1. Introduction

Luis C. Corchón and Marco A. Marini

In recent years, game theory has provided the ideal landscape in which to develop a wide range of industrial organization topics, as firms' entry, product differentiation, predation, delegation, mergers, collusion and R&D investment, auctions, health economics, contests and intellectual property rights, just to cite a few. Game theory was also recently and successfully applied to new fields such as law and economics, economics of networks, digital economy, experiments, corruption, and much much more.

This second volume of the *Handbook* is devoted to presenting a wide set of applications of game-theoretic models to industrial organization topics. Thanks to the outstanding quality of the current contributors, this volume is relevant for both established researchers as well as to graduate and advanced undergraduate students.

In this second volume we have organized the numerous applications into four distinct parts: (I) Collusion and Mergers; (II) Contests; (III) Special Topics; and (IV) Experimental and Empirical Evidence. More specifically, Part I of the *Handbook* deals with the analysis of horizontal mergers, with various collusive practices and mergers in vertically differentiated markets, with leniency effects in cartels and, finally, with coordinated effects in mergers. Part II introduces the state of the art in the literature dealing with both static and dynamic contests. Part III presents a quite wide spectrum of game-theoretic tools applied to various industrial organization topics such as firm pricing under consumer search, liability and product safety, strategic delegation, platforms and networks, auctions, intellectual property rights, healthcare markets, and corruption. All chapters use rigorous game-theoretic settings. Finally, Part IV presents two widely encompassing surveys of recent advances in experimental industrial organization and empirical models of firms' R&D. Let us now illustrate, in more detail, the content of all chapters composing this second volume of the *Handbook*.

PART I: COLLUSION AND MERGERS

In Chapter 2 on horizontal mergers in oligopoly, Ramon Faulí-Oller and Joel Sandonís analyze, in turn, the case of exogenous and endogenous mergers. In addition, the chapter examines in detail the models of horizontal mergers in vertically related industries and the models of mergers in an international setting, also looking at their welfare consequences.

In Chapter 3 on collusive agreements in vertically differentiated markets, Marco Marini introduces a number of game-theoretic tools that can be used to model the collusion between firms in a vertically differentiated market. The chapter starts reviewing the classical literature on two-firm collusion and, thus, the analysis is extended to a N-firm vertically differentiated market to study the incentive to form either a whole market cartel or partial cartels made up of subsets of firms colluding in prices. It is shown that a sufficient condition for the coalitional stability of the whole market cartel is the equidistance of firms' products along the quality spectrum. Also, adopting a standard infinitely repeated game approach, it is shown how an increase in the number of firms in the market makes collusion harder for all firms regardless of their product quality. Finally, by means of a three-firm example, the feasibility of firm alliances under endogenous quality choice is studied.

In Chapter 4 on cartels and leniency, Catarina Marvão and Giancarlo Spagnolo study leniency policies. These policies reduce or cancel the sanctions for the first firm(s) that self-report being part of a cartel. They have become the main enforcement instrument used by competition authorities to fight against cartels. Hence, it is vital for competition authorities to understand how leniency programs affect firms' incentives, in order to optimize their design and administration. In this chapter, the authors review some of the key studies that have been undertaken to date, with emphasis on more recent contributions and highlight the main results and their limitations. The chapter concludes with a general assessment and an agenda for future research on this topic at the core of competition policy.

In the final chapter of Part I, Chapter 5 on assessing coordinated effects in merger cases, Natalia Fabra and Massimo Motta focus on the analysis of coordinated effects in merger cases; that is, the possibility that, after a merger, firms can increase their market power by coordinating their actions. The authors explain what coordinated effects are and how they can be assessed. For this purpose, they review the economic meaning of collusion, and assess the factors that allow firms to reach and enforce collusive outcomes. They also review some approaches for identifying and quantifying coordinated effects in practice, and provide an overview of the use of coordinated effects in European merger control.

PART II: CONTESTS

In the first chapter of Part II, Chapter 6 on contest theory, Luis Corchón and Marco Serena introduce the readers to the main ingredients of contests, with a focus on how the efforts of the agents translate into probabilities of winning (i.e., the contest success function). In the second part of the survey, they focus on some extensions of the basic model, with a particular focus on dynamics, information and groups. They use the popular lottery model of contest with heterogeneous contestants to highlight their equilibrium properties and to review some results on how a designer can optimally design the contest.

In the second chapter of Part II, Chapter 7, Magnus Hoffmann and Grégoire Rota-Graziosi survey the extensive literature on endogenous timing in contests. They first introduce the structure of a two-player contest with either simultaneous or sequential moves and fixed prizes. They then present the case of ubiquitous contests with effort-dependent prizes, in which timing is endogenously determined. Finally, they conclude by looking in detail at the literature on sequential play, endogenous timing, and commitment in contests.

PART III: SPECIAL TOPICS

In the first chapter of this third part, Chapter 8 on firm pricing with consumer search, Simon P. Anderson and Régis Renault discuss in detail the basic concepts underpinning the theory of imperfectly competitive markets with consumer search. They first stress how the appropriate theoretical frameworks should involve sufficient heterogeneity among agents on both sides of the market. Moreover, they explain why the analysis of ordered search constitutes an essential ingredient for modeling recent search environments. Finally, they examine in detail the important issue of the impact of the reduced search cost on prices, variety, product choice, and advertising practices.

In Chapter 9, on market structure, liability, and product safety, Andrew Daughety and Jennifer Reinganum consider how models of imperfect competition provide insight into an important area of law: products liability, which is liability for harms and losses associated with goods and services sold via markets. Traditional law and economics analyses of products liability generally find no role for market structure or strategic interaction to influence safety or liability policy. Rather, different liability regimes, and alternative market structures, lead to the same private choice of safety, and this private choice is socially optimal. Daughety and Reinganum find that two simple (but plausible) model modifications, cumulative harm or endogenous fixed costs, yield a substantial impact of market structure on the choice of safety and liability regime.

In Chapter 10 on strategic delegation in oligopoly, Michael Kopel and Mario Pezzino provide the reader with a clear and intuitive description of the topic of strategic managerial incentives under oligopolistic competition. They describe in detail the related models of vertical separation, where a manufacturer delegates her decisions to a retailer, and the agent appointment game, where a principal delegates her decisions to a certain type of agent. Each of these themes is presented by discussing the seminal paper that first introduced the topic, its key assumptions and its applications along with some empirical and experimental evidence. The contributions that have provided important extensions to the basic frameworks are also discussed in the final section of the chapter.

In Chapter 11 on platforms and network effects, Paul Belleflamme and Martin Peitz review the key findings of the literature on network effects and two-sided platforms. They explore how to define network effects and markets with platforms, and investigate market demand and the provision of network goods. Then they outline the basic models of monopoly platforms and platform competition, and elaborate on some routes taken by recent research.

In Chapter 12 on auctions, Ángel Hernando-Veciana provides an overview of the advances in the auction field that have taken place in the last decade. To this aim, the survey starts with an introductory section in which the basic tools of analysis are summarized. Next, the main advances in three innovative areas of auction theory are spelled out in detail: position auctions, Internet auctions and combinatorial auctions. The final section of the chapter summarizes the major contributions to auction theory organized by topics.

In Chapter 13 on differential oligopoly games in environmental and resource economics, Luca Lambertini offers a comprehensive overview of the literature based on differential games whose main focus is the interplay between either regulated or unregulated oligopolistic firms' profit incentives and the preservation of the stock of natural capital. The first section introduces Cournot oligopoly games with either polluting emissions or resource extraction under open-loop rules, without regulation on emissions or access to the commons. The second section reviews the literature on environmental games with feedback structures, where firms may be subject to emission taxes and possibly activate R&D projects for green technologies. The third section considers games with exploitation of renewable and nonrenewable resources. The final sections are devoted, in turn, to corporate environmentalism and the Porter hypothesis as well as to the issue of international trade and the environment, both crucial for the ongoing debate on globalization and climate change.

In Chapter 14 on intellectual property, Miguel González-Maestre discusses the current literature on intellectual property rights from a perspective taking into account two main features of the evolution of modern economies: (1) the increasing level of complexity associated with the production and design of goods; and (2) the rapid development of new technologies of information and communication. To this end, the chapter mainly focuses on the recent literature dealing with the role of technological changes on the optimal design of patents and copyrights. This overview suggests that the substantial changes observed in Western economies, aiming at reinforcing intellectual property rights, cannot be justified either theoretically or empirically on the grounds of welfare or of creative and innovational incentives. Instead, alternative explanations based on rent seeking and lobbying activities by copyright or patent holders emerge as their most plausible rationale.

In Chapter 15 on healthcare and health insurance markets, Pau Olivella introduces some modeling tools for the analysis of healthcare provision and health insurance. In particular, the chapter devotes great attention to a series of topics for which the tools of industrial organization and game theory have proven most fruitful: (1) firms' incentives to invest in R&D in the pharmaceutical industry; (2) risk selection and screening of consumers; and (3) the effect of hospitals' competition.

In Chapter 16 on the microeconomics of corruption, Roberto Burguet, Juan-José Ganuza and José G. Montalvo review the most recent research on corruption. They start by analyzing the seminal models of corruption built on three-tier delegation models. Then, they discuss the case of corrupted deals to see which main economic factors affect corruption. Incentives and compensations in bureaucracies, as well as the strict interplay of market and bureaucracies are discussed. Competition and contract design are also reviewed in relation to procurement in the presence of corruptible agents. After reviewing theory, the authors turn to empirical evidence. Finally, they critically evaluate several anti-corruption mechanisms proposed by the literature to both control and eliminate illegal activities.

PART IV: EXPERIMENTAL AND EMPIRICAL EVIDENCE

In the first chapter of this fourth part of the *Handbook*, Chapter 17 on experimental industrial organization, Jordi Brandts and Jan Potters present a selective survey of the recent experimental studies on industrial organization issues. The first section of the chapter presents, starting with the classical models of Cournot, Bertrand and Stackelberg, the results of experiments based on static models involving the choices of quantities and prices. The second section deals with tacit collusion. The third section covers horizontal product differentiation and the fourth discusses experience and credence goods. The last section presents a few studies on entry deterrence and R&D competition.

In the concluding chapter of the volume, Chapter 18, devoted to the empirical models of firms' R&D, Andrés Barge-Gil, Elena Huergo, Alberto López, and Lourdes Moreno survey the ever-growing empirical literature of R&D. They explain that this literature is still growing due to the increasing availability of micro-data. Taking this fact into account, the main purpose of this chapter is to provide an overview of three important topics covered by the recent literature: the determinants of firms' R&D investment, the link between R&D, innovation and productivity, and the analysis of the R&D black box. This chapter is presented as an invitation to industrial organization practitioners, both theorists and applied, to cross the bridge (and to change sides) between theory and applications.