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### Vertical relations in cartel theory: managerial incentives, buyer groups & antitrust damages

Han, M.A.

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# 1 Introduction

A cartel is a group of firms collectively attempting to restrict or eliminate competition among them. Cartel members most commonly do this by fixing prices, sharing markets, or rigging bids. Such coordinated behavior, which is called *collusion*, affects the process of fair market competition and is illegal in virtually all capitalist countries.

This dissertation aims to contribute to the theoretical basis of an effective competition policy, which is the set of legal measures to fight cartels and other anticompetitive practices. I investigate how the incentives to operate a cartel are affected by vertical relations both within firms (owners-management) and among firms (suppliers-buyers). Before outlining the details of such vertical relationships, I provide three examples of cartels active on the European, American, and Dutch market, respectively.

The LCD Panel Cartel is a recent example of an international price-fixing cartel prosecuted by the European Commission.<sup>1</sup> Executives of six producers of liquid crystal display (LCD) panels arranged secret meetings—the so-called *Crystal Meetings*—in Taiwanese hotels. During these meetings, the cartel members agreed on minimum prices and other commercial terms of LCD panels for the European market. The European Commission charged the cartel a total fine amount of €649 million.

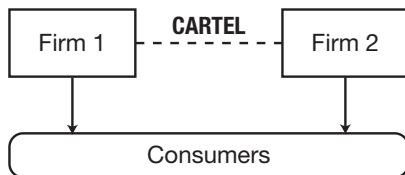
In the United States, a prime example of a price-fixing and market-sharing conspiracy is the Lysine Cartel.<sup>2</sup> The CEOs and other executives of five American and Asian producers of lysine, an amino acid used mainly in animal feeds, collectively raised prices and allocated customers among themselves on the worldwide lysine market. Interestingly, the FBI managed to record undercover tapes of the cartel's secret hotel meetings. These so-called *Lysine Tapes* illustrate the essence of the conspiracy when a CEO tells a senior executive from his largest competitor that “you are my friend” and “our customers are the enemy.”<sup>3</sup> In addition to corporate prosecution by the U.S. Department of Justice, three executives were sentenced to a total of 99 months in federal prison.

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<sup>1</sup>See the European Commission's decision of 8 December 2010 in *Case COMP39309-LCD*.

<sup>2</sup>See, for instance, the speech *Caught in the Act: Inside an International Cartel*, delivered by Hammond (2005) on behalf of the U.S. Department of Justice, Antitrust Division.

<sup>3</sup>The *Lysine Tapes* are accessible online via [carteltheory.com/references](http://carteltheory.com/references).

FIGURE 1.1 *The basic horizontal cartel model.*

In Holland, a well-known case of collusion is the Dutch Construction Cartel, the *bouwfraude*.<sup>4</sup> A substantial part of the Dutch construction sector engaged in bid-rigging: construction firms would coordinate their bids in tenders so as to artificially increase profits. The Netherlands Competition Authority (NMa) imposed monetary sanctions on more than 1,400 companies. For similar practices, three executives of construction firms recently received individual fines of up to €250,000.<sup>5</sup>

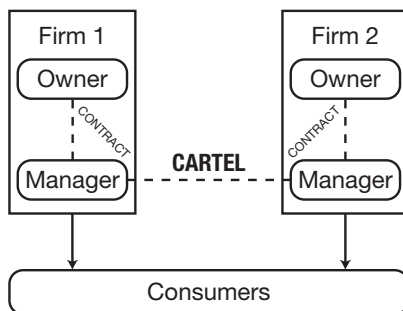
As the examples illustrate, cartels most commonly entail horizontal conspiracies among competitors at the same level of the production chain. However, as I will argue below, vertical relations both within firms (owners-management) and among firms (suppliers-buyers) can have an important impact on the operation of cartels. In this dissertation, I investigate this impact by extending the basic cartel model.

**Basic cartel model.** The basic model of cartels and collusion considers firms as profit-maximizing integrated black boxes on the same horizontal level of production. Figure 1.1 provides a stylized graphical representation of the basic cartel model for two firms; the arrowed lines represent the flow of goods (or services), and the dashed line represents strategic interaction. Both firms produce goods for consumers and strategically interact with each other on the market by setting, for example, prices, quantities, quality or service levels. The resulting market outcome depends on how firms strategically interact—that is, whether they compete or form a cartel.

I extend the basic horizontal cartel model to allow for vertical relations both within firms (owners-management) and among firms (suppliers-buyers). Investigating such vertical relations enriches the understanding of how cartels operate, which allows for an assessment of the design of an effective competition policy. This dissertation studies three types of vertical relations in cartel theory: managerial incentives in cartels, buyer groups operating as cartels, and antitrust damages in longer chains of production.

<sup>4</sup>For the complete *bouwfraude* file, see the websites of the Netherlands Competition Authority (NMa) and the Dutch Public Prosecution Service (OM), at [nma.nl](http://nma.nl) and [om.nl](http://om.nl), respectively. The first pieces of evidence were exposed by the Dutch current affairs television program *Zembla* in 2001; *Zembla* and the ACLE have collaborated to produce a DVD of the full story with English subtitles and voiceovers, accessible online via [carteltheory.com/references](http://carteltheory.com/references).

<sup>5</sup>See NMa decisions of 29 October 2010 in cases 6494 and 6836 (*Limburgse bouwzaken*).

FIGURE 1.2 *Managerial incentives in cartels.*

**Part I: managerial incentives.** The first part of this dissertation (*Managerial Incentives in Cartels*) studies vertical relations *within* firms. Cartels often involve firms that have separated ownership and control in such a way that the incentives of the key decision maker (CEO, manager) are not fully aligned with those of the profit-motivated owners (shareholders). Figure 1.2 conceptually illustrates this extension of the basic cartel model. I open the black box of the firm: two managers strategically interact on the product market and choose whether to compete or to form a cartel. Their behavior is affected by the type of employment contract offered by the owners (superiors in general).

Such intra-firm vertical relations may give rise to several corporate governance issues. For example, the operation of cartels may be affected by the type of managerial compensation—such as fixed wages vs. variable wages, bonus plans, and stock options plans—the duration of the employment contract, and personal considerations such as career concerns and attitudes toward corporate crime. With regard to the examples above, one might expect that the cartelization decisions by the executives in the LCD Panel Cartel depend on the details of their compensation packages negotiated through the vertical relationship with their board of shareholders. Similarly, the *Lysine Tapes* reveal that the CEOs in the Lysine Cartel were challenged to vertically implement their price-fixing arrangements through intra-firm hierarchical relationships with their sales managers.

**Parts II & III: buyer groups & antitrust damages.** The second and third parts of this dissertation investigate vertical relations *among* firms. The second part (*Buyer Groups and Cartels*) studies how retailers teaming up to jointly buy their inputs through a buyer group can serve as a collusive device against final consumers. Figure 1.3 conceptually represents this set-up: two retailers interact with their suppliers through a buyer group.

The buyer group allows the retailers to jointly source their inputs and to coordinate their negotiations with suppliers regarding prices and other commercial terms. On the output market, the two retailers compete for consumers. This set-up allows to study how

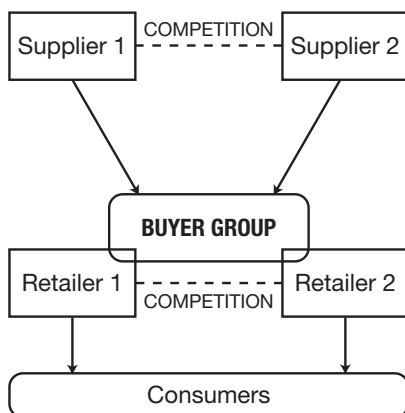


FIGURE 1.3 *Cartelization through a buyer group.*

a buyer group on the input market can effectively operate as an “implied cartel,” thereby contributing to the theoretical basis of competition policy aimed toward buyer groups.

The third part (*Antitrust Damages*) investigates the distribution of economic harm caused by a cartel in a vertical production chain; victims of a cartel can sue the cartel for such harm. Figure 1.4 graphically represents a vertical production chain with a cartel in the second layer. The two firms engaging in the cartel source their inputs from two suppliers and sell their products to two retailers. The retailers, in turn, resell these products to final consumers. The model studies how an anticompetitive price increase by a cartel in a longer production chain can percolate through to final consumers. Insights about the distribution and passing on of antitrust harm is key in determining the damages that direct victims (retailers), as well as indirect victims (final consumers and possibly even the suppliers), can claim in court.

The Dutch Construction Cartel illustrates the relevance of the second and third parts of this dissertation. The intricate vertical relationships between suppliers and buyers at various levels of the production chain is expected to affect both the behavior and the harmful effects of the cartel.

This introductory chapter proceeds as follows. In Section 1.1, I briefly present the underlying rationale of cartel policy as well as the policy elements that are studied throughout this dissertation. This sets the stage to introduce the three topics of this dissertation in more detail in Section 1.2. Section 1.3 describes the research methodology and Section 1.4 presents the dissertation’s outline.

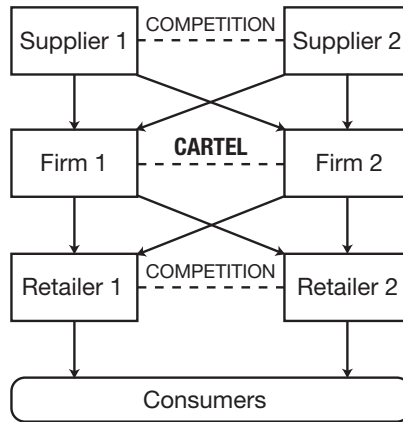


FIGURE 1.4 *Antitrust damages in a longer chain of production.*

## 1.1 Cartel Policy: Rationale and Key Elements

Cooperation and trust are great entrepreneurial traits and provide the basis for well-functioning markets. However, when firms cooperate by coordinating their behavior through a cartel instead of competing for customers, prices are likely to rise while product quality and service levels may fall. Although this is expected to benefit cartel members, it may hurt customers. The overall economy can suffer from such price increases, as some customers do not buy at the elevated cartel price, but would have bought at the competitive price. Thus, cartelization is likely to result in *inefficiencies*.

Arguably more important, the restriction or elimination of competition can reduce firms' incentives to outperform each other. This may result in a lower level of product innovation, which, in turn, inhibits welfare-enhancing developments and can lead to less product variety. Although a precise quantification of these effects is complex, Connor and Helmers (2007) estimate that discovered international cartels in the period 1990–2005 caused price increases worth over \$600 billion.<sup>6</sup> Therefore, cartels are considered detrimental to the economy.<sup>7</sup>

<sup>6</sup>Connor and Helmers (2007) report total overcharges of over \$550 billion in 2005 dollars, which is over \$600 billion in 2011 dollars when corrected for inflation.

<sup>7</sup>Every rule has its exceptions. If efficient firms are struck by extraordinary circumstances, such as a severe economic crisis, temporary cartelization through a so-called crisis cartel may allow them to survive, which could potentially be beneficial in the long run. Also, a cartel can be beneficial if the consumption or production of the products entails *negative externalities*; for example, a cartel among tobacco companies may be welfare-enhancing as cigarettes become more expensive, thereby reducing the number of smokers and, thus, the incidence of smoking-related diseases. In addition, one may argue that cartels can enhance efficiency when cartel members exchange information, allowing them to better serve consumers, or when they cooperate on research and development or the joint purchase of inputs—see Chapter 5.

These economic insights are the underlying rationale for the illegality of cartels under competition or antitrust laws.<sup>8</sup> Such laws are enforced by competition or antitrust authorities, on both the national and European level.<sup>9</sup> Besides the detection and punishment of cartels, competition authorities have a broader task to execute and develop competition policy. This is the set of rules and instruments aimed at ensuring that fair competition in the market is not distorted. Competition policy, therefore, encompasses not only cartel policy, but also the assessment of mergers, dominant positions, vertical restraints<sup>10</sup> and state aid, as well as other arrangements affecting the competitive process, such as collaboration through joint ventures and standardization agreements.

While a detailed discussion of competition policy is beyond the scope of this section, I here briefly discuss five key elements of cartel policy that are studied throughout this dissertation. Without aiming to provide an exhaustive description of all the legal and economic elements of cartel policy, the following descriptions introduce the policy tools that are relevant to the discussion of this dissertation's topics in Section 1.2.

First, competition authorities impose *corporate fines* on cartel members, which are at most 10% of annual affected turnover under European competition law.<sup>11</sup> The stakes are high: the total amount of fines imposed by the European Commission in the period 2006–2010 was €12.1 billion, with the largest fines for the firms having engaged in the Car Glass Cartel (€1.4 billion).<sup>12</sup> The size of these corporate fines depend on the duration of the cartel as well as potential mitigating circumstances, such as limited participation in the cartel, or aggravating circumstances, such as being the ring-leader of the cartel or having engaged in previous infringements of competition law.

Second, some jurisdictions allow for *individual sanctions* aimed at executives involved in cartelization practices. Most notably, in the United States (U.S.), involved employees are criminally prosecuted and face substantial personal fines and even jail sentences. Although European competition law is an administrative law not targeting individuals, some European Union (E.U.) Member States—such as the United Kingdom (U.K.), Ireland, and Estonia—have enacted laws to criminally prosecute involved employees on the

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<sup>8</sup>In Europe, the U.S., and the Netherlands, respectively, cartels are banned under Article 101(1) of the Treaty of the Functioning of the European Union (TFEU), Section 1 of the Sherman Act, and Article 6(1) of the *Mededingingswet*.

<sup>9</sup>In Europe, the U.S., and the Netherlands, respectively, the competition authorities are: the European Commission's Directorate General for Competition (DG Competition); the U.S. Department of Justice (DOJ) and the Federal Trade Commission (FTC); and the Netherlands Competition Authority (NMa).

<sup>10</sup>Vertical restraints are agreements between suppliers and buyers, such as retail price maintenance, exclusive dealing contracts, rebate schemes, or slotting allowances—see also Chapter 5.

<sup>11</sup>See *Council Regulation (EC) No. 1/2003 of 16 December 2002 on the implementation of the rules of competition laid down in Articles 81 and 82 of the Treaty*, Official Journal L1/1 (2003).

<sup>12</sup>See statistics by the European Commission at [ec.europa.eu/competition/catels/statistics/statistics.pdf](http://ec.europa.eu/competition/catels/statistics/statistics.pdf).

national level.<sup>13</sup> Moreover, the U.K. system allows for “director disqualifications,”<sup>14</sup> and in the Netherlands, individuals involved in cartelization can be personally fined.<sup>15</sup>

Third, competition authorities have implemented *leniency programs*.<sup>16</sup> Under the E.U. corporate leniency program, cartel members have the option to report evidence to the European Commission (“blow the whistle”) in exchange for full immunity from legal sanctions aimed at the corporation. The U.S. corporate leniency program also protects employees from legal sanctions when the corporation reports the cartel. In addition, the U.S. individual leniency program grants the involved employee full immunity when coming forward with incriminating evidence. The objective of such leniency programs is to incentivize corporations and individuals to blow the whistle, which is expected to destabilize cartels from an *ex ante* perspective.

Fourth, victims (customers and final consumers) of cartels can sue the cartel in court and claim *private damages* for the economic harm suffered. While the U.S. has decades of experience with private damages law suits, Europe is in the early stage of developing such a practice. The U.S. Clayton Act allows direct customers to sue the cartel for three times the harm (“treble damages”). In contrast, the European Commission aims for a European private damages practice, with both direct and indirect customers being able to recover single damages.<sup>17</sup> Such private law suits not only serve as an extra means to punish cartels, but also allow for reparation of the economic harm caused by the cartel.

Fifth, competition authorities aim to prevent the formation of cartels by encouraging firms to implement *antitrust compliance programs*. These programs entail internal firm measures to educate employees about competition law infringements and to monitor their behavior. Examples of such monitoring are unannounced inspections of documents, email messages, and telephone records, as well as lawyers accompanying managers to business meetings (Stephan, 2009). When well-designed and properly implemented, compliance programs have the potential to deter and detect illegal managerial conduct.

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<sup>13</sup> See Wils (2005) for a detailed overview of criminalization of competition law in E.U. Member States.

<sup>14</sup> See, for example, U.K. Office of Fair Trading (2010).

<sup>15</sup> See Articles 56(1) and 57(1) of the Dutch *Mededingingswet*.

<sup>16</sup> Clear overviews of leniency programs are presented in Wils (2007) and Spagnolo (2008). The Netherlands Competition Authority (NMa) made a film about the Dutch leniency program; it shows how a fictional cartel member feels uncomfortable and applies for leniency—see the link at [carteltheory.com/references](http://carteltheory.com/references).

<sup>17</sup> See the European Commission’s 2008 *White paper on damages actions for breach of the EC antitrust rules*, pp. 3 and 7. The practical implementation of such a damages practice entails not only economic challenges, but also several legal issues—see, for example, the 2010 *Fédération Internationale de Droit Européen* (FIDE) conference proceedings (Rodríguez Iglesias and Ortiz Blanco (Eds.), 2010).



## 1.2 Vertical Relations in Cartel Theory

This dissertation extends the basic horizontal model of cartels—see Figure 1.1—to allow for three types of vertical relations. These extensions aim to contribute to the continuous development of the policy elements presented in the previous section. The next three subsections briefly discuss the three topics of this dissertation in more detail: managerial incentives in cartels (1.2.1), buyer groups operating as cartels (1.2.2), and antitrust damages in longer chains of production (1.2.3).

### 1.2.1 Managerial Incentives in Cartels

The majority of the literature on cartels and collusion treats the firm as profit-maximizing integrated entities (black boxes), thereby deriving key insights into the economic forces governing the operation of cartels. However, virtually all discovered cartels are formed and operated by managers (executives) whose incentives may not be fully aligned with those of the profit-motivated owners (shareholders). Such misalignment of incentives can have a key impact on the stability and behavior of cartels.

The greater part of this dissertation aims to understand how horizontal collusion among firms is affected by vertical corporate governance issues within firms.<sup>18</sup> To that end, Chapters 2–4 extend the basic horizontal cartel model by incorporating the employment relationship of the key decision maker within the firm.

Insights from discovered cartels indeed illustrate the central role of corporate governance issues and managerial incentives in cartels. From a sample of 40 international cartels, Stephan (2009) reports that decisions to engage in collusion are typically made by senior management. Moreover, as discussed earlier, top management struggled to keep sales representatives in line with price agreements in the Lysine Cartel (Eicherwald, 2000). Similarly, in the Sotheby's Christie's Auction House Cartel, the two involved CEOs instructed their managers to implement the collusive agreement (Mason, 2004). The conceptual model in Figure 1.2 can be used to investigate such vertical relations between either shareholders and senior management, or senior management and middle (or lower) management. Chapters 2, 3 and 4 develop different versions of this model.

Chapter 2 investigates the impact of monitoring managers through antitrust compliance programs on the authority's optimal sanctions and leniency policy. Competition authorities encourage firms to implement such programs. However, whether such programs are indeed effective in preventing violations of competition law depends on the details of their implementation, as well as their interaction with other policy instruments. The model in Chapter 2 allows to study the optimal degree of corporate versus manage-

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<sup>18</sup>Buccirossi and Spagnolo (2007) provide an overview of corporate governance factors in cartels.

rial liability; the design of corporate and individual leniency programs; and whether the authority should regard the adoption of an antitrust compliance program as a mitigating circumstance when determining sanctions.

In Chapter 3, I investigate how commonly observed short-term, renewable CEO employment contracts affect cartel stability and behavior. The type of employment contract and remuneration package of key decision makers within firms may have an important impact on the stability and behavior of cartels. For example, Spagnolo (2000) argues that stock-related managerial compensation can improve cartel stability. The model in Chapter 3 allows to derive the impact of the short-termism associated with commonly observed executive contracts on the internal operation of cartels.

Chapter 4 studies how the decision to delegate control to a manager who is remunerated with a share of profits and sales affects the stability of cartels between firms. In the Lysine Cartel and the Sotheby's Christie's Auction House Cartel, for example, delegation of decision rights to managers was a challenge to executives. The model in Chapter 4 exposes an economic mechanism through which delegation of decisions to managers can improve the stability of cartels.

### 1.2.2 Buyer Groups Operating As Cartels

Buyer groups are cooperative arrangements between firms (usually: retailers) to combine their purchases in input markets—see Figure 1.3. Such groups are widespread in the economy, especially in the European grocery industry.<sup>19</sup> While buyer groups are not *per se* illegal under either E.U. competition law or U.S. antitrust law, there is a growing debate among both academics and practitioners on their competitive effects.<sup>20</sup> Chapter 5 of this dissertation investigates how retailers forming a buyer group on their input market can induce a stable cartel outcome on their output market by making use of slotting allowances, rebate schemes, and other vertical restraints.

The discussion on the competitive effects of buyer groups has traditionally mirrored the discussion surrounding the issue of buyer power more generally. A buyer group may enable firms to exercise countervailing power over their suppliers, thereby allowing them to obtain lower input prices. Such a reduction in input prices may be passed on to consumers in the form of lower retail prices, provided that there is effective retail competition (Inderst and Mazzarotto, 2007). Moreover, buyer groups can potentially serve to level the playing field among downstream firms by allowing smaller buyers to source against the same terms of trade as larger buyers.

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<sup>19</sup>See, for example, Dobson and Waterson (1997, 1999) and Inderst and Wey (2003, 2007).

<sup>20</sup>See, for example, U.K. Office of Fair Trading (2007).

While buyer groups potentially allow for several competitive effects based on buyer power considerations, such arrangements may also affect the operation and stability of cartels. For example, the group arrangement can facilitate the sharing of information between firms or can increase the degree of symmetry between members, thereby possibly facilitating collusion.<sup>21</sup> Also, purchasing quotas negotiated through a buyer group can effectively be targets for market shares in the downstream market.<sup>22</sup> The contribution in this dissertation relates to Piccolo (2010) and Foros and Kind (2008) and shows how buyer group members can coordinate on wholesale contractual provisions so as to effectively form a stable cartel on the output market.

### 1.2.3 Antitrust Damages in Longer Production Chains

Anticompetitive price increases by cartels can cause widespread harm throughout the economy. In the U.S. and the E.U., victims (customers) of cartels can sue the cartel to compensate them for such harm. However, the identification of antitrust harm can be complicated. In longer supply chains, in which one product is an input in the production of the next, an illegal price increase somewhere in the chain can percolate through to the other layers in a ripple of partial pass-ons—see Figure 1.4. Chapter 6 presents a model that allows to study how such harm is distributed within the chain of production.

In the U.S., the difficulties in determining antitrust harm have, to some extent, been circumvented by case law. The combination of the Clayton Act, *Hannover Shoe*<sup>23</sup> (1986), and *Illinois Brick*<sup>24</sup> (1977) implies that only direct purchasers of the cartel can claim three times the so-called direct-purchaser *overcharge*, which is the number of products bought multiplied by the collusive price increase. Schinkel, Tuinstra and Rüggeberg (2008) argue that such a policy, in which indirect purchasers do not have legal standing, can result in arrangements in which the cartel forwards a share of the collusive profits to direct purchasers so as to disincentivize them from claiming damages.

The European Commission promotes a European private damages practice in which all direct and indirect purchasers have legal standing. Its 2008 White Paper calls for “simplified rules on estimating the loss” from antitrust infringements, compensating direct and “indirect purchasers” for their “actual loss,” as well as “the loss in profit as a result of any reduction in sales.”<sup>25</sup> Chapter 6 of this dissertation shows that there is no simple structural relationship between the direct-purchaser overcharge and the true harm caused by a cartel in the full chain of production.

<sup>21</sup> See fn. 20.

<sup>22</sup> See the Commission’s decision of 20 October 2004 in *Case COMP/C.38.238/B.2-Raw Tobacco-Spain*.

<sup>23</sup> *Hannover Shoe Inc. v. United Shoe Machinery Corp.* 392 U.S. 481 (1968).

<sup>24</sup> *Illinois Brick Co. v. Illinois* 431 U.S. 720 (1977).

<sup>25</sup> See fn. 17.

### 1.3 Methodology and Analytical Concepts

The two dominant methodologies to derive economic insights are based on empirical observations and game-theoretic modeling. These methodologies are complementary in developing progressing economic knowledge. Examples of empirical research range from fully-fledged econometric models to anecdotal observations, and from large-scale natural experiments to precisely controlled experiments in an artificial setting.

The predominant approach in microeconomic theory is game theory, which is the methodology used in this dissertation. A game is a situation in which two or more players strategically interact with each other. Strategic interaction means that the payoff (or: utility) of at least one player depends on the action taken by at least one other player. The players of a game each have their own pieces of information about several aspects, such as the structure of the game, the actions available to and taken by other players, and the objectives of the players. Each player plays the game with a certain strategy.

Game theory serves to better understand the underlying forces governing human as well as economic interactions. Modeling complex situations as simplified games can help to develop insights about such situations. For the reader without an economics background, the following example, based on Chapter 2, loosely illustrates the idea of a game. Consider as the players of the game a law-enforcing authority, the board of shareholders of a firm, and its CEO. The authority's task is to design a policy ensuring that the firm complies with the laws. The shareholders offer the CEO an employment contract so as to maximize the firm's net profit. In turn, the CEO may (secretly) form a cartel, thereby increasing profits. Such a set-up allows to analyze several questions: What are the optimal sanctions? Should the authority implement a whistle-blower scheme? If so, how should the whistle blower be treated? Would it be smart for the authority to rely on the board of shareholders to monitor the CEO's behavior? Should the authority reward firms for such monitoring? These questions are considered in Chapter 2 by game-theoretically modeling the *authority-shareholders-CEO* relationship.

It is important to address two related points about the practical relevance of game theory. First, game-theoretic results must always be interpreted in light of the assumptions made in the model. That is, economic insights obtained through game-theoretic analysis should be carefully weighted against unmodeled considerations; by definition, no (economic) model can capture all the subtleties of reality. Second, the players of all models in this dissertation are assumed to be rational. Although, in reality, people's behavior is sometimes rational and sometimes irrational, the rationality assumption serves as a solid benchmark against which considerations of irrationality can be placed.

All models in this dissertation use non-cooperative game theory, which means that players behave independently. The games are solved by determining sets of strategies

that satisfy the Nash equilibrium concept. A set of strategies is a Nash equilibrium if and only if no player is better off by unilaterally adopting a different strategy. Most of the chapters deal with infinitely repeated games and solve for the subgame perfect Nash equilibrium—that is, the equilibrium strategies satisfy the Nash equilibrium concept in every possible stage of the game. All games in this dissertation are characterized by complete information: the players know the structure of the game as well as the payoffs and actions available to the other players. The games in Chapters 2 and 3 are characterized by imperfect information: the players do not know all the payoff-relevant information or do not observe the actions of other players.

## 1.4 Dissertation Outline

This dissertation presents five pieces of research on vertical relations in cartel theory. Each of the Chapters 2–6 is a stand-alone theoretical contribution and can be read independently of the others; the corresponding research papers on which the chapters are based are available in their most updated form at [carteltheory.com](http://carteltheory.com). Each chapter begins with an introduction and motivation; provides an overview of the related literature; develops the formal model; presents the results; discusses the policy implications (when applicable); and closes with concluding remarks.

Chapter 2 (*Monitoring Managers Through Corporate Compliance Programs*, joint with Charles Angelucci) aims to shed light on the effectiveness of (antitrust) compliance programs in deterring corporate crime.<sup>26</sup> Modeling a compliance program as a monitoring technology *vis-à-vis* employees, we show how compliance programs entail a perverse effect: superiors may, in fact, use the information that comes available through the compliance program to encourage employees to breach the law. We coin this the “credibility issue” of compliance programs. Our three-tier principal-agent hierarchy *authority-shareholder-manager* also allows to derive the optimal sanctions and leniency policy. Our results partly contrast the U.S. Federal Sentencing Guidelines, the U.S. and E.U. corporate leniency program, and the U.S. individual leniency program. In particular, we find that the authority optimally (i) grants partial corporate leniency when the corporation blows the whistle, while not granting leniency to the involved individual; (ii) does not always grant individual leniency when an employee blows the whistle; and (iii) does not apply a discount on the corporate fine for the mere fact of having adopted a compliance program. Finally, we discuss the implications for competition policy.

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<sup>26</sup>Although the project was initially motivated from an antitrust perspective, the model is more broadly applicable to any type of corporate crime that benefits the firm, absent intervention by the law enforcer. Examples include tax evasion, cooking the books (i.e., accounting fraud), and environmental fraud.

Chapter 3 (*Short-Term Managerial Contracts and Cartels*) asks how commonly observed short-term, renewable CEO employment contracts affect the stability and behavior of cartels. Departing from the collusion literature with long-term contracts, I show how the threat of not being rehired associated with a short-term contract may reduce the manager's incentives to defect from a collusive agreement. Additionally, the model allows for an analysis of fixed-term vs. profit-dependent salary components, as well as of the impact of firms engaging in "serial collusion." Extending the model to a dynamic game of contracts spanning multiple periods, I argue that short-term contracts can be a source of cyclical collusive pricing. Finally, reinterpreting the model in light of firm financing shows how firms financed by debt can form more-stable cartels than firms financed by equity.

Chapter 4 (*Strategic Delegation Improves Cartel Stability*) deals with collusion and strategic delegation. I extend the Cournot strategic delegation model by Fershtman and Judd (1987) and Sklivas (1987) to an infinitely repeated setting, thereby allowing both firm owners and managers to collude. I find that strategic delegation allows a cartel to be stable for a larger set of discount factors than collusion in the standard Cournot model. The reason is that the unprofitable static Nash delegation equilibrium is used by owners to commit to punishing deviant managers by firing them.

Chapter 5 (*Efficient Cartelization Through Buyer Groups*, joint with Chris Doyle) shows how retailers can extract monopoly profits on their output market by coordinating on wholesale contracts on their input market. We show that coordination through such an anticompetitive buyer group allows for increased cartel stability when retailers sign exclusive dealing or minimum purchase provisions, which are commonly observed vertical restraints used by a buyer group. Moreover, we extend the model to allow for cost efficiencies—a commonly claimed rationale for forming a buyer group—thereby showing that a buyer group may induce the joint monopoly outcome for every discount factor, while, in fact, raising consumer welfare above the competitive level. Finally, we discuss the implications of our findings for competition policy aimed toward buyer groups.

Chapter 6 (*The Overcharge as a Measure for Antitrust Damages*, joint with Maarten Pieter Schinkel and Jan Tuinstra) presents a model showing how a cartel's price increase inflicted on direct purchasers is passed on to indirect customers in lower levels of the production chain. The resulting increase in the price for final consumers leads to additional harm caused by a reduction in demand to downstream (in)direct purchasers, as well as to upstream suppliers. Taking the perspective of a practical measure of antitrust harm, we show that there is no structural relationship between the direct-purchaser overcharge and the true harm inflicted by an antitrust violation on all of the direct and indirect purchasers and sellers in the chain of production.

Finally, Chapter 7 (*Implications for Competition Policy and Conclusions*) presents policy implications and conclusions.