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***Handbook of Game Theory and Industrial Organization, Volume I: Theory
Introduction***

Luis C. Corchón¹ and Marco A. Marini²

Abstract. *We introduce here the first volume of Handbook of Game Theory and Industrial Organization: Theory, by L. C. Corchón and M. A. Marini (eds.), Edward Elgar, Cheltenham, UK and Northampton, MA, by describing its main aim and its basic structure.*

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JEL codes: C02, C50, C70, C71, C72, C73, C78, C79, D21, D43.

Game theory lies at the heart of modern industrial organization. Over the second half of the last century, it provided a sound foundation to the main equilibrium concepts adopted in classical industrial economics, as in Cournot, Bertrand and Stackelberg models. It also allowed to build up new and rigorous conceptual frameworks for many industrial organization topics, as product differentiation, predation, delegation, mergers, collusion and R&D in imperfectly competitive markets. Finally, and perhaps most importantly, over the years game theory has constantly continued to inspire new research grounds in the field of industrial organization which, in some cases, went far beyond the scope of the discipline. This occurred, for instance, in the development of dynamic and incomplete information games or in the recent applications of game theory to law and economics, networks, digital economy, auctions, experiments, health economics, intellectual property rights, contests and corruption, just to cite a few. Furthermore, it should be stressed that the relationship between game theory and industrial organization has never been unidirectional.³

Thus, it is not exaggerated to say that game theory has become the common language of industrial

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³As observed by Bagwell and Wolinsky (2002): "First, the needs of industrial organization fed back and exerted a general influence on the agenda of game theory. Second, specific ideas that grew out of problems in industrial organization gained independent importance as game theoretic topics in their own right. Third, it is mostly through industrial organization that game theory was brought on large scale into economics and achieved its current standing as a fundamental branch of economic theory. (Bagwell and Wolinsky, 2002, p.1852).

organization.⁴ In particular the adoption of a sound mathematical language has allowed industrial organization to steadily progress towards new and unexplored fields. As an example, the recent use of experimental game theory for industrial economics has opened the door to behavioral models for the explanation of the bias of consumers and sellers in the market.⁵

Due to the strong and increasing interlink between game theory and industrial organization, the current volume aims to provide a solid introduction to the main topics lying at the crossroads between these two disciplines. In managing such a - seemingly arduous - task, our major contribution as editors was mainly to attract a quite impressive array of renown economists in the challenge to yield up-to-date surveys for the volume. As a final result, and specially thanks to the outstanding quality of the contributors, the current *Handbook* appears suitable to both established researchers as well as to graduate and advanced undergraduate students.

Given the wide heterogeneity of topics being at the boundary between game theory and industrial organization, our primary aim in assembling the book was to give a rational structure to the great amount of material gathered for its preparation.

In our final plan for the *Handbook*, we judged as appropriate to divide the book into two volumes where, while the first volume is mainly devoted to present the major game-theoretic modelling tools currently in use in modern industrial organization, the second is specifically aimed to apply these tools to a wide range of industrial organization topics.

More specifically, the first volume is organized into four parts corresponding to four distinct topics: (i) *Basic games in industrial organization*; (ii) *Dynamic games in industrial organization*; (iii) *Games of collusion in industrial organization*; (iv) *Information games*.

More in detail, part I of this first volume of the *Handbook* aims at providing an overview of the basic game-theoretic tools currently used in modern industrial organization, as lattice techniques, aggregative games, monopolistic competition models, oligopoly models with product differentiation, welfare analysis and contest theory.

Part II introduces the state of the art in the literature applying dynamic games to well-known dynamic industrial organization topics as Stackelberg, entry, evolutionary games.

Part III aims at surveying the main cooperative and noncooperative games commonly adopted for the analysis of horizontal mergers and collusion.

⁴This is confirmed, if ever needed, by Fudenberg and Tirole's long survey contained in the *Handbook of Industrial Economics* (1989) actually encompassing most of the relevant topics in noncooperative game theory.

⁵See the survey on "Experimental Industrial Organization" by Brandts and Potters in this *Handbook*.

Finally, part IV provides an overview of some important classes of models dealing with informational issues in imperfectly competitive markets, as trading under asymmetric information, principal-agent under moral hazard, learning in markets and information-sharing in oligopoly.

In the next sections we describe in more detail the content of every single chapter composing the *Handbook*.

Part I: Basic games in industrial organization

In the chapter on *strategic complementarities in oligopoly* Xavier Vives provides a detailed overview of many recent results obtained by applying the techniques of supermodular games to the analysis of firm behaviour in imperfect competitive markets. Beside offering an excellent introduction to the recent lattice-theoretic methods, the chapter reviews the results obtained in the existence and comparative statics of Cournot, Bertrand, R&D, advertising, multidimensional and multimarket competition models. In addition, it introduces the use of supermodularity for the analysis of well-known classes of two-stage dynamic games as entry, dynamic strategic incentives and both Markov and incomplete information games applied to voluntary disclosures and auctions.

In the chapter on the *existence and comparative statics in Cournot and Bertrand oligopoly*, Rabah Amir surveys two important strands of literature in oligopoly theory, one dealing with the existence of Cournot equilibrium in the general asymmetric and symmetric cases and the other with the effects of exogenous entry on market performance in a Cournot industry. This chapter emphasizes that these two strands of literature share one important unifying common feature: both are achieved via the application of lattice-theoretic methods. This also provides a bridge with the previous chapter.

In *aggregative games* Martin Kaae Jensen nicely complements the first two chapters by introducing three important classes of widely used aggregative games: (i) linearly aggregative games; (ii) generalized aggregative games; (iii) quasi aggregative games. These games are very useful in industrial organization since they drastically simplify the analysis of existence, comparative statics and uniqueness of Nash equilibria and unify a vast amount of literature since they apply to a wide array of models like Cournot and Bertrand oligopoly, tournaments, work in teams, contests, patent races and network games.

In the following chapter *monopolistic competition with no apology*, Jacques Thisse and Philip Ushchev review what has been accomplished under the heading of monopolistic competition in industrial organization and in other closely related economic fields. Among other things, the authors argue that monopolistic competition is a market structure in its own right which encompasses a much broader set-up than the celebrated constant elasticity of substitution (CES) model. Also, although oligopolistic and monopolistic competition compete for adherents within the economics profession, the authors explain how such dichotomy is, to a large extent, unwarranted, being both models complements rather than substitutes.

In *oligopoly and product differentiation* Jean Gabszewicz and Ornella Tarola overview old and new oligopoly models on product differentiation characterized by local competition. Starting by the microeconomic theory of consumer demand based on characteristics, as introduced by Gorman (1956

and 1980) and then popularized by Lancaster (1966), they present the horizontal product differentiation as based on Hotelling (1929) and vertical product differentiation as based on Gabszewicz and Thisse (1979). Finally, they review the model nesting both horizontal and vertical product differentiation and propose two applications of this approach, one based on network externalities and the other on environmental economics.

In his chapter on *oligopolistic competition and welfare*, Robert Ritz nicely reviews the recent developments in the study of social welfare in oligopoly markets. In particular, the chapter covers the usefulness of the rate of cost pass-through for the analysis of market performance and includes a careful analysis of welfare losses due to market power in various widely-used models (with symmetric and asymmetric firms, and with or without endogenous entry).

Part II: Dynamic games in industrial organization

This second part of the book offers a collection of chapters focussing on the use of dynamic games in a set of well known industrial organization issues.

The initial chapter by Klaus Ritzberger on *dynamic games* sets the ground by introducing three alternative definitions of game trees and extensive forms and also discussing in detail their pros and cons. In the following sections, the author comes back to the normal form associated to the extensive form and explains the concept of perfect recall and its significance for economic applications.

In *Strategic Refinements*, Carlos Pimienta examines the classical literature on equilibrium refinements. Starting with Nash's definition of equilibrium, the chapter presents a comprehensive review of the most successful equilibrium concepts adopted in economic applications as well as the most recent contributions to the subject. The chapter explains in detail how a few decision-theoretic criteria - admissibility, backwards induction, forward induction and invariance - shape the definition of stable sets of equilibria and how they translate into their corresponding mathematical formulation.

In *Stackelberg games* Ludovic Julien introduces three classes of deterministic noncooperative Stackelberg games with increasing level of generality. The first is the basic duopoly game. The second is the oligopoly multiple leader-follower game. The third extends the multiple leader-follower setup within the framework of bilateral oligopoly to describe a multi-commodity market. In each case, the author defines and characterizes the equilibrium and the welfare consequences of market power. The chapter also considers the issues of endogenous timing, merging and free entry.

In the chapter on *entry games and free entry equilibria*, Michele Polo reviews how a wide range of symmetric oligopoly models share some common comparative statics properties. Individual profits and quantities decrease in the number of firms, and tend to competitive or monopolistic competitive equilibria when the number of firms increases indefinitely. The maximum number of firms sustainable in a symmetric long-run equilibrium are shown to depend on technology (economies of scale), preferences (market size) and strategies (toughness of price competition). On the normative side, in homogeneous product markets the business stealing effect drives the result of excessive entry, whereas adding product differentiation and the utility from variety may revert this result. In addition the author considers asymmetric free entry equilibria using the aggregative nature of many oligopoly models as we noted before. Finally, he discusses the issue of endogenous sunk costs, persistent concentration and frictionless entry in contestable markets.

In their chapter *Evolutionary oligopoly games with heterogeneous adaptive players*, Gian Italo Bischi, Fabio Lamantia and Davide Radi analyze the properties of evolutionary switching models in oligopoly games, where boundedly rational agents can follow different behavioral rules (or heuristics) to update their production through repeated adaptive decisions. In particular, they focus on well known heuristics such as best replies with naive expectations, local monopolistic approximation and gradient dynamics on marginal profits. Hence, the chapter examines some specific examples of evolutionary systems where the coexistence of heterogeneous behaviors and of oscillatory time patterns are obtained as possible outcomes.

Part III: Games of Collusion in Industrial Organization

In this part of the volume we gather two theoretical contributions on collusion and mergers in oligopolies.

In the first chapter *coalitions and networks in oligopolies*, Francis Bloch reviews the models on endogenous formation of coalitions and networks in oligopolies. It weaves together a literature in game theory on cooperation and a literature in industrial organization on the formation of groups of oligopolistic firms. The discussion of cooperation in oligopolies starts with a brief presentation of the game-theoretic models used to predict the formation of coalitions and networks. Two different forms of cooperation are considered: (i) cartels and horizontal mergers; (ii) strategic alliances, which encompass both research joint ventures and information exchange platforms.

In the chapter on *TU oligopoly games and industrial cooperation*, Jingang Zhao surveys the existing results on TU cooperative games applied to oligopolies and lists nine promising future areas for TU oligopoly games. On the theoretical side, TU oligopoly games are shown to make advances on the refinements and applications of the core, one of the most important solution concepts in cooperative game theory. On the empirical side, the author shows how cooperative games can allow the analysis of industrial cooperation and, hence, the understanding of all forces at work behind industrial changes with and without regulatory policies.

Part IV: Information and search

The final part of the first *Handbook* volume looks at the various effects occurring in markets when relaxing the assumption of symmetric information.

In their chapter *trading under asymmetric information: positive and normative implications*, Andrea Attar and Claude d'Aspremont mainly focus their attention on screening models. They divide the chapter in two parts. The first part adopts a simple mechanism design approach with only one mechanism designer. When the mechanism designer is an outsider (say a public authority), all traders may have private information and play simultaneously. When the mechanism designer is an insider (a principal, buyer or seller), he is uninformed and has no private information. Three illustrative applications are taken into account: bilateral trade, auctions and insurance. In the second part of the chapter these model are extended to the case of several principals who are uninformed and have no private information but compete by designing mechanisms.

In *moral hazard: base models and two extensions*, Inés Macho-Stadler and David Pérez-Castrillo analyze first the optimal contracts in static moral hazard situations, where the agent's effort is not verifiable. Then, they present the main trade-offs of the principal-agent model. Furthermore, they cover in detail the trade-off of incentives (motivation) vs. risk-sharing (efficiency), incentives vs. rents (when the agent is protected by limited liability), incentives to a task vs. incentives to another (in a multitask situation), and incentives to the agent vs. incentives to the principal (when both exert a non-verifiable effort). Finally, they discuss how the predictions of the classical moral hazard model are affected when: (i) there are behavioral biases of individuals and, (ii) in presence of a matching market.

In their chapter on *learning in markets*, Amparo Urbano surveys the problem of market learning as well as that of experimentation (or active market learning) in dynamic models incorporating a Bayesian expectation revision mechanism. Through the lens of this perspective, she reviews the extensive literature on this topic. The experimentation literature has by and large focused on broadly defined bandit models, and thus the starting point is the monopolist experimentation with the classic two-armed bandit problem. The essay extends to surveying the impact of price competition on experimentation, the role of externalities in social learning and learning in experience good markets.

In the chapter on *information sharing in oligopoly*, Sergio Currarini and Francesco Feri review the theoretical literature on information sharing in oligopoly and discuss some recent contributions extending the traditional multilateral model to encompass the possibility of bilateral sharing agreements. In the first part of the survey the authors revisit the early insights of the literature, stressing the role of quantity vs. price competition and of common vs. private values. In the second part, following some more recent contributions, they discuss the bilateral model of information sharing, stressing the role of signals' correlation for the emergence of information sharing in equilibrium and its effect on the architecture of sharing networks. Finally, they conclude the analysis by discussing the emergence of core-periphery networks when firms possess asymmetric information.

References

- Bagwell, K., Wolinsky, A., (2002). "Game theory and industrial organization", in Aumann R.J. and S. Hart (ed.), *Handbook of Game Theory with Economic Applications*, edition 1, vol. 3, chapt. 49, 1851-1895, Elsevier.
- Fudenberg D.M and J. Tirole (1989) "Noncooperative game theory for industrial organization: An introduction and overview" in R. Schmalensee and R. Willig (ed.) *Handbook of Industrial Organization*, 1989, vol. 1, pp 259-327, Elsevier.
- Gabszewicz, J.J. and J.F. Thisse (1979). Price Competition, Quality and Income Disparities. *Journal of Economic Theory*, 20, 3, 340-359.
- Gorman W.M. (1956) "The Demand for Related Goods", *Journal paper J-3129*, Iowa Agricultural Station.
- Gorman W.M. (1980) "A Possible Procedure for Analysing Quality Differentials in the Egg Market", *The Review of Economic Studies*, 47, 5, 843-856.
- Hotelling H. (1929) "Stability in Competition", *The Economic Journal*, 39, 153, 41-57.
- Lancaster K. J. (1966), "A New Approach to Consumer Theory", *Journal of Political Economy*, 74, 2, 132-157.