Part I
Getting started

Introduction to Part I: Getting started

A large part of economic transactions takes place through markets. Markets thus play a central role in the allocation of goods in the economy. Moreover, the existence and nature of markets affect production decisions. *Industrial Organization Markets and Strategies* is an attempt to present the role of imperfectly competitive markets for private and social decisions.

The array of issues related to markets and strategies is extremely large. To convince yourself, log in to the website of any newspaper or magazine, and start a search for these two key words: markets and strategies. The search engine will provide you with a long list of articles concerning a huge variety of sectors, companies and business practices. As an illustration, here follows a selection of recent articles that were returned by the *International Herald Tribune* search engine (www.iht.com) on 1 February 2009.[1]

'Pfizer Inc., the world's largest drugmaker, said Monday it is buying rival Wyeth for $68 billion in a deal that will quickly boost Pfizer's revenue and diversification and – if it works as advertised – help the company become more nimble.'

'Only a few years ago, debates about the future of banking across the Continent were dominated by talk of border-straddling "European champions" that could compete with U.S. giants. But now a different development looms: the disintegration of truly European banking as the financial crisis pressures banks to retrench and refocus on their home markets.'

'The shock waves from the global downturn are pushing a fragmented and once fast-growing Chinese retail sector to consolidate as sales slow and profit margins shrink. Global giants like Wal-Mart Stores and Carrefour will benefit from the consolidation, along with China's growing consumer class, but rapid expansion has caught some retailers overextended as their home markets collapse.'

'In moves that will help shape the online future of the music business, Apple said on Tuesday that it would remove anticopying restrictions on all of the songs in its popular iTunes store and allow record companies to set a range of prices for them.'

'The ancient Château d'Ermenonville and a circuit of others around Europe served for more than a dozen years as bases for executives from some of the biggest names in oil – Exxon Mobil; Royal Dutch Shell; Sasol, of South Africa; and Repsol YPF, of Spain – to fix prices of paraffin, the overlooked wax byproduct of crude oil, that is used in candles, paper cups, lip balm and chewing gum. The scheme drove up prices to consumers in a plot that probably touched most households, according to the European commissioner for competition, Neelie Kroes, whose office punished nine oil companies with more than half a billion euros in penalties.'

All these stories describe firms taking strategic decisions (e.g., acquisition of a competitor, repositioning of activities, change in product specification and pricing) that result from particular market conditions (e.g., European banks or Chinese retailers react to adverse demand shocks) and that affect the well-being of market participants (e.g., the acquisition is likely to improve Pfizer's performance, smaller Chinese retailers should suffer from the consolidation of the sector, European consumers were hurt by the collusive behavior of paraffin producers). Such decisions are relevant to the field of *Industrial Organization* and their analysis lies at the heart of this book.

Before we fully engage in the analysis of markets and strategies, we devote the first part of the book to a number of preliminaries. In Chapter 1, we provide a roadmap as well as some instructions

about how to use the book. In Chapter 2, we present the players in a market, namely firms (that is, sellers) and consumers (that is, buyers). We elaborate on the hypothesis that firms maximize profits and that consumers maximize utility. A large part of the exposition can be seen as health warnings which should be kept in mind when consuming the book. We then start the analysis of market interaction and provide some prototypes of markets, ranging from perfectly competitive to monopolistic markets. This provides a first glance at firm strategy in market environments. While this is only a first look at such markets, it is hopefully useful material to refresh the knowledge that has been gained in some microeconomics lectures.

Once you have worked through these first two chapters, you will be ready to start the real thing.

1 What is *Markets and Strategies*?

In this short introductory chapter, we give a broad presentation of the book and indicate how we think it is best to use it. We start by explaining the title of the book: what do we mean by 'markets' and by 'strategies', and why do we associate the two terms? We argue that it is market power and the exercise of it that relate markets and strategies to one another. Next, we outline the approach that we adopt in this book: we believe in formal modelling, which explains that the book is theory-based; yet, we also believe that it is important not to overload readers with techniques and to motivate the analysis with real-life cases; our aim is thus to blend up-to-date theoretical developments and real-life applications in a rigorous and concise manner. Finally, we describe the level, the scope and the organization of the book.

1.1 Markets

Markets allow buyers and sellers to exchange goods and services in return for a monetary payment. Markets come in a myriad of different varieties. Examples are your local farmers' markets (local) and the market for passenger jets (global), the market for computer software (product) and software support (service), the market for electricity (homogeneous product) and markets for highly specialized steel (differentiated product). These markets may exist in physical or virtual space.

We mostly consider markets in which a small number of sellers set price or quantity strategically, as well as possible other variables, whereas buyers mostly come in large number so that they non-strategically react to supply conditions. The reverse situation applies to some procurement markets in which a small number of buyers faces a large number of sellers. We mainly use examples of markets in which buyers are final consumers; however, the formal investigation relies on certain characteristics of markets that also apply to other markets in which buyers are not final consumers but e.g. small retailers, service providers, or manufacturers.

Market power: what it means

Markets and Strategies, and the industrial organization literature at large, attempts to describe the interaction of firms as sellers, and consumers or other economic agents as buyers. The outcome of this interaction is a market allocation (i.e., an allocation of resources through free markets). This allocation depends on how the market operates. We want to predict these resulting allocations (positive analysis) and their efficiency or welfare properties. The latter

can be used for normative analysis, e.g., to address the question about whether and how a government should intervene.

To address these questions, we have to make assumptions as to how markets operate. Here we may follow the perfectly competitive paradigm according to which both sides of the market are price-takers and simply post their supplies and demands. This paradigm appears to be well-suited for those industries in which there are only small entry barriers and many small firms compete against each other. In such a market, it can be seen as a good approximation to assume that firms indeed do not have any price-setting power, and that output decisions by an individual firm have a negligible effect on market price and thus on the profit-maximizing decisions of other firms.[a] Modern industrial organization literature largely ignores such perfectly competitive markets and, in this tradition, this book focuses on markets in which firms do have market power so that an incremental price increase above marginal costs does not lead to a loss of all (or most) of the demand.

If we are only interested in competition policy issues, neglecting perfectly competitive markets is essentially without loss of generality because antitrust authorities deal with concerns of market power and its abuse. If we look at the current landscape of important industries, we observe that firms such as Microsoft, Boeing, and Porsche clearly do have market power. For those firms, a small increase in price does not lead to a loss of all or most of the market share. Even small local retailers may enjoy market power in the sense that small price changes do not lead to drastic changes in demand. The reason is that although there are, e.g., many bakeries and butchers, they are located at different places and cater to different tastes. Here, product differentiation gives rise to market power. Alternatively, firms may offer identical products or services but consumers may not be perfectly informed. Then firms enjoy market power due to consumers being less than perfectly informed (or incurring search costs to obtain this information). Finally, consumers may be locked into long-term contracts or may have become accustomed to a particular product. Then a firm has some market power over these captive consumers due to consumer switching costs.[b]

Market power and its sources are at the core of *Markets and Strategies*. Because of market power, firms may want to invest in exploring their market environment and finding suitable instruments to improve their profits. Antitrust authorities may limit the set of actions that is available to firms by punishing certain types of behaviour or by interfering ex ante. For instance, mergers are only cleared if the antitrust authority does not foresee anticompetitive behavior as the result of the merger.

While market power appears at first sight to be a static concept, this view is misleading. Firms enjoy market power because other firms do not find it worthwhile to offer identical or similar products or services. In particular, fixed costs define a minimum level of output a firm has to achieve in the industry to make non-negative profits. However, the presence of other market characteristics alone may make it unattractive for firms to enter the industry. More generally, in some markets, only one or a small number of firms is viable. At this point, we want to discuss informally the number of firms in an industry.

[a] We review the competitive paradigm in some more detail in the next chapter.
[b] We systematically examine these different sources of market power in Part III of the book.

Natural monopoly and natural oligopoly

Consider a market with few firms and possibly only one firm as seller. If, in the latter case, the profit-maximizing monopolist makes positive profits and sells above marginal costs or, in a market with more than one firm, these firms make positive profits and sell above marginal costs, we may wonder whether additional firms may have an incentive to enter so that eventually profits are competed away. Note that post entry, the strategic situation is very different so that profits before entry are not a reliable source of information for the entrant firm. Rather, it has to predict profits that would occur after entry has taken place. It may well come to the conclusion that although current profit levels are high, entry would trigger fierce competition which therefore does not make it worthwhile to enter.

While entry may not be profitable so that there exists a natural monopoly due to demand and supply conditions, an alternative reason for the analysis of a market with a given number of firms is the scarcity of available necessary inputs. For instance, mining is limited to the presence of the natural resource of interest. In other cases, as we now discuss, the government limits the number of firms in the market.

Government-sponsored monopolies and oligopolies

From a competition policy perspective, the role of the government is to avoid the monopolization of the market. However, it should not be overlooked that the government sometimes does exactly the opposite, namely that it restricts entry of firms into the market so that the incumbent firms enjoy market power. The most extreme form are government-sponsored monopolies.

One justification for such monopolies are efficiency considerations based on fixed or sunk costs, or increasing returns more generally. In particular, since additional entry may lead to socially wasteful duplications of certain investments, additional firm entry may be privately profitable but socially undesirable. In such a case, the government may opt for a regulated monopoly and explicitly prohibit additional firm entry.

In some instances (e.g., due to resource constraints), it may be socially desirable to limit the number of firms to, say, three or four. An example can be found in spectrum auctions for mobile telephony. Here, the resource constraint is the available spectrum. The goal of the auction, then, is to efficiently distribute the spectrum that is made available.

A second and substantially different reason for granting an albeit temporary monopoly right can be found in investment incentives in new technologies. If innovations were not protected and could be immediately appropriated by other firms at zero or negligible costs, firms would not have strong incentives to invest in innovations. This is the rationale behind patent and copyright protection, or, more generally, intellectual property right protection.[c]

A third reason is the goal to create national champions motivated by the belief that national firms lead to higher welfare than foreign ones. Erecting international barriers of entry effectively limits competition (presuming that the government takes measures that favours the national firm). While such policies can be frequently observed in the real world, we do not analyse such policies in this book. We believe that this topic is better addressed in a course on international trade.

[c] See Part VII of the book.

Case 1.1 illustrates how a combination of the previous factors allowed Alcoa to enjoy a monopoly position in the aluminum market for a long period of time.

Case 1.1 Alcoa's natural monopoly[2]

The processes for extracting aluminum on a large scale were invented at the end of the nineteenth century. Because they were patented, a small number of companies were able to dominate the industry right from the start. Among these companies, the most successful was Alcoa (shorthand for 'The Aluminum Company of America'). Since the production of aluminum is capital intensive, it is subject to large economies of scale. This led Alcoa to manufacture intermediate or final aluminum products so as to develop adequate markets for its growing output. The production of aluminum is also intensive in energy (smelting requires a lot of electricity) and in raw materials (bauxite). Alcoa quickly understood the competitive advantage it could gain by controlling the procurement of these two crucial inputs. As for energy, Alcoa became in 1893 the first customer of the new Niagara Falls Power Company, signing up for hydroelectric power in advance of construction. As for the raw material, Alcoa progressively managed to stake out all the best sources of North American bauxite for itself. As a result of these strategies of downstream and upstream vertical integration (we study these strategies in Chapter 17), Alcoa managed to improve its productivity and increase its scale. These efficiency gains made entry more difficult and protected its leadership after initial patents had expired. Other factors explain the virtual monopoly position that Alcoa enjoyed until World War II: public policy, tariff protection, the failure of Alcoa's few potential competitors, and the limited checks of antitrust before World War I (see Appendix B for more on the latter factor).

1.2 Strategies

A large part of modern industrial organization (and most models presented in this book) considers firms as 'strategic players'. What do we mean by this term? This is what we explain in this section.

Analysing basic monopoly and oligopoly problems – decision theory vs. game theory

Game theory is concerned with situations where the players (the decision makers) strategically interact. In contrast, decision theory deals with situations where each decision maker can make his or her own choices in isolation, i.e., without concern for the actions taken by other decision-makers. Abusing terms, one can say that decision theory is a theory of 'one-person games', or of games where a single player plays against nature (thus taking uncertainty into account).

The basic monopoly problem can therefore be addressed by using the tools of decision theory. Indeed, a monopolist is by definition the only firm to be active in the market; moreover,

if the environment is such that no entry is possible and if there is a large number of buyers, whose individual decisions have a negligible impact, the monopolist can make its one-shot decisions in complete isolation.

Things change as soon as other firms are present in the market, or could be present (i.e., if there is a threat of entry). Then, what these other firms do, or could do, affects the first firm's profits and it is thus wise for this firm to take this interaction into account in its decision process. That is, if other firms are present on the market, it is important to anticipate their actions; or, if other firms may enter the market, it is possible to take advance actions so as to discourage entry or to limit its negative effects. Similarly, if the firm remains the only seller but faces a single buyer, the bargaining power of this buyer has to be factored into the decision process. The analysis of such situations (i.e., oligopoly problems, monopolies threatened by entry or bilateral monopolies where a single seller faces a single buyer) belongs to the realm of game theory.

Firms as strategic players and the notion of equilibrium

To analyse markets in which firms interact strategically, we need a solution concept that provides predictions as to what will be the market outcome. The basic solution concept we use is the *Nash equilibrium*. Consider a price-setting duopoly. Here, the profit-maximizing price chosen by one firm depends on the price set by the other. We call this firm i's *best-response* b_i to the competitor's price p_j. By definition, in a Nash equilibrium, prices must be mutual best responses, i.e., $p_i^* = b_i(p_j^*)$, $i, j = 1, 2$, $i \neq j$. Note that this solution is not implied by the individual rationality assumption. Indeed, it is perfectly rational to set a different price as long as firm i believes that firm j sets a price different from p_j^*. The Nash equilibrium has the additional property that each player's belief about the intended play of the other player is confirmed. Thus, no player has an incentive to deviate given the competitor's equilibrium strategy. We can extend this notion to allow players to mix between different prices. In other words they choose a probability distribution of prices. If players can choose mixed strategies, we use the solution concept of *mixed-strategy Nash equilibrium*.

In richer economic environments, firms choose various actions over time, have private information about their type, make initially a choice that cannot be observed by others, or interact repeatedly for the foreseeable future. In all these cases, the set of Nash equilibria is typically too large. To obtain sharper predictions, we impose additional restrictions on the solution concept depending on the problem at hand.

Suppose firms choose actions over time and consider a particular set of strategies that form a Nash equilibrium. Then this equilibrium is said to be *subgame perfect* if it induces a Nash equilibrium in any subgame (even if this subgame is reached only off the equilibrium path). For instance, in a price setting oligopoly, one firm may be the first-mover and all other firms choose at a second stage. Here, the firm that is the first-mover anticipates the reaction of its competitors to its price change. The restriction to subgame perfect Nash equilibrium is the standard concept that is used in such applications, but it may nevertheless be criticized in situations where players are not fully forward looking.

In other economic environments, players may be of different types. For instance, in a price-setting duopoly each firm may be a low- or a high-quality firm. If this information is private information so that firms only know their own type but not the type of their competitor

(while consumers later observe the true quality), beliefs about the other firm's type matter. Here we assume that players know the ex ante quality distribution so that their beliefs are correct from an ex ante point of view. The associated equilibrium concept is the one of *Bayesian Nash equilibrium*: in the price setting duopoly each firm maximizes its profits given its probability distribution over quality types of the competitor.

Private information can also be introduced into environments in which players choose sequentially. For instance a monopolist may sell a product whose quality is only known to the firm but not to consumers, who become the second player since their beliefs determine their purchasing decisions. In this case, the informed player moves first and may use its action to signal its type. In situations like these, we apply the *perfect Bayesian Nash equilibrium* concept. Here, uninformed players who choose later can use the observed action of the informed party to update their beliefs about the type of the firm. In the monopoly context, the firm may, for instance, choose a very high price to signal the quality of its product. For the reader who is not familiar with these concepts, we provide formal definitions of these concepts in Appendix A. In addition, the reader may want to consult a textbook in game theory.[3]

1.3 Models and material of *Markets and Strategies*

This book is theory-based. We are perfectly aware that there is also a great demand for a textbook that covers recent advances in empirical industrial organization. However, we decided to focus on theory (without ignoring empirical work) for two reasons: first, we find it important to start with theory at the advanced undergraduate level as guidance for empirical work; second, we find it difficult to provide the empirics at a level which is appropriate for advanced undergraduates. Concerning our second reason, we hope to be proved wrong soon and would be happy to see our theory-based textbook be complemented by a good textbook on the empirics of industrial organization.

It is our goal to present our book as a collection of topics which are then explored with the help of theoretical models. These models are deliberately simple so that we can rely on well-established concepts from game theory, which most of our readers will be familiar with. In particular, we try to avoid more debatable equilibrium refinement concepts. Most of our formal analysis relies on functional form specifications, e.g. we often specify the consumer side such that demand is linear. Such functional form assumptions are a mixed blessing: when highlighting an economic mechanism, we want to understand the general effects and do not want our results to rely on the specifics of the demand (and cost) functions. We try to avoid this criticism by providing a more general intuition for the results, which does not rely on the particular functional form and hope to be careful enough to address the most important robustness issues. Hence, we try to keep the cost of using functional form assumptions low while keeping the technical level of the exposition low. We are, however, aware that some of the models require somewhat more technical sophistication than others. Particularly demanding material is marked as such.

The main insights of our formal analyses are summarized as '*lessons*'. These lessons are less formal than propositions or theorems but, in our view, better allow the reader to take home the main message. Lessons are to be seen in the context of the models that are presented.

To better connect to the real world, we provide a number of '*cases*', which relate the general issue under investigation to a particular industry. Students from business schools should be warned that these do not, by any means, constitute full-blown case studies, but only sketch a few facts or findings from a particular industry, as illustrated by Case 1.1 above.

Our main text contains few footnotes that present additional remarks or observations. References and the occasional technical remarks are put into endnotes. So, if you are looking for detailed references to the scientific literature, do not forget to look at those endnotes; otherwise, we recommend not to interrupt your reading by consulting them. Each chapter (but this one) ends with a set of review questions and gives a very short guide to the most important work on which the exposition is based. Exercises are posted on our website. This allows us to continuously update them. They are, however, an integral part of the book. If you master the material of the book, you should be able to solve most of them.

1.4 Level, scope and organization of the book

Level

This book is aimed at advanced undergraduate students who take a course in Industrial Organization, Price Theory, or something similar. We presume that the reader is familiar with basic notions of calculus. The book can also partly be used for a more specialized course, which, to name a few topics, focuses on competition policy, asymmetric information and industrial organization, or innovation. This book is also aimed at courses at the Ph.D. level in economics and management. Here, it may be useful to complement the book with additional material such as research articles. Also, the book may be useful to practitioners in antitrust and strategy who want to catch up with some recent ideas.

Scope

Very broadly defined, the scope of the book is the analysis of all markets in which firms interact strategically. As illustrated by the numerous real-life situations presented in the book, this analysis spans a very large array of industries belonging to the secondary (manufacture of final goods) and tertiary (services) sectors of the economy, and also to what is sometimes called the 'quaternary sector', which consists of all intellectual activities.

Regarding the contents of the book (which we detail below), we want to stress that we depart from the majority of previous Industrial Organization (IO) textbooks by giving up the dichotomy between monopoly and oligopoly. Most books start with monopoly and then move to oligopoly (and, often, return to monopoly in between). We find it more appropriate to focus on content issues in the organization of the book. For each issue, we decide whether separating monopoly and oligopoly provides additional insights or not. For instance, price discrimination is first analysed in a context in which the behaviour of competitors is taken as given (monopoly) and then endogenized (oligopoly). Yet, most of the book considers strategic interaction and can thus be seen, like a large part of current IO theory, as applied oligopoly theory.

Organization

Markets and Strategies is organized in nine parts, each part being further divided into two to four chapters. Each part starts with a general introduction that gives a bird's-eye view of the part material; it is a verbal exposition, usually related to real-life situations, that informally describes the salient features of the analysis that follows and explains the organization and the links between the various chapters. The introduction ends with a summary of what the reader will learn from that part of the book. Each chapter starts with a short introduction that describes its contents. The chapter ends with several review questions and a quick guide to the relevant literature.

Here is a quick sketch of the book contents (we give a more detailed table of contents below). The book starts with two introductory parts. This part, **Part I**, helps the reader to *get started* by describing what the book is about and by defining a number of key concepts. **Part II** develops the *basic models of oligopolistic competition*. The goal is to understand how the nature of the strategic variable, namely price or quantity, and the timing of moves affect strategic interaction and, thereby, the extent of *market power*. The reader may already be familiar with some of these models through previous microeconomics or industrial organization courses. However, Part II also includes more advanced material including private cost information in oligopoly and dynamic firm entry and exit.

The next two parts describe how market power is acquired and exercised. **Part III** looks at *sources of market power*: product differentiation, advertising, and consumer inertia. **Part IV** examines how firms with market power design advanced *pricing strategies* to capture as much value as possible from their consumers.

The first four parts of the book mainly deal with search goods, i.e., products or services with features and characteristics that can be easily evaluated before purchase. In contrast, **Part V** examines *experience goods*, i.e., products and services with characteristics that can only be ascertained upon consumption because they are difficult to observe in advance. In such markets, consumers have less information than the producers about product quality, and therefore firms have to convince consumers that their products are of high quality. To this end, firms can use a variety of marketing instruments, which are studied in Part V.

The analysis made up until then is mostly positive in nature. **Part VI** turns to a more normative analysis by developing the theory of *competition policy*. It first explores two ways by which the number of firms in the market – and thus competition – may be reduced: either virtually when a number of firms act as if they were a single one, a behaviour known as *collusion*; or actually when *horizontal mergers* occur, which replace existing direct competitors by a new, bigger, entity. Next Part VI focuses on monopolization strategies, i.e. strategies by a single firm that hamper competition. It studies the potential *predatory behavior of incumbent firms* facing the threat of entry by other firms on their market. Finally, it analyses vertical arrangements between firms acting at successive stages of the value chain. In this context, *vertical mergers* are studied.

Parts VII and VIII examine how, in the long run, firms may act to modify a part of their environment that was considered as fixed up to then in the book, namely their technological possibilities. **Part VII** focuses on firms' investments in *research and development (R&D)*, which bring *innovation* to the market. It also explains what sets investments in R&D apart from other investments made by firms or individuals and why institutions such as *intellectual*