Game Theory and the Law

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For
Bruce, Emily, and Lucy,
Leo,
and
Gretchen, Benjamin, and Adam

Preface

This book rests on the premise that game theory can offer insights to those who want to understand how laws affect the way people behave. Laws often matter in situations in which the behavior of one person turns on what that person expects others to do. Because strategic behavior is common, the formal tools that can help us understand it are important. We set out to accomplish two goals in writing this book. First, we wanted to introduce the formal tools of modern game theory to a wide audience using a number of classic legal problems ranging from tort and contract law to labor law, environmental regulations, and antitrust. These problems are familiar to those who are trained in the law and readily accessible to those who are not. Second, and as important, we wanted to show how modern game theory allows us to sharpen our intuitions and provides us with new ways of looking at familiar problems. In short, we have tried to write a book that offers those interested in law a new way of thinking about legal rules, and a book that shows those interested in game theory a fertile and largely unexplored domain in which its tools have many applications.

Much of the analysis in this book makes extensive use of concepts that have been developed only within the last decade, and we have not compromised on the rigor that these cutting-edge concepts demand. Nevertheless, we have been able to apply these concepts to the law without requiring the reader to know calculus, probability theory, or any other formal mathematical tools beyond simple algebra. Indeed, algebra is used only in a few places, and calculations are set out and explained in the endnotes. In this respect, this book stands apart from others that explore recent developments in game theory. We depend

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only on the reader's willingness to think through hard problems logically and carefully.

This book is the first to address in general terms the use of the formal tools of game theory and information economics in legal analysis, and many of the models and ideas it sets out are new. Nevertheless, legal scholars have worried about strategic behavior for a long time, and we have drawn on their insights. Moreover, there are many papers that take advantage of these tools in studying specific legal problems in subjects as diverse as procedure, contracts, conflicts of law, bankruptcy, taxation, and corporations. We have benefited from them as well. We have also relied heavily on work in law and economics and in game theory proper. The bibliographic notes at the end of each chapter give a sense of both the breadth of this literature and the connections between it and the ideas set out in each chapter. Given the extent of the literature, however, these notes are necessarily incomplete. The glossary defines the basic legal and economic terms that we use in the text.

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In-Koo Cho, Cass Sunstein, and Alan Sykes offered valuable advice throughout the project. Patrick Bolton, Frank Easterbrook, Richard Epstein, David Friedman, and Mitchell Polinsky gave us the benefit of their close reading of several chapters. Anne Marie Harm prepared the figures. We are especially grateful to Ian Ayres, Jon Elster, Daniel Farber, Mark Fisher, Ted Frank, Jason Johnston, William Landes, Richard Posner, Mark Ramseyer, Robert Rasmussen, Elizabeth Rosenblatt, Eun Shin, David Skeel, and Lars Stole for their extensive written comments on the entire manuscript.

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Understanding Strategic Behavior

Strategic behavior arises when two or more individuals interact and each individual's decision turns on what that individual expects the others to do. Legal scholars have long recognized the need to take account of strategic behavior. Too often, however, they have not taken advantage of the formal tools of game theory to analyze strategic behavior, other than to invoke a simple game such as the prisoner's dilemma as a metaphor for a collective action problem. This alone may not help us significantly. It may not matter much whether we call something a collective action problem or a multiperson prisoner's dilemma. This failure to make better use of game theory is unfortunate, given that modern game theory is sufficiently powerful to offer insights into how legal rules affect the way people behave. The challenge is one of applying its highly technical tools, many of which have been developed only in the last decade, to a new environment.

We begin in the first chapter with a problem—the tort rules governing an accident involving a motorist and a pedestrian—that is already well understood. Our ambition is to show how, even in the context of so simple a problem, a rigorous focus on strategic behavior advances our understanding of the legal rules. In the second part of the chapter, we review the best-known paradigms of game theory—the stag hunt, the prisoner's dilemma, and matching pennies—and show both how they may be applied to legal problems and what limits we encounter in doing this. In Chapter 2 we examine how parties interact with each other over time, using the problem of market preemption in antitrust law and several issues in debtor-creditor and contract law as vehicles for introducing additional game-theoretic tools.

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In subsequent chapters we explore more difficult issues. Incomplete information is the central problem in game theory and the law. Shaping laws that give parties an incentive to act in a way that leaves everyone better off is a straightforward matter as long as all the parties and those who craft and enforce the legal rule possess enough information. Complications arise, however, when the necessary information is not known or, more commonly, is known, but not to all the parties or not to the court.

We focus in Chapter 3 on the simplest information problem. With respect to some kinds of information, legal rules have to confront a problem of unraveling—situations in which the ability of people to draw inferences from silence leads to the revelation of information. With respect to other kinds of information, we have to focus on the problems of signaling and screening—the ability of parties to draw inferences from the actions that other parties take. In both cases, we must take account of the ability of other parties and a court to acquire information. These distinctions should guide our understanding of such questions as legal rules governing the renegotiation of contracts. We develop a new model that shows how legal rules affect contracts that are written with the understanding that the parties may want to renegotiate contract terms at a later time.

We go on in Chapter 4 to analyze legal rules that must work in situations in which one party possesses information that cannot be communicated directly to other parties or to a court. Inferences about the information must be drawn from actions that the parties take. Advances in game theory now provide a rigorous way to explore how changes in legal rules affect the ability of parties to draw such inferences. Various legal regimes, such as plant closing laws and the Americans with Disabilities Act, can be put in this framework and subjected to scrutiny.

In Chapter 5 we examine how legal rules may affect parties who interact with each other over time. We illustrate this problem first by examining the Statute of Frauds, the contract law principle which requires that most contracts be evidenced by a writing. We show how a new way of interpreting this principle emerges once the problem is seen as a repeated game. We then examine a number of issues in antitrust law, including tacit collusion and predatory pricing. We use these problems to illustrate how legal rules affect the ability of parties to develop reputations that lead not only to anticompetitive conduct, but also to long-term cooperation.

In Chapter 6 we explore a number of different collective action prob-

lems. We show the dangers of treating interactions between parties as stand-alone games rather than as part of a larger game. Legal rules often address collective action problems when information is incomplete. We show how the mechanism design literature allows us to set out the limits of what legal rules can do in these situations. We also explore network externalities and herd behavior and the subtle ways in which the actions of one individual can impose costs on others.

How parties bargain with each other and the way in which they split the surplus from trade are problems that recur in legal analysis. Noncooperative bargaining theory provides a vehicle for understanding the dynamics of negotiations. In Chapter 7, we examine an important question of contract law involving the availability of specific performance when the loss a party suffers from breach is private information. We show how the problem can be seen as a bargaining game in which there is private, nonverifiable information, and we explain how this game can be solved. This model, like many others we develop in the book, is new. It suggests unappreciated strengths and weaknesses of a number of legal doctrines, including the automatic stay and the new value exception to the absolute priority rule in bankruptcy, and limits on the ability to hire permanent replacements in labor law.

In Chapter 8, we focus again on the dynamics of bargaining and, in particular, on the way in which legal rules governing bargaining must take account of the possibility that one or both of the parties may possess private information. We use a number of examples from the rules governing civil procedure to illustrate these problems. We also incorporate two-sided private information into a model of bifurcated trials and create a new model to explore rules governing discovery, a problem that by its nature turns on private information. In addition, we show that private information is likely to influence both the kinds of cases that are litigated and the inferences that can be drawn about the law from reported decisions.

Although we touch on many different legal problems in the course of the book and draw on much of the work that has been done in noncooperative game theory and information economics, particularly in the last decade, we also show that only a few basic paradigms are needed to capture the essential problems of strategic behavior that legal rules need to take into account. It is with the simplest paradigm—that of simultaneous decisionmaking under complete information—that we begin the first chapter.

Bibliographic Notes

The problem of strategic behavior. John von Neumann is generally recognized as the founder of modern game theory. Von Neumann (1928) and Von Neumann and Morgenstern (1944) are the two important early works. John Nash also made seminal contributions to game theory; see Nash (1950a) and Nash (1950b). Schelling (1960) is a classic nontechnical introduction to game theory, as well as one of the first works to enlarge significantly the scope of game-theoretic issues in the political and social sciences. A number of excellent introductions to game theory now exist. The best formal introductions include Fudenberg and Tirole (1991a), Kreps (1990b), and Myerson (1991). Fudenberg and Tirole (1991a) is encyclopedic and a useful reference for understanding many game-theoretic concepts. Kreps (1990b) connects the tools of game theory to the foundations of microeconomics. Hirshleifer and Riley (1992) is a good formal introduction to information economics.

Several excellent books on game theory aimed at nonspecialists have also been published in recent years. These include Binmore (1992), Dixit and Nalebuff (1991), Gibbons (1992), Kreps (1990a), and Rasmusen (1989). Both Binmore (1992) and Gibbons (1992) are formal introductions to game theory that are accessible to nonexperts. Gibbons (1992) focuses especially on applications of game theory to many standard economic problems, whereas Rasmusen (1989) focuses on the role of information. These books, however, require readers to be familiar with single-variable calculus and basic probability theory.

Dixit and Nalebuff (1991) is a nontechnical book that illustrates the general ideas of game theory using examples drawn from sports, business, and other familiar contexts. Kreps (1990a) discusses game theory and the conceptual underpinnings of its solution concepts.

Game theory and the law. The early applications of economic reasoning to the law were made with an eye toward understanding how legal rules affect behavior. The more prominent of these seminal works include Coase (1960) and Calabresi (1970). Posner (1992) offers a comprehensive examination of the economic analysis of law. First published in 1973, the book remains the starting place for analyzing many of the questions whose strategic components are the focus of this book. Farber and Frickey (1991) shows how public choice theory can illuminate legal analysis. See also Coase (1988) and Buchanan (1989) for more detail on Coase and the combination of legal issues and economic logic.

Legal scholarship that uses game theory in analyzing particular legal problems is large and growing. For example, Ayres (1990) provides a general discussion, and Jackson (1982) applies the prisoner's dilemma to bankruptcy law. Cooter, Marks, and Mnookin (1982) is one of the first studies to use an explicit game-theoretic model to examine what takes place before trial. Bebchuk (1984) and Bebchuk (1993) use information economics and game theory to examine rules of civil procedure. Mnookin and Kornhauser (1979) and Mnookin and Wilson (1989) examine strategic bargaining in the context of family law and bankruptcy respectively. Katz (1990b) uses game theory to analyze the problem of offer and acceptance in the law of contracts; Johnston (1990) uses it to explore contract default rules; and Gordon (1991) and Leebron (1991) use it to look at corporate law. Menell (1987) draws on the network externalities literature to analyze copyright protection for computer software. Brilmayer (1991) employs game theory to analyze problems in the conflicts of laws, as does Kramer (1990). Ellickson (1991) uses game theory to show how custom can work in much the same way as legal rules.

CHAPTER 1

Simultaneous Decisionmaking and the Normal Form Game

The Normal Form Game

The simplest strategic problem arises when two individuals interact with each other, and each must decide what to do without knowing what the other is doing. An accident involving a motorist and a pedestrian is such a case. The likelihood of an accident is determined by how carefully the motorist drives and how carefully the pedestrian crosses the street. Each must decide how much care to exercise without knowing how careful the other is. The behavior of the motorist and the pedestrian also depends on the legal regime. Legal scholars have long assumed that motorists will drive more carefully if they are liable for the injuries that the pedestrian suffers in the event of an accident. This observation alone, however, does not tell us how to shape the law of torts, and we must know more about how law affects these simple interactions if we are to understand its effects on more complicated ones.

Much of law and economics scholarship over the past several decades has focused on the intriguing claim that many legal regimes, including all those in Anglo-American tort law, induce the motorist and the pedestrian to act in a way that minimizes the total costs of the accident, costs that include the possibility of injury to the pedestrian as well as the expenses the motorist and the pedestrian incur when they take care to avoid the accident. To draw these conclusions, however, we need to make many assumptions. The pedestrian and the motorist, for example, must know what the legal rule is, and courts must be able to enforce it. Indeed, we cannot draw firm policy prescriptions or choose among possible tort regimes without subjecting all these assumptions to close scrutiny.

Many scholars have undertaken the task of exploring the various assumptions leading to the conclusion that these many different tort regimes are efficient. The debate about which rules work best when certain assumptions are relaxed now fills many volumes. We do not revisit this debate here. Rather, we begin by using the interaction between the motorist and the pedestrian to introduce one of the basic tools of game theory, the normal form game. We then show why many different legal regimes tend, under the same set of assumptions, to induce both parties to act in a way that is mutually beneficial. The model we develop in this chapter allows us to make clear exactly what it means to assume that individuals in the position of the motorist and the pedestrian are rational.

Game theory, like all economic modeling, works by simplifying a given social situation and stepping back from the many details that are irrelevant to the problem at hand. The test of a model is whether it can hone our intuition by illuminating the basic forces that are at work but not plainly visible when we look at an actual case in all its detail. The spirit of the enterprise is to write down the game with the fewest elements that captures the essence of the problem. The use of the word "game" is appropriate because one can reduce the basic elements of complicated social and economic interactions to forms that resemble parlor games.

Our goal in this chapter is to understand the common thread that unites different tort regimes. These regimes range from comparative negligence, in which liability is apportioned between parties according to their relative failure to exercise care, to strict liability with a defense of contributory negligence, in which the motorist is liable to compensate the pedestrian for any injuries unless that pedestrian acted carelessly. To discover what these different tort rules have in common, we can use a model in which the motorist and the pedestrian are each completely informed about everything, except what level of care the other will exercise. They know what it means to act carefully, and they know what consequences the law attaches to any combination of actions. Similarly, we may assume that courts can enforce any given legal regime and that they have all the information they need to do so. For many questions, of course, we cannot make so many simplifying assumptions, but, as we shall see, it is useful to do so here.

We model the interaction between the motorist and the pedestrian by using a traditional game theory model called a *normal form game*, sometimes referred to as the *strategic form* of a game. The normal form game consists of three elements:

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