentrated industries with keener leadership might be able to find ways to avoid competition without resorting to collusion – and the threat of prosecution.)

3. Cartel Organization

How are cartels able to survive, despite the temptation to cheat? We argue that cartels today, as in the past, rely on a range of organizational devices to modify members’ incentives and directly prevent them from cheating. Many studies of cartels make passing reference to the importance of organization for cartel success, but direct examination of the question is quite limited. MacKie-Mason and Pindyck (1987), in an examination of the mercury cartel, argue that structural factors, such as barriers to entry, are actually much more important than organizational ones. In the absence of barriers to entry, organizational innovations were able to preserve the

⁵ See Levenstein and Suslow 2002 and 2004b for further discussion of previous findings on the relationship between concentration and the likelihood of collusion.

formal structure of the cartel, but not its ability to increase price. In contrast, an insightful study of the sugar industry by Genesove and Mullin (2001) concludes that organizational learning and innovation were critical to the cartel. Cross-sectional studies have characterized the various mechanisms that cartels use to create barriers to entry and prevent cheating, but have had little success in establishing a systematic relationship between organizational variables and collusive success. Spar (1994) has a useful approach to the importance of cartel organization because she focuses on how prior interactions among firms influence expectations and therefore the set of feasible equilibria; earlier cooperation changes expectations and increases the stability of collusion in the future. In her study of the De Beers diamond cartel, she describes the historical background in which diamond miners were forced to develop cooperative solutions to a variety of problems unrelated to price-fixing; she argues that this created the context for successful collusion in the industry for years to come. Her broader perspective on cartel organization is that cartels are sustained only through continuous bargaining and are “best managed by those producers who are able to keep the circle of negotiators small, the rules flexible, and the power to retaliate as strong as possible.”⁶

Table 4 provides a comparison of the organizational mechanisms employed by our sample of contemporary international cartels with those of earlier studies. One of the most striking features is the consistent involvement of trade associations in facilitating or providing cover for cartel activities. From Table 4, it would appear that nothing has changed over time or place, and that trade association involvement is and has been a consistent element in facilitating collusion. A closer look at our sample suggests something different. Of the sixteen cartels that had trade association involvement, none involve a U.S. trade association. Nine of them involve pre-existing European trade associations whose activities in facilitating collusion probably pre-date the recent changes in EU law and enforcement policies which have made the legal environment much more hostile to price-fixing than in years past. Six of the seven trade associations that reach beyond Europe are related to shipping cartels that also evolved from associations or agreements that pre-date current competition policy; several of these shipping associations were in fact formed after previous cooperative agreements were banned by the European Commission. Finally, one cartel (lysine) strategically formed an international trade association as a cover for

⁶ Spar (1994), p. 219.

its activities. Thus, it appears that American trade associations have learned to refrain from involvement in such conspiracies.

In contrast to trade association involvement, our sample shows a very different pattern from earlier studies with regard to market allocation. Almost three quarters of the cartels in our sample allocated geographic markets or assigned specific customers to cartel members. While market allocation is a common feature of the other cartel samples reported here, it is generally less than a third. Similarly, more than half of the cartels in our sample set other terms and conditions of sale, while that proportion never reaches 15% in these other samples. There are several possible explanations for these differences. First, national barriers provide a ready mechanism for dividing markets. This has been true of international cartels in the past; Suslow (2001) finds that 40% of her sample of inter-war international cartels assigned exclusive territories to cartel participants. Thus, removing trade barriers across national boundaries may not give rise to competition as readily as has been expected, especially in highly globally-concentrated industries. National boundaries provide focal and institutionally-supported (e.g., by differences in language, currency, distribution networks) market divisions that can facilitate collusion. Second, it is possible that both the use of market allocation mechanisms and agreements on other terms of sale reflect increasing sophistication of cartels. On the other hand, one must always consider the selection criteria for the sample and the availability of such information about internal illegal cartel activities. The low numbers in our sample as well as other cross-section studies for cartel features such as disciplinary actions, exclusion, penalties, and monitoring may reflect the lack of publicly available information on these activities. Because both the United States and the European Union now treat price-fixing as per se illegal, convictions for price fixing need not include any description of the details of these conspiracies.⁷

In order to test the relationship between cartel organization and cartel duration, we have developed an index of organizational complexity for our contemporary international cartel sample.⁸ This ten-point index assigns one point for each of the following cartel characteristics:

⁷ National law varies among the member states of the European Union. Great Britain has recently criminalized price fixing, the first country outside the United States to do so. Many of the newly admitted European Union countries have adopted national laws that are modeled on European Law. But “old Europe” law still varies from country to country regarding its treatment of price fixing.

⁸ Griffin creates a measure of internal cartel organization that attempts to capture the extent of control that the cartel has over member operations. Griffin finds that more centralized cartels are more effective at raising price. Griffin

control of distribution; trade association participation; bid rigging; market or customer allocation; agreeing to other terms and conditions of sale; monitoring of output and pricing; penalties or other compensation for exceeding cartel quotas (self-imposed); disciplinary actions in response to cartel violations (cartel-imposed); exclusionary practices (to prevent entry or expansion by non-members); elaborated internal structure (e.g., an organizational hierarchy within the cartel itself). The mean value of this index for this sample is 3.6, with a range from zero (aluminum phosphide and plastic dinnerware cartels, both lasting less than a year) to nine (steel heating pipes cartel, involving ten vertically integrated firms and lasting about five years).

III. EMPIRICAL ANALYSIS OF CARTEL DURATION

In order to examine these issues more rigorously, we estimate a proportional hazard model, specifying the probability of cartel breakdown as a function of variables that we expect to influence the stability of collusion: the number of cartel members, whether the industry is highly concentrated,⁹ whether the product is homogenous, the interest rate, a measure of macroeconomic variability, and our index of cartel organization (discussed above). See Table 5 for sample means of each of these variables.

We first estimate this model for the entire sample; we then estimate it separately for cartels that were broken up by antitrust activity and those that had ended prior to prosecution (due to customer complaints, for example). As all cartels in the sample were at risk of breakup from either antitrust action or other general economic causes, we will next estimate a competing hazards model (Meyer and Katz 1989, Hill et al 1993).

The hazard function (also known as the failure rate, hazard rate, or force of mortality) $h(x)$ is the ratio of the probability density function $f(x)$ to the survival function $S(x)$, given by

$$\lambda(x) = \frac{f(x)}{S(x)} = \frac{f(x)}{1 - F(x)},$$

does not elaborate on how he measures organization. He simply states that it "is a subjective measure assigned after reading the available descriptions of the effectiveness of the cartel structure" (Griffin 1989, p. 191).

⁹ We have defined "high concentration" very strictly: we consider only industries that have a global C4 greater than 90% highly concentrated.

where $F(x)$ is the cumulative distribution function. The hazard rate is the probability that an event occurs (i.e., the cartel dissolves) at time t , given that it has not already occurred.

A proportional hazard model with a vector of covariates, \mathbf{x} , can be written as

$$\lambda(t; \mathbf{x}) = \kappa(\mathbf{x})\lambda_0(t),$$

where $\kappa(\cdot) > 0$ is a nonnegative function of x and $\lambda_0(t) > 0$ is called the baseline hazard. The baseline hazard is common to all subjects in the population. Individual hazard functions differ proportionately based on a function $\kappa(\mathbf{x})$ of observed covariates. Typically, $\kappa(\cdot)$ is parameterized as $\kappa(\mathbf{x}) = \exp(\mathbf{x}\boldsymbol{\beta})$, where $\boldsymbol{\beta}$ is a vector of parameters and $\exp(\mathbf{x}\boldsymbol{\beta})$ is a shift factor that depends on cartel or industry characteristics.

Then

$$\log \lambda(t; \mathbf{x}) = \mathbf{x}\boldsymbol{\beta} + \log \lambda_0(t),$$

and β_j measures the semi-elasticity of the hazard with respect to x_j .

In our application we are interested in how the covariates shift the hazard function, in which case the estimation of λ_0 is not necessary. Cox (1972) obtained a partial maximum likelihood estimator for $\boldsymbol{\beta}$ that does not require estimating λ_0 (the baseline hazard is invariant across cartels, but can be any separable function of time).

Let's assume now that

$$\lambda(t; \mathbf{x}) = \lambda_0(t)e^{(\beta_1x_1 + \beta_2x_2 + \dots + \beta_px_p)},$$

where $\lambda(t; \mathbf{x})$ is the hazard at time t for a cartel with covariate pattern $\mathbf{x} = (x_1, x_2, \dots, x_p)$ and $\lambda_0(t)$ is the underlying or baseline hazard. The parameter vector $\boldsymbol{\beta}$ is estimated from data via a maximum likelihood approach.

Note that if we change the measurement of one covariate, say x_1 , by one, and keep other covariates unchanged, then the relative risk of breakup is

$$\frac{\lambda_0(t)e^{(\beta_1x_1+\beta_2x_2+\dots+\beta_px_p)}}{\lambda_0(t)e^{(\beta_1(x_1-1))+\beta_2x_2+\dots+\beta_px_p}} = e^{\beta_1(x_1-x_1+1)} = e^{\beta_1}.$$

Thus, the estimated coefficient is the natural logarithm of the hazard rate ratio when x_j is increased by one unit. An estimated hazard rate ratio greater than one, for example, indicates that the covariate is associated with an increased hazard of cartel breakup.

Tables 6 and 7 present preliminary estimates of hazard rate ratios for our sample of contemporary international cartels. In general, they are not highly statistically significant, but that is to be expected given the small size of our sample. Neither the number of cartel participants nor the industry being highly concentrated seems to have a large effect on cartel duration. This is consistent with studies of cartel duration in previous eras. These variables probably have a larger effect on where collusion is attempted than on how long it succeeds. Product homogeneity, however, appears to increase cartel stability. Using our point estimates, a cartel marketing a homogenous good has 27% lower probability of breakup (Table 6). If we restrict our attention to cartels that broke up on their own, prior to antitrust action, our point estimate suggests a 70% reduction in the probability of breakup for cartels selling homogenous goods (Table 7).

Two variables that have received considerable attention in the theoretical literature on cartel stability are the discount rate and macroeconomic fluctuations. Perhaps the single most robust result of the repeated game literature on collusion is that, as players become more impatient, collusion is harder to sustain.¹⁰ This prediction has rarely been tested in cross-section studies; we do so here by including a measure of global interest rates, LIBOR.¹¹ Our estimates are consistent with the theoretical predictions. For the full sample, an increase of one percent in interest rates increases the probability of cartel breakup by 11%. However, when one restricts attention to those not censored by antitrust intervention, the effect appears much larger: an increase of one percent in interest rates increases the probability of cartel breakup by 48%.

There has been much less consensus regarding the effect of macroeconomic fluctuations on cartel stability. Green and Porter (1984) propose a model in which negative shocks to demand

¹⁰ Friedman (1971).

¹¹ The London Inter-bank Offer Rate.

lead to the appearance of cartel breakup. Rotemberg and Saloner (1986) propose an alternative model in which cartels become less effective during macroeconomic booms. Haltiwanger and Harrington (1991) reverse the Rotemberg and Saloner result by introducing auto-correlated shocks to demand. Previous cross-sectional studies have found that macroeconomic volatility reduces cartel life spans (Suslow 2001, Dick 1996, Marquez 1994). We examine this issue with respect to our sample of contemporary international cartels by estimating the effect of deviations from trend global GDP.¹² The point estimates of the hazard rate ratio are very large, but are not robust to changes in the regression specification and are not statistically significant. At least for this sample of cartels, in operation during the boom period of the 1990s, macroeconomic fluctuations do not appear to reduce cartel duration. It may be that a closer examination of the timing of cartel *formation* may suggest a role for macroeconomic fluctuations (and market integration). This requires further investigation.

In order to capture the effects of antitrust policy on cartel breakup, we include two additional variables: a dummy for whether the cartel was broken up before or after 1994, when the U.S. Justice Department changed its amnesty policy to give automatic amnesty to firms that cooperate and provide evidence against their co-conspirators and a dummy variable indicating whether cartel participants had previously been convicted of price-fixing.¹³ U.S. Department of Justice policies (known as “amnesty plus”) also provide firms with an incentive to give the Department information regarding the existence of other cartels, so being caught in one cartel net frequently leads to investigations and convictions in others related cartels. Our initial expectation was that the increased enforcement associated with these two variables would be associated with decreases in cartel duration. The results are just the opposite; we believe that this is because our “recidivism” variable confounds several things. Having been caught in one cartel increases the likelihood that you will assist the DoJ in breaking up other cartels that you participate in. On the other hand, multimarket contact among colluding firms, which is also picked up by our “recidivism” variable, is widely believed to facilitate cartel stability, as it increases the range of punishments available to the cartel. Multimarket contact also increases stability because cartels also seem to apply what they learn about collusion in one market to collusion in other markets.

¹² We use the Hodrick-Prescott (HP) filter with a smoothing parameter of 6.25 to estimate trend growth in global GDP. Global GDP data are from *World Development Indicators*, World Bank: Washington, DC.

These latter two effects seem to outweigh the effects of the “amnesty plus” policy on cartel duration. Our point estimates for “recidivism” (for those cartels broken up by antitrust authorities) suggest that having a prior conviction for collusion decreases the probability of cartel breakup by 68%. For those that broke up for other reasons, the effect is smaller and less statistically significant, but further investigation is clearly warranted to disentangle the different effects being picked up by this variable.¹⁴

Finally, increases in organizational complexity are associated with increases in cartel duration. For firms that were not broken up by antitrust authorities, an increase of one in our organizational index (described above) decreased the probability of cartel breakup by approximately 21%. For cartels that were broken up by the authorities, the effect was much smaller (4%). While there is much variation in cartel organization that is not captured by this index, and while we recognize that organizations may become more complex as they endure, these estimates are consistent with anecdotal evidence that cartels use organizational innovations to modify participants’ incentives to cheat and their opportunities to do so. For example, over two thirds of the cartels in this sample had a system for monitoring one another’s output or market share. About a sixth had a method of automatically compensating one another for any sales above allocated market shares, and about sixty percent went beyond setting prices to limit competition on a range of other dimensions.

IV. IMPLICATIONS FOR POLICY: POST-CARTEL RESTRUCTURING

The obvious implication of this analysis is that cartels do not necessarily fall apart of their own accord, but rather are able, when the incentives are great enough, to design mechanisms to overcome the prisoner’s dilemma and maintain collusion for extended periods of time. In recent years, competition authorities around the globe have become increasingly aggressive in their prosecution of price-fixing, and there have been proposals that the World Trade Organization adopt disciplines or recommendations regarding what are called “hard core cartels.” In order to

¹³ The U.S. Department of Justice changed its policy in 1993, but we use 1994 because the policy change was mid-year and we are using annual data.

¹⁴ Our data set includes a multimarket contact variable as well as the recidivism variable used here, but it confounds multiple contacts in geographic and product market. We expect to refine the variable before using it in future analysis.

evaluate the wisdom of these policy recommendations, it is important to examine the impact, including the unintended consequences of such policy changes. This is particularly the case if there is a requirement, as is often suggested, that countries “phase in” competition policy rules, first making price-fixing illegal and only after some period of time trying to introduce the much more costly and complex process of regulating mergers. Since the response of many firms to the enforcement of cartel laws appears to be merger or consolidation, the limited adoption of a competition policy against cartels could result in *more* consolidation and *less* competition, not the opposite.¹⁵ For example, in citric acid, vitamins, and carbonless paper, there have been joint ventures with competitors, exit and merger.¹⁶ In 1991, the U.S. Federal Trade Commission blocked the sale of a carbonless paper mill from one former member of the cartel to another out of concern for its anticompetitive effects. But in other, especially European cases, such mergers have been permitted. National policies, as well as perhaps an international agency charged with responsibility for promoting competition in international markets, should address these unintended consequences of more aggressive cartel enforcement.¹⁷

We have relevant historical experience which can and should inform this debate. Symeonidis (2002) examines the impact of the 1956 Restrictive Trade Practices Act; this Act effectively outlawed most price fixing agreements in Great Britain. He finds that this change in competition policy and the resulting increase in competition led to systematic increases in industry concentration across. He argues that increases in competition decreased profits; those profits were restored by reductions in the number of firms in the industry. U.S. economic historians have frequently noted a similar pattern following the introduction of anti-trust prohibitions in the United States in the late nineteenth century. In the United States the 1890 Sherman Act ban on price fixing preceded by a decade the *Northern Securities* Supreme Court decision limiting mergers for monopoly and by twenty-five years the Clayton Act’s more systematic regulation of mergers. In the intervening 25 years, concentration increased significantly in a large number of

¹⁵ For an example of this in an earlier period, see Symeonidis’s examination of Britain’s adoption of an anti-cartel policy in the 1950s and 1960s. GEORGE SYMEONIDIS, *THE EFFECTS OF COMPETITION: CARTEL POLICY AND THE EVOLUTION OF STRATEGY AND STRUCTURE IN BRITISH INDUSTRY* (2002).

¹⁶ Levenstein and Suslow (2001).

¹⁷ See, e.g. Ajit Singh, *Competition and Competition Policy in Emerging Markets: International Developmental Dimensions* (UNCTAD and Center for International Development Harvard University, G-24 Discussion Paper Series No. 18, 2002).

U.S. industries.¹⁸ While we certainly would not want to suggest that changes in antitrust law were the sole or even primary reason for this increase in consolidation, the disparity in the treatment of pricing strategy by independent firms and multi-unit firms does create an incentive for firms to merge in order to lessen the intensity of competition.¹⁹ In our discussion below we examine consolidation following anti-cartel enforcement actions in two cartels in our contemporary international cartel sample

A. Graphite Electrodes Cartel

Graphite electrodes (GE) are large carbon columns used by electric arc furnaces (EAF) or “mini-mills” in the making of steel. These mini-mills use graphite electrodes to generate the enormous heat necessary to melt scrap metal and convert it back into a marketable steel product. Price-fixing by graphite electrode producers began in 1992 and continued through at least 1997.²⁰ In this highly concentrated market, UCAR International of the United States and SGL Carbon Corporation of Germany dominate, with a combined world market share of roughly two-thirds. According to reports in the press, investigation of alleged price-fixing began after a complaint from a steel manufacturer.²¹ The U.S. indicted seven firms for price-fixing, UCAR, SGL, Carbide/Graphite, Showa Denko, Tokai, SEC, and Nippon, and six were fined (C/G was granted leniency by the Department of Justice). An eighth firm, VAW Aluminum, was fined by the European Commission, but not by either the U.S. or Canada.

There was a shakeout and consolidation in the industry in the late 1980s and early 1990s, just prior to the price-fixing conspiracy. The consolidation was precipitated by slumping steel production and Japanese entry into Western markets. GE industry capacity shrank by one-third

¹⁸ Nelson (1959), Table 54, p. 102.

¹⁹ See Lamoreaux (1985) for the definitive treatment of the causes of the merger wave of the 1890s.

²⁰ EUROPEAN UNION, *Commission Fines Eight Companies in Graphite Electrode Cartel*, European Union Press Release, July 18, 2001.

²¹ Adam Jones, *Blowing the Whistle – American-Style*, THE TIMES, February 24, 2000.

between the mid-1980s and 1994.²² New entry is limited not only by high capital requirements but also by the importance of implicit technical and market knowledge.²³

There has been a downward price trend since the conspiracy ended. This reflects in part the Asian financial crisis that hit the steel industry and therefore the graphite electrode industry in late 1998. There is also evidence that points to readjustment to a new equilibrium in the industry since the cartel ended. The breakup apparently precipitated a “market share-driven price war” that cut prices by five percent.²⁴ In addition, individual companies restructured in the face of mounting fines. Joint ventures were also formed. In 1999, for example, UCAR entered into a production and marketing joint venture with Jilin Carbon, the largest Chinese producer of graphite electrodes.²⁵ In 2002 the other leading GE producer, SGL entered into a joint venture with fellow-conspirator Japan-based Tokai Carbon Co., Ltd. to make ultra high power graphite electrodes in China.²⁶ In 2003, SGL tried unsuccessfully to acquire the GE assets of the Carbide/Graphite group.²⁷

B. Seamless Steel Tubes (Oil Country Tubular Goods) Cartel

Seamless steel tubes, pipes, and casings are used in the construction of wells in the oil and gas industry. They are often referred to in the trade literature as Oil Country Tubular Goods (OCTG). Steel line pipes are used in the transmission of oil and gas from wells.

In December 1999, the European Commission fined four European and four Japanese steel manufacturers over \$100 million, charging them with fixing bids on seamless steel tubes and line pipes between 1990 and 1995. The European manufacturers included the inventor of steel tubes, Mannesmann; British Steel (now Corus, which exited the industry prior to the cartel breakup); Dalmine, indirectly owned at the time by the Italian government but privatized in 1996;

²² Anonymous, *New Issues – UCAR International IPO*, STANDARD & POORS EMERGING AND SPECIAL SITUATION NEWSLETTER, November 14, 1994, at 15.

²³ *Ferromin International Trade Corp., et al. v. UCAR, et al.* In the United States District Court for the Eastern District of Pennsylvania, Second amended complaint, filed May 1, 1999, at paragraph 47. Hereinafter referred to as the “Ferromin complaint.”

²⁴ Anonymous, *Purchasing Hotline*, PURCHASING, June 1, 2000, at 3.

²⁵ John E. Sacco, *UCAR Enters Joint Venture with Jilin Carbon*, AMERICAN METAL MARKET, October 17, 2000.

²⁶ “SGL Carbon and Tokai Carbon sign joint venture for carbon electrodes,” *Advanced Ceramics Report*, August 1, 2002.

²⁷ The U.S. Justice Department sued to block the acquisition which was eventually rejected by a bankruptcy judge. Anonymous, “DOJ dismisses SGL Carbon Lawsuit,” *Daily Deal*, May 9, 2003.

Vallourec, a French steel producer who specializes in tubular products. The Japanese conspirators were NKK, Kawasaki, Nippon, and Sumitomo Metal. These eight independent firms created a cartel organization called the “Europe Japan Club.” Under the auspices of the Europe Japan club they agreed “that the domestic markets of the different producers ... should be respected” so that producers refrained from selling in the home countries of the other members of the Club.²⁸ To handle shared markets, the Club met regularly and designated which company was to win a particular job by bidding an agreed upon price, with the others to submit higher bids.

Since the demise of the cartel, the industry has undergone a fairly substantial reorganization, in which all parties to the cartel have joined in one of three international alliances. The largest of these, with a 25% market share of world OCTG consumption is led by the Techint, an Italian–Argentinean firm controlled by the Rocca family. Techint controls Dalmine, the Italian member of the cartel, Tamsa, a Mexican tube producer, and Siderca, an Argentine steel producer. They are known jointly as the DST group. The Rocca family has been in the steel tube business since before World War II. NKK, also a member of the Europe-Japan club, has now formed an alliance with DST, as has a Canadian producer.

Internationally, the creation of alliances among major producers has also meant the consolidation of their sales forces. In fact, the alliance among Nippon, Kawasaki, and Sumitomo Metal appears primarily to be a joint sales agency to distribute their goods worldwide.²⁹ The opportunity to combine its sales force with the existing international sales network of Techint (DST) was apparently central to NKK’s decision to spin off its OCTG unit to NKK Tubes, which is now jointly owned by NKK and DST.³⁰ While the use of a single, consolidated sales network may provide efficiencies in distribution or convenience for customers, it also makes communication and coordination of prices and market shares much easier, and effectively prevents cheating by firms who have delegated sales to the joint distributor.

²⁸ EUROPEAN COMMISSION, *Commission fines cartel of seamless steel tube producers for market sharing*, European Commission Press Release (December 8, 1999).

²⁹ Audrey McAvoy, *Japanese Steel Companies Discussing Seamless Steel Pipe Tie-Up*, DOW JONES INTERNATIONAL NEWS (August 18, 1999).

³⁰ Anonymous, *NKK Merges Seamless Pipe Operations int JV with Grupo Technit*, DOW JONES INTERNATIONAL NEWS (November 2, 1999).

Mannesmann and Vallourec, the other two firms in the Europe-Japan Club have formed a joint venture to which they have transferred all their OCTG production. They are also engaged in steel tube joint ventures with Corus, another member of the Club that has exited the OCTG market.

CONCLUSION

Some cartels do last. As in previous periods, cartels today have developed sophisticated organizational mechanisms to limit the incentive to compete, to monitor each other's actions, and to remove control over individual actions in certain cases (e.g. through joint sales agencies). As has been suggested in economic theory, high interest rates seem to undermine cartel stability, and product homogeneity seems to promote it. Industry concentration may influence where cartels are attempted, but differences in concentration do not appear to affect duration. At least as measured here, macroeconomic variability appears to have little impact on cartel stability. It may be that cartels develop mechanisms to cope with such variability, particularly because in this day and age macroeconomic variability, as opposed to idiosyncratic shocks, quickly becomes common knowledge.

Competition authorities need to adopt policies that prevent the immediate, and in some cases, long term costs of these cartels. Increasingly, they have done so. We must now also consider the unintended consequences of such policies to assure that they are refined (e.g. by the adoption of "probationary" periods of greater merger scrutiny) in a way that does not simply encourage global consolidation rather than competition.

TABLE 1

INTERNATIONAL CARTELS CONVICTED BY THE U.S. DEPARTMENT OF JUSTICE AND THE EUROPEAN COMMISSION: 1990s-2000s

Industry	Start	End	Country of Origin of Cartel Members
Aluminum Phosphide	1990	1990	Brazil, Germany, India, US
Beer	1993	1998	Belgium, France
Bromine Products	1995	1998	Israel, US
Cable-Stayed Bridges #1	1996	1997	France, US
Cable-Stayed Bridges #2	1994	1996	US
Carbon Cathode Block	1996	1997	Germany, Japan, US
Carbon, Electrical	1988	2000	Austria , France, Germany, UK, US
Cement	1983	1994	Belgium, Denmark, France Germany, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK
Chemical Tankers	1998	2002	Japan, Netherlands, Norway, UK
Citric Acid	1991	1995	Austria, France, Germany, Netherlands, Switzerland, US
Copper Tubes	1998	2001	Finland, Germany, Italy
Explosives	1988	1992	Norway, UK, US
Ferrosilicon	1989	1991	Germany, Norway, US
Ferry Operators (Adriatic Sea)	1987	1994	Greece, Italy
Ferry Operators (Cross-Channel Freight)	1992	1992	France, Netherlands, Sweden, UK
Fine Arts	1993	1999	UK, US
Graphite Electrodes	1992	1998	Germany, Japan, US
Graphite, Isostatic	1993	1998	France, Germany, Japan, Netherlands, US
Graphite, Extruded	1993	1996	Germany
Lysine	1990	1995	Japan, South Korea, US
Maltol	1989	1995	US, Japan
Marine Construction Services (Heavy-Lift)	1993	1997	Netherlands

Industry	Start	End	Country of Origin of Cartel Members
Marine Transportation Services (Heavy-Lift)	1990	1995	Belgium, US
Methionine	1985	1999	Germany, France, Japan, US
Methylglucamine	1990	1999	France, Germany
Monochloroacetic Acid	1995	1999	France, Germany, Netherlands
Nucleotides	1989	1998	Japan, South Korea
Organic Peroxides	1971	1999	France, Netherlands, Spain, UK
Paper, Carbonless	1992	1995	France, Germany, Spain, South Africa, UK
Paper, Cartonboard	1986	1991	Austria, Canada, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, UK, US (via European subsidiaries)
Paper, Thermal Fax	1991	1992	Japan, US
Plasterboard	1992	1998	Belgium, France, Germany, UK
Plastic Dinnerware	1991	1992	Canada, US
Plastic Laminated Tubes	1987	1996	Switzerland, US
Polyester Staple Fiber	1999	2001	Luxembourg
Shipping (Central West African CEWAL)	1972	1992	Belgium, Denmark, Germany, Holland
Shipping (Far East FEFC)	1990	1994	Croatia, Denmark, France, Germany, Hong Kong Italy, Japan, Malaysia, Netherlands, Norway, Singapore, UK
Shipping (Far East, FETTCSA)	1991	1994	Denmark, France, Germany, Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, UK
Shipping (French-West African)	1975	1992	Belgium, Benin, Cameroon, Cote-d'Ivoire, Denmark, France, Gabon, Germany, Guinea, Italy, Mauritania, Netherlands, Norway, Poland, Senegal, Slovenia, Spain, Sweden, Switzerland, Togo, UK, Zaire

Industry	Start	End	Country of Origin of Cartel Members
Shipping (North Atlantic TAA)	1992	1994	Denmark, Germany, Korea, Netherlands, Mexico, Poland, Singapore, Switzerland, UK, US
Shipping (North Atlantic, TACA)	1994	1996	Denmark, Germany, Hong Kong, Japan, Mexico, South Korea, Singapore, Switzerland, UK, US
Sodium Erythorbate	1992	1994	US
Sodium Gluconate	1987	1995	France, Japan, Netherlands, Switzerland, US
Sorbates	1978	1996	Germany, Japan, US
Steel Beam	1988	1991	Belgium, France, Germany, Italy, Spain, UK
Steel Heating Pipe (Pre-Insulated Pipe)	1990	1996	Austria, Denmark, Finland, Germany, Italy, Sweden, Switzerland
Steel, Stainless	1994	1995	Belgium, France, Germany, Italy, Spain, Sweden, UK
Steel Tube, Seamless	1990	1995	France, Germany, Italy, Japan, UK
Tampico Fiber	1990	1995	Mexico, Netherlands, US
Vitamin C ¹	1991	1995	Canada, Germany, Japan, Switzerland, US
Wastewater Construction	1988	1995	Germany, Switzerland, US
Zinc Phosphate	1994	1998	France, Germany, Norway, UK

Source: Information provided by the prosecuting authorities, including DOJ and EC press releases, European Court of Justice decisions, and industry and business news sources, such as *American Metal Market*, *Chemical Marketing Reporter*, *European Business Week*, *International Cement Magazine*, *Oil and Gas Journal*, and *Wall Street Journal*.

¹There were price fixing conspiracies in at least nine other vitamins, but we currently have sufficient data for analysis only for Vitamin C, so it is the only one included here.

TABLE 2**CARTEL DURATION: A COMPARISON TO PREVIOUS STUDIES**

<i>Duration</i>	<i>Levenstein & Suslow</i>	<i>Eckbo</i> ^a	<i>Griffin</i>	<i>Suslow</i> ^b	<i>Posner</i> ^c	<i>Gallo et al</i>
Mean (years)	5.9	5.3	7.3	8.3	7.5	5.4
Standard deviation	5.4		6.3	6.2		
Range	0-28	1 – 18	1 – 29	1 – 13		
% <5 years	63%			40%		
% > 10 years	13%			37%		
Sample definition	DOJ and EC price fixing convictions, with participants from more than one country, 1990-2004	51 international agreements, late 1800s to 1960s	54 international cartels, 1888-1984	71 international cartels active before World War II	DOJ price fixing cases, 1950-1969	DOJ price fixing cases, 1955-97

Notes:

^a We calculate an average duration for the cartels in Eckbo's study. In the original work, he reports separate averages for different sub-samples that he analyzes separately, because he has different information about the cartels in the sub-samples.

^b The mean duration of the 28 uncensored (by World War II) cartel episodes in Suslow (2004) is 3.7 years with a standard deviation of 3 years.

^c Posner examines all horizontal price fixing cases from 1890 to 1969, but he reports average duration and related statistics only for cases from 1950-69.

TABLE 3

SECTORAL COMPOSITION OF CONTEMPORARY INTERNATIONAL CARTELS

Industry ^a	Percentage ^b
Chemicals	31
Water Transport	19
Primary Metal Manufacturing	12
Carbon and Graphite Manufacturing	10
Fabricated Metal and Machinery Manufacturing	10
Plastics	6
Paper Manufacturing	4
Miscellaneous Manufacturing	6
Auction houses	2

^a Cartels were grouped by 3-digit NAICS classification, though where all the cartels fell into a narrower classification, that is reported here.

^b Note that these percentages are based on simple counts of the number of cartels and are not weighted by the value of their output.

TABLE 4
COMPARISON OF CARTEL CHARACTERISTICS

	<i>Levenstein & Suslow</i>	<i>Hay & Kelley</i> ^a	<i>Fraas & Greer</i> ^b	<i>Posner</i> ^c	<i>Gallo et al</i> ^d
Mean Number of Firms in Conspiracy	7.75	7.25	16.7	29.1	3.9
Median Number of Firms in Conspiracy	5.5	7	8	Between 6 and 10	
Fewer than 10 Cartel Members	75%	79%	60%	64%	
Trade Association Involvement	31%	29%	36%	44%	23%
Bid Rigging	21%	29%	19%	14%	30%
Market Allocation ^e	73%	35%	26%	26%	27%
Single Sales Agent	15%		3%	6%	
Terms & Conditions of Sales Set	56%	14%	5%	14%	
Disciplinary or Coercive Practices; Exclusion	10%	5%	12%		
Policing; Penalties; Audits	15%			4%	

Notes:

^a The Hay and Kelley sample includes 65 DOJ convictions for horizontal price fixing between 1963 and 1972. Not all industry characteristics were available for each case. For example, trade association information is available in 62 cases, concentration data in only 50 cases. In calculating the mean of their sample, they exclude four cases with 50 or more conspirators.

^b The Fraas and Greer sample includes 606 DOJ convictions for horizontal price fixing between 1910 and 1972.

^c Posner's sample includes 989 DOJ cases instituted for horizontal price fixing between 1890 and 1969. The mean falls to 19.9 if one omits the cases brought between 1920 and 1934, a period which included relatively lax anti-cartel policies by the federal government. The average number of conspirators that Posner reports for those years is as follows: 1920-24: 53; 1926-29: 95; 1930-34: 56.

^d The Gallo et al sample includes 688 cases involving horizontal per se violations. We report here the average number of *defendants* in these cases. (The average number of firms is not given).

^e Market allocation includes use of production quotas, division of markets, division of territories, allocation of customers.

TABLE 5

Determinants of Cartel Breakup

Variable	Mean
Number of cartel participants	7.75
Highly concentrated industry	0.39
Homogeneous good	0.62
Organizational index	3.62
Interest rate	5.64
Macroeconomic fluctuations	0.03
Recidivism	0.23

TABLE 6
PROPORTIONAL HAZARDS MODEL

Cartel Breakdown Hazard (Full Sample $n = 52$)	
Variable	Hazard Ratio
Number of cartel participants	0.98 (0.02)
Highly concentrated industry	1.00 (0.00)
Homogeneous good	0.73 (0.23)
Organizational index	0.90 (0.08)
Interest rate	1.11 (0.24)
Macroeconomic fluctuations	0.47 (1.78)
Post-change in US DOJ amnesty policy	0.67 (0.33)
Recidivism	0.55 (0.25)

TABLE 7

Cartel Breakdown Hazard (Separated By Cause Of Breakdown) ^a		
Variable	Cartels broken up by antitrust authorities (<i>n</i> = 26)	Cartels that broke up prior to antitrust action (<i>n</i> = 20)
Number of cartel participants	0.89 (0.14)	1.01 (0.03)
Highly concentrated industry		1.00 (0.01)
Homogeneous good		0.30 (0.14)
Organizational index	0.96 (0.11)	0.79 (0.15)
Interest rate		1.48 (0.56)
Macroeconomic fluctuations		0.00 (0.04)
Post-change in US DOJ amnesty policy	0.12 (0.11)	0.90 (0.57)
Recidivism	0.32 (0.19)	0.58 (0.56)

^a All the cartels in this sample were eventually prosecuted by antitrust authorities. Twenty of them had already broken up due to internal problems, entry, or other factors. Twenty-six were clearly ongoing at the time of antitrust action. We could not definitely classify the remaining six.

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