

“The Practical Requirements of a Successful Cartel”

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Abstract: Towards understanding what makes a cartel successful, this chapter examines a variety of collusive practices with an eye to how they vary in their efficacy in establishing and sustaining supracompetitive prices and in the legal risk they create for firms. Four conditions for cartel success are reviewed and illustrated with numerous cases. First, firms must achieve a common understanding not to compete and how they are not to compete (coordination condition). Second, a cartel must adopt a collusive arrangement that incentivizes its members to comply (internal stability condition). Third, a cartel must tame the possible expansion of supply by firms not members of the cartel (external stability condition). Fourth, a cartel must avoid detection and penalization by the competition authority and customers (enforcement condition). Also discussed is the efficacy-exposure trade-off which recognizes that practices that are more effective for collusion also tend to come with more legal exposure.

I. Introduction

In the context of a market, collusion is coordinated conduct among firms with the intent to constrain competition for their mutual benefit. A cartel is what we call that collection of firms. This chapter examines what it takes for firms to succeed in their collective endeavor to circumvent competition.

As just defined, collusion is an economic phenomenon which existed before the adoption of antitrust or competition laws.¹ Indeed, it was the egregious displays of collusion that inspired those laws. If one is to understand the practices that make for a successful cartel, it is necessary to appreciate how those practices vary in their efficacy in establishing and sustaining a supracompetitive market outcome but also in their legal exposure with the commensurate risk of shut down by the authorities and the imposition of financial penalties.

In the US, EU, and many other jurisdictions, firms engage in *unlawful collusion* when they have an *agreement to unreasonably restrain trade*. According to US jurisprudence, firms have an agreement when

¹ Formed in 1470 to control the price of alum is one of the earliest recorded cartels (Günster and Martin, 2015).

they have a ‘unity of purpose or a common design and understanding, or a meeting of minds’² or ‘a conscious commitment to a common scheme designed to achieve an unlawful objective.’³ This perspective is echoed by the E.U. General Court which has defined an agreement as ‘joint intention’⁴ or a ‘concurrence of wills.’⁵ In short, an agreement is *mutual understanding among firms to constrain competition*. Through the lens of economic theory, an agreement corresponds well with an equilibrium which sustains a supracompetitive outcome (DeSantis and Yao, 1993; Werden, 2004).

In order to prove there is an agreement, a common requirement is that ‘there must be evidence that tends to exclude the possibility that the [firms] were acting independently.’⁶ While many avenues have been pursued to argue that firms’ conduct could not have been reached independently, ‘few courts have found a conspiracy without some evidence of communication tending to show an agreement.’⁷ When firms communicate in a manner pertinent to future conduct (either expressing intentions or conveying information relevant to intentions), they create the legitimate concern that they have influenced each other’s conduct and, therefore, their behavior was not reached independently.⁸

With regards to liability and the attendant implications of possible shutdown and penalization, it is useful to recognize three broad categories of collusive practices. First, there is collusion so egregious that, once discovered, conviction is reasonably assured. Firms who pursue that brand of collusion know it is essential not to be discovered. Second, there is collusion that is legally problematic in that, once discovered, there may or may not be prosecution, and conviction is highly uncertain should a case be brought. Less legal exposure is the appeal of these practices but they are generally less effective as a means of collusion. Examples of these first two categories are provided in Section III. Finally, there is collusion that is grudgingly accepted by courts as lawful because there is no remedy.⁹ An example is price signaling

² American Tobacco Co. v. United States 328 U.S. 781 (1946).

³ Monsanto Co. v. Spray-Rite Serv., 465 U.S. 752 (1984).

⁴ Judgment of the Court of 15 July 1970. ACF Chemiefarma NV v Commission of the European Communities Case 41-69.

⁵ Judgment of the Court of First Instance of 26 October 2000. Bayer AG v Commission of the European Communities.

⁶ Monsanto Co. v. Spray-Rite Serv. Corp., 465 U.S. 752,768 (1984).

⁷ Hovenkamp (2016), p. 243.

⁸ In the EU, there is also the illegality of ‘concerted practices’ which can facilitate collusion but fall short of an agreement. This chapter focuses on practices that align with the notion of an agreement.

⁹ ‘Courts have noted that ... individual pricing decisions (even when each firm rests its own decisions upon its belief that competitors do the same) do not constitute an unlawful agreement under section 1 of the Sherman Act ... [T]hat is not because such pricing is desirable (it is not), but because it is close to impossible to devise a judicially enforceable remedy for “interdependent” pricing. How does one order a firm to set its prices without regard to the likely reactions of its competitors?’ Clamp-All Corp., 851 F.2d 478, 484 (1st Cir. 1988)

whereby a firm conveys an invitation to collude through its price. Another form of lawful collusion arises when government-mandated price caps act as a focal point.¹⁰

An episode during a German spectrum auction offers an example of lawful collusion (Klemperer, 2004). The German government was selling 10 blocks of spectrum with the rule that any new bid had to be at least 10 percent higher than the prevailing bid. The bidders were Mannesman and T-Mobile. Mannesman began with a bid of 20 million (Deutsche Marks per megahertz) on blocks 1-5 and a bid of 18.18 million on blocks 6-10. Why 18.18? With the minimum 10 percent rule, the next highest bid that T-Mobile could submit on blocks 6-10 would be 20 million. A candidate explanation is that Mannesman was signaling to T-Mobile that each company should win 5 blocks at 20 million. Subsequent behaviour substantiates that intent and that T-Mobile correctly interpreted the signal. In the next round of bidding, T-Mobile bid 20 million on blocks 6-10 and did not submit a bid on blocks 1-5. There were no subsequent bids and each of them ended up with five blocks at a price of 20 million. These two bidders lawfully colluded. If, prior to the auction, the two companies had verbally shared the plan that was implicit in Mannesman's bid, they would have unlawfully colluded.

The point is that collusion is an economic phenomenon for which its legal status lies on a continuum, ranging from clearly illegal to clearly legal with gray areas between. How firms communicate is determinative of their legal exposure – the likelihood they are detected, prosecuted, and convicted – and whether they are able to coordinate on and sustain a supracompetitive outcome. Both the legal and economic dimensions are crucial in determining a cartel's success.¹¹

II. Collusive Outcomes

Collusion ultimately manifests itself in terms of a market outcome that raises firms' profits and, almost universally, lowers consumer welfare. In principle, it is possible that collusion can be beneficial to both firms and consumers. If firms coordinate on higher prices but continue to make independent decisions on other strategic variables (such as service and advertising) then, given the higher profit from selling another

¹⁰ See Knittel and Stango (2003) for credit card markets and Genakos, Koutroumpis, and Pagliero (2018) for fruit and vegetable markets.

¹¹ For surveys of collusive theories and empirical evidence relevant to cartel success, see Levenstein and Suslow (2006) and Asker and Nocke (2021).

unit (due to charging the collusive price), competition will intensify with respect to those other variables.¹² It is possible that the intensification of competition on these other variables could more than offset the harm from higher prices so that consumers are better off and, at the same time, not all collusive rents are competed away so firms remain better off.¹³ Theoretical possibilities aside, firms agreeing to a common price or a market allocation scheme (whereby each firm serves a segment of the market without competition) are considered sufficiently unlikely to produce substantial mitigating benefits that they are a per se (or by object) offense, rather than subject to the rule of reason (or by effect).

In this section, we review some of the supracompetitive outcomes that cartels have produced. Let's start with the canonical one: firms directly coordinate on the prices that consumers pay (i.e., transaction prices). For example, members of the citric acid cartel agreed to a higher price for all customers except a firm's largest customers who received a discount of three percent.¹⁴ Rather than coordinate on a particular price, they may instead agree to a range of prices. For example, trade associations have conspired with its members to impose a minimum price that all firms should charge.¹⁵

Even though higher transaction prices are the goal, some cartels have chosen instead to coordinate on prices that *influence* transaction prices. In industrial markets where firms set list prices and buyers routinely negotiate discounts off of them, cartels in urethane and cement markets agreed to a higher list price but not to discounts and, therefore, not to transaction prices.¹⁶ The presumption was that these higher list prices would ultimately result in higher negotiated prices. Given that buyers observed list prices, collusion could then affect bargaining and thereby transaction prices. However, in the EU trucks cartel, manufacturers coordinated on an *internal* list price which was never observed by customers.¹⁷ A higher internal list price has been argued to raise transaction prices by affecting a firm's internal pricing process determining dealer prices.

¹² When firms coordinate with respect to some, but not all, of the ways in which they compete, it is referred to as semi-collusion; see Sørsgard and Steen (2009).

¹³ This possibility is shown in Fershtman and Pakes (2000) for when firms collude in prices and compete in product quality.

¹⁴ This and other cases can be found in Harrington (2006). Also see Connor (2008), and Marshall and Marx (2012).

¹⁵ See Harrington (2016) for cases.

¹⁶ Unless otherwise noted, Harrington and Ye (2019) provide references for cases pertaining to coordination on list prices and surcharges.

¹⁷ Commission Decision in Case AT.39824 – Trucks of 19 July 2016.

Some cartels agreed to restrict discounts, such as eliminating a cash discount for industrial purchases of salt¹⁸ and double coupons in grocery retail¹⁹ or capping discounts on travel bookings to three percent.²⁰ Yet another outcome is adopting a surcharge, while leaving cartel members with full discretion as to the other components that make up the final price. Firms coordinated on a fuel surcharge in the air cargo, air passenger, and rail industries and a lead surcharge in a battery market.

In some of these cases, it is not clear how it was an effective form of collusion. If firms coordinate on only list prices, why wouldn't firms undermine the agreement by offering larger discounts in order to gain more market share? If they only agreed on a surcharge, why not try to gain market share by lowering the price of other components of the invoice? Nevertheless, collusion was effective as evidenced, for example, in the air cargo case with customer damages exceeding US\$1.2 billion. Harrington and Ye (2019) make some progress on understanding how and when coordination on list prices is effective. The point to be underscored is that collusion intended to raise transaction prices can be achieved by coordinating on other variables which influence those transaction prices.

Rather than coordinate on specific prices – whether transaction prices, list prices, discounts, or surcharges – firms may agree to pricing rules or conventions that again will result in higher transaction prices. In the market for turbine generators, the only two suppliers coordinated on replacing a policy of negotiation with one of non-negotiable posted prices (Harrington, 2011). In a stock exchange, market makers coordinated on not quoting prices ending in odd-eighths which, by raising the minimum bid-ask spread, resulted in higher price-cost margins (Christie and Schultz, 1994). In an online market, poster sellers on Amazon Marketplace coordinated on pricing algorithms, rather than individual prices (Oxera, 2017). By doing so, they eliminated competition with each other while still competing with other sellers.

Another path to higher transaction prices is to coordinate on restricting supply. Firms have used public announcements in the markets for chicken and pork to promote a collective curtailing of supply (Harrington, 2021). Alternatively, collusion could have firms allocating the market so only a subset of firms supplies a particular collection of customers. This could take the form of exclusive territories whereby each firm is given monopoly power over a particular geographic market. Or, when customers are large, allocating them among cartel members. With a customer allocation scheme, a firm is not supposed to

¹⁸ Morton Salt Company v. United States, 235 F. 2d 573 (10th Cir. 1956).

¹⁹ United States v. The Stop and Shop Companies, Inc., U.S. District Court of Connecticut, no. CRE B-84-51 (Nov 9, 1984).

²⁰ Case C-74/14 Eturas and others, European Court of Justice, 21 January 2016.

solicit the business of a customer assigned to another firm and, should the customer approach the firm, it should offer a very high price or simply decline making an offer ('Sorry but we do not have any available inventory.').

The takeaway from Section II is that there are many ways in which firms can enact a collective increase in their prices and, more generally, constrain competition in a mutually beneficial manner.²¹ However, so as to make for a more coherent analysis, from hereon we will generally discuss collusion in terms of directly coordinating on transaction prices.

Overview of Sections III-VI

A cartel is more successful when the profits earned while colluding are higher which will be the case when price (or, equivalently, the overcharge which measures the percentage increase in price due to collusion) is higher. While a higher price reduces how much cartel members sell, the amount of reduction in sales depends on how much demand is diverted to non-cartel suppliers. The more that the cartel can limit that diversion, the more profit it will earn. A cartel is also more successful when collusion has longer duration which requires maintaining the cartel's stability and avoiding detection that might cause the cartel's shut down. Finally, a cartel is more successful when it avoids or limits penalties in the event of conviction or settlement. The remainder of this chapter will discuss the challenges faced by a cartel to be successful and how firms have met those challenges.²²

Towards understanding cartel success, let us begin by asking why collusion might not succeed or achieve only modest success. First, firms may fail to coordinate. That is, firms do not agree to constrain competition or do not agree on a collusive arrangement. Section III explores the various methods for coordinating and the associated impediments. Second, firms may coordinate but the collusive arrangement is internally unstable. That is, there is a lack of compliance among cartel members which then reduces efficacy – overcharges are low, collusion periodically breaks down – and might result in the cartel's collapse. Section IV reviews the essential requirements for internal stability. Third, firms may coordinate on an internally stable collusive scheme but it is externally disrupted by non-cartel suppliers. As a result, the cartel sells fewer units and limits the overcharge in order to stem non-cartel supply, and

²¹ A class of collusive outcomes not covered is when firms coordinate to perform exclusionary activities against some class of competitors. For some examples, see Kwoka (2019) and Chapter 5 of Garrod, Harrington, and Olczak (2020).

²² Market conditions that contribute to a successful cartel are not reviewed here. The interested reader is referred to Motta (2004).

its duration may be shortened because external instability spills over to internal instability. Cartels have devised various strategies to mitigate this source of instability as reviewed in Section V. Fourth, the cartel fails because it is caught by public or private enforcers, which is covered in Section VI. We will examine each of these four challenges: 1) coordination; 2) internal stability; 3) external stability; and 4) avoiding detection and penalization (enforcement).

III. Coordination

Though collusion is a joint activity, it begins with one firm (or, more exactly, one firm's executives) deciding to shift rival firms' beliefs that they are competing to a common belief not to compete along with how they are to constrain competition. To make this happen, a firm engages in a *coordinating practice* which is communication intended to coordinate on a collusive arrangement.²³ As we describe later, a cartel will communicate for other purposes but here it is done in order to agree not to compete and how not to compete.

In seeking to coordinate, a firm communicates a message – either through an announcement or an action – which is conveyed privately (only among the prospective cartel members) or publicly (easily accessed by other market participants). An *announcement* is the expression of language, broadly defined. An *action* is an act that has consequences independent of the information that it delivers, while an announcement has consequences only because of the information that it delivers. For example, the announcement of a firm that it will raise price by 10 percent in 30 days has consequences only if it conveys information that changes what other agents do, whether it induces customers to buy earlier (in order to avoid the anticipated price increase) or rival firms to match the price increase (so it is a coordinating practice). In contrast, the action of raising price by 10 percent has consequences irrespective of the information that it delivers. Whether or not rival firms interpret a firm's price increase as an invitation to collude, the firm's revenue and profit will change because fewer consumers will buy and those that do buy pay more.

Let us begin by considering the use of announcements for firms to coordinate. The canonical coordinating practice is express communication in which firms openly share their intentions and plans using natural language. For example, in the fine arts auction houses cartel, the Chairman of Christie's conveyed to Sotheby's Chairman: 'We're getting killed on our bottom line. I feel it's time to increase pricing.' Sotheby's

²³ For a comprehensive discussion of communication in the context of cartels, see Chapter 3 in Kaplow (2013).

Chairman responded: 'I agree. But it's your turn to go first this time.'²⁴ Here we have an unambiguous invitation to collude and acceptance of that invitation, which did indeed work as both auction houses raised their commission rates. The history of cartels is replete with such cases.

While such direct, unvarnished language is the most effective means to coordinate, it also delivers the most compelling evidence for proving a violation of competition law. Consequently, less transparent announcements may be used which, while less effective, leave less of an evidentiary trail. This category includes unilateral announcements whereby a firm expressly invites other firms to collude and, rather than soliciting an express acceptance, counts on them to act accordingly. This could take the form of a written letter describing a collusive plan which is sent to all firms with the letter noting it has been sent to all firms²⁵ or announcing a plan to increase price at a private meeting with other firms.²⁶

The coordinating practices mentioned thus far all share the features of private communication with a reasonably explicit invitation to collude. Coordinating practices can also encompass public announcements such as advance price announcements. Consider a firm contemplating a joint increase in firms' prices. It could raise its price hoping that other firms would interpret it as an invitation to collude. However, that is somewhat risky for other firms may not follow and, in the meantime, the firm is losing sales. Alternatively, it could publicly announce a future price increase (specifying the amount and date) and wait for other firms to respond. If they make the same announcement then firms have a 'meeting of minds' and implement the proposed price increase. If not then the original firm retracts its announcement. This was the collusive theory used by the U.S. Department of Justice against several airlines (Borenstein, 1994). Of course, firms will claim the announcements are intended to inform customers of future prices, which may well be true. That customers are a possible audience can make these cases difficult to prosecute but also make advance price announcements less effective as a means of collusion since other firms may be uncertain as to whether there is an invitation to collude.

Firms have also coordinated by using public announcements that refer to rival firms' conduct rather than a firm's own conduct. Harrington (2021) identifies three classes of messages. First, a firm describes how its future conduct is contingent on rival firms' conduct. An example is AirTran stating during an earnings call that it would adopt a first-bag fee but only after its main competitor Delta Airlines did so. Shortly thereafter, internal documents show that Delta changed its decision and adopted a first-bag fee. Through

²⁴ Mason (2004), p. 121.

²⁵ *Interstate Circuit, Inc., et al. v. United States* 306 U.S. 208 (1939).

²⁶ *United States v. Foley*, 598 F.2d 1323 (4th Cir. 1979).

further public announcements, the two airlines initiated the same fee on the same date. In this case, public announcements were used to form an agreement between firms to have a leader-follower arrangement which then resulted in a supracompetitive outcome.

A second class of messages is when a firm announces how rival firms or the industry at large *should* behave. Examples are episodes of “capacity discipline” in the airline and steel industries. Through earnings calls and statements at industry meetings, senior executives criticized past conduct as having been too aggressive and encouraged all firms to reduce capacity and supply in order to raise prices. Market data and their own subsequent announcements showed they succeeded. The third class has a firm announce how rival firms or the industry at large *will* behave. This forecast of future conduct could be an invitation to firms to act consistent with that forecast. As of yet, there are no documented episodes.

A firm can also use actions to coordinate. In the turbine generator market, it has been argued that General Electric’s shift from negotiating with buyers to setting a non-negotiable price was an invitation to Westinghouse to collude because such a pricing policy could only be in GE’s self-interest if Westinghouse were to match that policy and coordinate their prices (Harrington, 2011). Westinghouse did match it and supracompetitive prices followed as GE acted as a price leader.

Another avenue is price signaling which has been argued could be used to form an agreement though not one that would be unlawful:

If a firm raises price in the expectation that its competitors will do likewise, and they do, the firm’s behavior can be conceptualized as the offer of a unilateral contract that the offerees accept by raising their prices.²⁷

In a meticulously documented analysis, price signaling was shown to be an effective form of collusion in an Australian gasoline market (Bryne and de Roos, 2019). In the same spirit is signaling through bids as occurred in FCC spectrum auctions (Cramton and Schwartz, 2000). As part of a market allocation scheme, a bidder used the last three digits of a multi-million dollar bid to signal to another bidder not to bid on a particular license (which the FCC had numerated using three digits).

As has been described, there is a wide array of coordinating practices. We next turn to exploring why they might fail in achieving a ‘meeting of minds.’ One obvious source of failure is miscommunication; that is, the sender of a message fails to result in the receiver drawing the intended inference. Miscommunication may occur due to messages lacking clarity or veracity. Clarity refers to the ease with which the receiver

²⁷ *In re High Fructose Corn Syrup Antitrust Litig.*, 295 F.3d 651, 654 (7th Cir. 2002) (Posner, J.)

can infer the meaning that the sender would like the receiver to infer. Veracity refers to the degree to which the meaning that the sender would like the receiver to infer reflects the sender's true intentions. Clarity can be challenging when announcements do not involve the express use of natural language. For example, will rival firms interpret an advance price announcement as an invitation to collude? Will a higher price be so interpreted? Regardless of the mode of communication, veracity can be problematic because, even when the intended content of a message is clear, there may be a lack of trust. Ironically, the illegality of inviting a competitor to collude could actually enhance its veracity as it may only be optimal for a firm to incur the risk of penalties if it intended to coordinate on higher prices (Aghadashli and Legros, 2020).

A second reason that coordinating practices may fail to deliver an agreement is due to bargaining breakdown. Even if messages are correctly interpreted and believed, there may be disagreement as to whether to collude or with regards to the collusive outcome or arrangement. In crystal clear language, the CEO of American Airlines invited Braniff Airlines to collude: 'Raise your goddamn fares twenty percent. I'll raise mine the next morning. You'll make more money and I will too.' However, Braniff's CEO declined the invitation (and, having recorded the conversation, shared it with the U.S. Department of Justice).²⁸

Even if firms agree to collude, they may disagree on the collusive arrangement. There could be different views on the best collusive price. In a Quebec gasoline cartel, it took about 65 phone calls for several cartel members to agree to a price increase (Clark and Houde, 2013). Given that firms were heterogeneous – varying in their cost, number of stations, sale of complementary products – they probably had different views as to the most appropriate common price. Even if they do agree on price, they are likely to disagree on the allocation of demand. Market allocation is a zero-sum game for the more sales one cartel member receives, the fewer sales there are to go to other members. A bromine cartel often experienced price wars due to bargaining breakdown as some cartel member sought to renegotiate the collusive outcome (Levenstein, 1997). The lysine cartel had no difficulty agreeing to a common price but struggled with finding sales quotas to satisfy all members.²⁹ Though initially able to raise price without having settled upon a market allocation, the arrangement soon unraveled with a series of price cuts as firms sought to gain more market share. Only after coming back to the bargaining table and settling on an allocation was the cartel successful.

²⁸ United States v. American Airlines, 743 F.2d 1114 (5th Cir. 1984)

²⁹ *Official Journal of the European Union*, L 152/24, 7.6.2001, Case COMP/36.545/F3 - Amino Acids, Decision of June 7, 2000.

Critical to the selection of coordinating practices is the *efficacy-exposure trade-off*. Coordinating practices vary in terms of their efficacy in achieving mutual understanding that firms will not compete and how they will collude. They also differ in terms of their legal exposure and, more specifically, the likelihood of detection and penalization. There is generally a trade-off because coordinating practices which are more effective for collusion also tend to come with more exposure.

Private, express, and unfettered communication is strong on efficacy but comes with considerable exposure. Though detection may be low by virtue of being private, conviction is high conditional on detection. In comparison, public announcements about rival firms' conduct (e.g., encouraging the industry to restrict supply) and advance price announcements are less effective and easier to detect but more difficult to prosecute. They are less effective and less prosecutable for the same reason: they could be intended for other market participants such as customers, input suppliers, and investors. Using actions to coordinate – such as price signaling – is, compared to those public announcements, even less effective and, in most instances, comes with minimal or no legal exposure. Public announcements and actions are also less effective because they constrain the type of collusive arrangement. For example, advance price announcements may be able to coordinate on price but not on a market allocation scheme. Finally, it is worth emphasizing that leniency programs, which have been quite useful in detecting and prosecuting cartels, are generally relevant only when firms engage in express, unfettered communication so that a leniency applicant has direct evidence of an agreement. Firms wary of a leniency program may then opt for a subtler coordinating practice.

IV. Internal Stability

Let us suppose firms agree to raise their prices to some common level (or by some common percentage) above the existing competitive price. This agreement comes with a source of potential instability in that there is a temptation to cheat. The competitive price has the property that it maximizes a firm's current profit given other firms are charging the competitive price; in other words, each firm is doing the best it can given the prices set by competitors. Should rival firms raise their prices by, say, 10 percent, the firm would also want to raise its price for it now faces stronger demand given that customers find the alternative – rival firms' products – to be priced higher. However, in maximizing current profit, the firm would raise its price by less than 10 percent as it seeks to pick up more market share at this supracompetitive price-cost margin. Thus, if the collusive agreement calls for it to raise price by 10 percent

along with all other firms, a firm is foregoing some current profits in doing so. There is then a temptation to cheat by undercutting the collusive price set by rival firms. In its simplest terms, this is the challenge for internal cartel stability.

In practice, this temptation to cheat is neutralized by firms adopting strategies that embody a *reward-punishment scheme*. This strategy makes a firm's current conduct (what price to charge) contingent on firms' past conduct (what prices were charged). If a firm abides by the collusive outcome - which could involve high prices, sales quotas, customer allocation, etc. - then it is rewarded in the future by rival firms continuing to abide by the collusive outcome (e.g., charging high prices, not selling more than their quotas, staying away from other firms' customers); while if it departs from the collusive outcome (e.g., setting a low price, selling above its quota, serving another firm's customers) then it is punished in the future by rival firms acting aggressively to reduce the deviating firm's profits (e.g., lowering prices, selling more, soliciting the deviating firm's customers). Collusion is a common understanding among firms that ties future rewards and punishments to current behaviour and, when effective, induces compliance with the supracompetitive outcome. This understanding can be viewed as contractual though where the penalties for acting contrary to the terms of the contract take the form of rival firms' future punishing behaviour.

Embodying this reward-punishment scheme, a collusive strategy is composed of three elements, some of which may be implicit but still understood by cartel members. First, there is the collusive outcome, such as what common price is to be charged. Second, there is the monitoring protocol which refers to how firms will monitor each other for compliance with the collusive outcome. Third, there is the punishment that occurs when there is evidence of noncompliance.

A cartel is internally stable when, given the reward-punishment scheme embodied in the collusive strategy, it is in each firm's best interests to comply by acting in accordance with the collusive outcome. This means that the short-run gain in profits by deviating (e.g., undercutting the collusive price and gaining more sales) is exceeded by the expected foregone future profits from the deviation being detected and the resulting lower profits from the punishment. The *internal stability condition* can be represented as:

$$\text{Collusive Profit} + \text{Expected Value of Future Collusive Profits} > \text{Deviation Profit} + \text{Expected Value of Future Punishment Profits.}$$

The Expected Value of Future Collusive Profits encompasses the likelihood of continued collusion and possible future punishments in response to evidence of noncompliance, as well as possible cartel collapse. The Expected Value of Future Punishment Profits encompasses the likelihood that a deviation is detected

and punished, as well as the likelihood that the firm gets away with it and collusion continues uninterrupted.

The internal stability condition can be rearranged to:

$$\text{Future Loss from Deviation} > \text{Current Gain from Deviation}$$

where

$$\text{Future Loss from Deviation} = \text{Expected Value of Future Collusive Profits} - \text{Expected Value of Future Punishment Profits}$$

$$\text{Current Gain from Deviation} = \text{Deviation Profit} - \text{Collusive Profit.}$$

The internal stability condition is more likely to be satisfied when deviations are detected sooner (which implies the current gain from deviation is lower) and the punishment is more severe (so the future loss from deviation is greater). As noted earlier, the charging of a higher common price will intensify competition along non-price dimensions. The more that the cartel can control those other dimensions and thereby keep collusive profit high, the more likely the internal stability condition is satisfied.³⁰ Finally, when a firm cares more about future profit relative to current profit, the future loss from a deviation will loom larger and that will enhance stability.

Satisfaction of the internal stability condition is one of the determinants of the collusive price. As the collusive price is set higher, the current gain from deviation increases as a given rise in sales from undercutting the collusive price yields more profits. On the other hand, a higher collusive price raises collusive profits and thus increases the future loss from a deviation. Generally, economic theory has shown that the first effect is larger in magnitude so that a higher collusive price makes it less likely the internal stability condition is satisfied. A cartel will then be constrained as to how high it sets the collusive price for it will want to balance higher collusive profits against shorter duration due to a less stable cartel.

Colluding firms will also limit how fast they raise prices. Constraining forces include cartel detection (inexplicably large price increases may cause customers to suspect collusion), learning (firms may be uncertain how high a price is stable and thus need to experiment), and buyer resistance (industrial buyers may threaten delaying purchases). Consequently, cartels tend to gradually raise price as evidenced, for

³⁰ In addition to commission rates, the fine arts auction houses cartel coordinated on many non-price dimensions (Mason, 2004, p. 119).

example, by cartels in citric acid and vitamins (Connor, 2008) and graphite electrodes (Levenstein and Suslow, 2004).

Monitoring for compliance is crucial for internal stability. If monitoring is less effective then the probability of a deviation being detected will be lower which makes deviation more attractive. With retail markets, a firm's price is posted (either in stores or online) which makes monitoring fairly straightforward. If retailers form a cartel and agree on certain prices, each can monitor the others for compliance. Price monitoring is well documented for cartels involving grocery stores, drugstores, and many other retailers (Garrod, Harrington, and Olczak, 2020). In some of these cartels, an upstream manufacturer assisted in collecting price information as part of a hub-and-spoke cartel (which are covered in Chapter 12).

Monitoring is a very different exercise with industrial products because transaction prices are often not public information. Those markets are typically characterized by the setting of list prices with buyer-specific discounts. That means the price that a buyer pays is private information to it and the seller, and thus is not observed by other sellers. Though a firm's sales representative may periodically learn from customers what prices other firms are offering, such information is sporadic and not always reliable. If a cartel coordinates on setting some common transaction price but those prices are difficult to observe, there is the concern that a deviation might not be detected which will then encourage deviations and undermine cartel stability.

One response is to coordinate on list prices, for they are observable. While we have noted some cartels pursued that strategy, it is a less effective form of collusion because it does not control discounts. More common is for a cartel to coordinate on transaction prices and put in place a market allocation scheme and to monitor sales rather than prices.³¹ For example, the lysine cartel agreed to a price and a global sales quota for each of the five cartel members: Ajinomoto – 73,500 tons, Archer Daniels Midland (ADM) – 48,000 tons, Kyowa – 37,000 tons, Sewon – 20,500 tons, Cheil – 6,000 tons. Each month, sales were reported to one of the cartel members which were then shared at the quarterly meetings. Firms were complying as long as they did not sell more than their quota. As an ADM executive announced at a cartel meeting: 'If I'm assured that I'm gonna get 67,000 tons by the year's end, we're gonna sell it at the prices we agreed to and I frankly don't care what you sell it for.'³²

³¹ Many such cartels are described in Harrington (2006) which is the source of the ensuing facts.

³² March 10, 1994 meeting of the lysine cartel. "The International Lysine Cartel at work, 3/28/00," Antitrust Division, U.S. Department of Justice.

Sales monitoring is made easier when the market allocation scheme assigns geographic markets or customers to cartel members. If a firm is not supposed to sell in a particular territory or to a particular customer, deviation is easily detectable. When it comes to monitoring, there are two other advantages of these schemes over sales quotas. First, a firm may not have full control over its sales due to unpredictability in its customers' demands (and not wanting to upset customers by limiting supply) or some customers choosing to switch suppliers. Thus, a firm may exceed its sales quota even when it sets the collusive price. Second, a challenge with the use of sales quotas is that it requires cartel members to accurately report their sales, but a firm could easily have an incentive to underreport when it has oversold. We will return to that issue – and how cartels solved it – when discussing punishments. While allocation by territories or customers allows for more effective monitoring than sales quotas, some industrial markets do not lend themselves to divvying up the market in such a manner. Furthermore, there is the concern that the lack of willingness to serve some customers might create suspicions that firms are colluding.

Monitoring serves both an ex ante and ex post role. Ex post, detection of a deviation offers an opportunity to induce the non-compliant firm to get back in line with the cartel plan. The well-documented sugar cartel showed that cartel meetings were often used for this purpose (Genesove and Mullin, 2001). However, more critical for the internal stability of the cartel is the ex ante role of monitoring. If a cartel member anticipates that it will be monitored and subsequently punished should it deviate, it will then be more inclined to comply. Thus, an essential complement to monitoring is the threatened punishment, to which we now turn.

A punishment results in the cartel member suspected of deviation earning lower profits than had there been no evidence supporting its deviation. Let us begin by making two general points about punishments. From the perspective of cartel stability, a punishment should be designed to incentivize compliance not wreak vengeance. Thus, a punishment should be severe enough to deter deviations but not more. The second point is that punishments are not always under the control of the cartel. When episodes of noncompliance reach a sufficiently high level of frequency or severity, some cartel members may choose to discontinue colluding, thereby causing the cartel's collapse. There is still a punishment – the deviating firm (as well as all other firms) are back to earning lower competitive profits – but it may be more draconian than the cartel would have liked.

A symmetric punishment refers to when all cartel members are harmed. We just mentioned one example – a return (temporary or permanent) to setting competitive prices – while another could be a short,

intense price war which could have prices below competitive levels (and even below cost). The downside to a symmetric punishment is that it harms non-deviating firms which is not only unfair but is counterproductive because it reduces the profitability of collusion. A firm may be more inclined to deviate when collusion is less profitable.

An asymmetric punishment is one that is designed to punish only the deviating firm and it does so by transferring profits from the deviating firm to the other firms. An asymmetric punishment can serve the purpose of incentivizing compliance and also provide compensation for those firms that were harmed by the deviation. As opposed to a symmetric punishment – which transfers surplus from the cartel to consumers (through lower prices) - an asymmetric punishment moves surplus around among the cartel's members, and thereby is more attractive to a cartel.

The transfer of profits from a deviating firm to other firms can take the form of cash, current sales, or future sales. The transfer of cash is uncommon in because an inexplicable monetary transfer between competitors is likely to generate suspicions. However, it has been used where legality was not a concern. Consider the 1926 international steel agreement which specified a quota for each country. Article 6 stated: 'If the quarterly production of a country exceeds the quota which was fixed for it, that country shall pay in respect of each ton in excess a fine of 4 dollars.' While Article 7 provided compensation: 'If the production of any country has been below the quota allotted to it, that country shall receive in compensation ... the sum of 2 dollars per ton short.'³³

More recent cartels have instead used inter-firm purchases to enact a transfer (Leslie, 2018). Referred to as a "guaranteed buy-in" in the lysine cartel and "buy-back" in the citric acid cartel, a cartel member that sold more than its quota was required to buy output from those members who sold below their quotas. For example, at the 14 November 1991 meeting of the citric acid cartel, Haarmann & Reimer was told to buy 7,000 tons of citric acid from ADM (Harrington, 2006). As there are legitimate reasons for such inter-firm sales (e.g., a firm is short on supply and has a contract to fulfill), they need not create suspicions like a monetary transfer. Another transfer scheme is to adjust the future market allocation by adjusting the market share or sales assigned to a firm that oversold or undersold its quota. In the zinc phosphate cartel, a particularly large customer was rotated among the cartel members but would be disproportionately allocated to a member that had been underselling its quota (Harrington, 2006).

³³ Plummer (1938), p. 248.

As previously noted, a sales monitoring scheme requires firms to accurately report their sales to other cartel members. Such a collusive arrangement creates a double challenge for cartel stability: a cartel member must be incentivized to price at the collusive level *and* to truthfully report its sales. The latter is problematic when overselling one's quota means having to buy output from other firms. Nevertheless, this scheme was effective in a number of cartels including those in the markets for citric acid, lysine, and vitamins. It has been shown that a two-tier punishment can explain its success (Harrington and Skrzypacz, 2011). If a firm anticipates accurately reporting its sales, it will be in its best interests to set the collusive price in order to avoid overselling and incurring the (tier one) punishment of buying output from other firms. A firm is incentivized not to underreport sales because of the (tier two) punishment of returning to competition which is triggered when the sum of all firms' sales reports is too low. A firm that underreports, while presuming other firms are accurately reporting, would depress the aggregate sales report and thus increase the chances of causing a shift back to competition.

Some cartels have used a third party to shore up internal stability by having them aid in coordinating, monitoring, and punishing. To assist at arriving at a collusive outcome, a bidding ring of stamp dealers used a taxi driver (Asker, 2010) and the organic peroxides cartel used the consultancy AC Treuhand (Marshall and Marx, 2012). A Swiss accounting firm validated firms' reported sales in the lysine cartel,³⁴ and, in several retailer cartels, an upstream supplier threatened retailers who undercut the collusive price with a higher wholesale price or denial of supply (Garrod, Harrington, and Olczak, 2020, Chapter 3).

V. External Stability

A cartel can be made less effective or result in collapse because of the expansion of non-cartel supply. That cartel members are pricing at a supracompetitive level will cause existing suppliers who are not members of the cartel to increase their supply, and may even cause entry into the market. Non-cartel supply is a serious concern whenever significant capacity remains outside of the cartel.³⁵ The global citric acid cartel encompassed only 60 percent of global production and 67 percent of EU production. In particular, Chinese suppliers were excluded, as they were with cartels in vitamins B1, B2, and C. The EU industrial tubes cartel left about 20 percent of capacity out of its control.

³⁴ *Official Journal of the European Union*, L 152/24, 7.6.2001, Case COMP/36.545/F3 – Amino Acids, Decision of June 7, 2000.

³⁵ The ensuing examples are from Harrington (2006).

As a general rule, a cartel would like all firms to be members for it would be better to have a firm inside the cartel keeping price high and restricting its supply than outside the cartel undercutting the collusive price. In practice, a cartel may choose to exclude some members due to a lack of trust. For a variety of reasons – such as past aggressive conduct or foreign ownership – a firm may be viewed with suspicion when it comes to abiding by a collusive arrangement, in which case their inclusion could undermine internal stability. A firm may also be excluded related to enforcement concerns (Bos and Harrington, 2015). More firms mean more ways that a competition authority can learn of a cartel. If there is a leniency program then one more cartel member is one more firm to compete for receiving leniency, should it come to that. Especially when a firm is small – so its presence outside of the cartel will not be too disruptive – firms may prefer to exclude it from the cartel because of these enforcement concerns.

A cartel may also not be all-inclusive because some firms choose not to join (Bos and Harrington, 2010). Large firms will have to join if the cartel is to be effective. Small firms prefer not to join because their inclusion has a small effect on raising the collusive price but as a cartel member may be expected to substantively restrict how much they produce. Medium-sized firms may or may not want to join, and their participation could make the difference between a moderately successful cartel and a highly successful cartel. It is worth noting that, even if a firm prefers to be outside of the cartel, cartel members could coerce participation by threatening exclusionary actions.

As an example of the havoc that non-cartel supply can create, consider the global vitamins cartel which comprised 16 vitamins with an overlapping set of suppliers. Initiated during 1990-91, six cartels internally collapsed over 1994-95, while the other 10 shut down due to government investigations over 1998-99. With the objective of understanding the source of internal collapse, Igami and Sugaya (2020) focused on four vitamin markets: vitamin C which did internally collapse, and vitamins A, E, and beta carotene which did not. They estimated the internal stability condition (described in Section IV) and found it was first violated for vitamin C in 1995 – the year in fact the vitamin C cartel collapsed – and was never violated for A, E, and beta carotene. The determining factor in the collapse of the vitamin C cartel was the growth in Chinese supply which increased four-fold in the cartel's first four years and reduced the cartel's market share from 85-90 percent to 60-65 percent.

When a cartel is not all-inclusive, there are four strategies for dealing with non-cartel suppliers: starvation, coercion, bribery, and takeover.³⁶ *Starvation* limits non-cartel supply by taking control of an essential

³⁶ These terms and the ensuing discussion are from Harrington, Hüschelrath, and Laitenberger (2018).

input or technology. When several Chinese firms expressed a desire to enter, the members of the global sorbates cartel agreed not to share their technology with them. *Coercion* curtails non-cartel supply through aggressive practices, such as selective price cuts, with the intent of continuing these practices until the non-cartel supplier limits its supply, joins the cartel, or exits the market. In the district heating pipes cartel, the firm Powerpipe declined an invitation to join the cartel and later filed a complaint with the European Commission on the grounds that the colluding firms had acted anticompetitively against it. For example, after Powerpipe was awarded a sizable contract, the cartel organized a boycott of Powerpipe's customers and suppliers.

While *coercion* uses the stick, *bribery* uses the carrot by sharing collusive rents with non-cartel suppliers who agree to limit their expansion of supply. In order to control Coors, which was a producer of vitamin B2 but not a member of the cartel, cartel member Roche agreed to purchase 115 tons of B2 from Coors (which represented half of Coors's capacity) and BASF in turn agreed to purchase 43 tons from Roche. In this manner, they shared the burden of controlling Coors' supply.

Takeover curtails non-cartel supply by acquiring non-cartel suppliers or the assets used to provide that supply. The carbon and graphite products cartel struggled with non-cartel suppliers known as 'cutters' who would purchase carbon blocks from the cartel members and then produce final products which competed with the cartel's supply. In response to the aggressiveness of cutter EKL, cartel members considered not supplying graphite to it (starvation) and undercutting EKL's price for customers considering doing business with EKL (coercion). Ultimately, the takeover approach was pursued as cartel member SGL Carbon acquired EKL.

VI. Enforcement

Suppose coordinating practices succeed in firms coming to a mutual understanding to constrain competition. Furthermore, they implement a collusive arrangement that is both internally stable – all cartel members comply - and externally stable – non-cartel suppliers do not substantively expand supply. If all that is done, the cartel may still fail because it is detected and penalized.³⁷

That firms may be subject to public prosecution and private litigation can affect their decision as to the mode and extent of communications. Communications are relevant to achieving mutual understanding

³⁷ For surveys of cartel detection, see Hay and Kelley (1974) and Harrington (2008).

(as discussed in Section III), the type of collusive arrangement (e.g., is it just with regards to price or is there also a market allocation scheme), and monitoring for compliance as well as the imposition of punishments. The more extensive are communications, the more effective collusion will be but also the greater chance of detection and the imposition of penalties. In deciding on the communications protocol, a cartel balances off higher collusive profits with possibly shorter duration and a higher likelihood of penalties.

Enforcement will also impact cartel success in terms of the collusive overcharge. When prices are increased at a faster pace and to a higher level, detection by savvy customers (especially when they are industrial buyers) and the competition authority becomes more likely. In choosing the price path, the cartel may then moderate its price increases.³⁸ Higher prices, as well as parallel price movements, will not only contribute to detection but also the likelihood of prosecution and conviction. While economic evidence is not sufficient by itself to prove a violation of competition law, it can be an important part of a case. Finally, some penalties are tied to the overcharge. Private litigation seeks customer damages which are measured by the overcharge multiplied by the number of units purchased by a customer. The U.S. Department of Justice can impose a fine as high as twice the harm to consumers. Thus, a cartel may limit its price in order to reduce this liability.³⁹

Obviously, enforcement affects cartel success when it causes a cartel to be shut down. While conviction will surely result in a cartel's collapse, detection and opening an investigation can often be sufficient. The ensuing increase in the probability of paying penalties can cause the cartel to become internally unstable. Less well recognized is that enforcement can reduce cartel duration even when a cartel goes undiscovered. Returning to the internal stability condition (Section IV), expected penalties will lower the value of future collusive profits which will reduce the foregone profits from deviating. By making collusion less profitable, enforcement makes a cartel less stable and that will reduce cartel duration.⁴⁰

VII. Concluding Remarks

The takeaway should be that collusion is difficult but manageable. A successful cartel must coordinate on an internally stable collusive arrangement while controlling non-cartel supply and avoiding detection and

³⁸ This trade-off is examined in Chapter 3.3 of Harrington (2017). Bos et al (2018) provides indirect evidence that enforcement constrains the prices that a cartel sets and reduces the profitability of collusion.

³⁹ See Chapters 21 and 25 for coverage of fines and damages.

⁴⁰ The ways in which enforcement can reduce cartel duration are examined in Chapter 3.1 of Harrington (2017).

penalization by public and private enforcers. Though the challenges are numerous and substantial, many firms in various industries have managed to master them.

Successful cartels exist for three simple reasons. First, there is a lot of money at stake. Notably, cartels are most common in markets with highly similar goods where price competition is intense.⁴¹ In such a setting, even a modest increase in price can have a significant impact on a firm's bottom line. Second, firms' executives are smart and they are used to solving difficult problems. Once enough executives come to believe that the primary obstacle to sufficient profits is too much competition, they are sharp enough to find a solution (as exemplified by the German spectrum auction at the start of this chapter). Third, there are many ways to constrain competition; collusion does not have to be sophisticated to succeed. In sum, cartels exist and thrive because firms have the incentive to collude, they have the skills to collude, and they have at their disposal many ways in which to collude.

⁴¹ See Grout and Sonderegger (2005) and Harrington (2015).

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