

Version 10/01/02

Game Theory and Business Strategy

B65.3323.30

Professor Adam Brandenburger

Course Overview

Spring 2003

1 Overview

This is a course on game theory and its application to business strategy. We will develop the basic tools of game theory through lectures and exercises, and we will put the tools to work by applying them to business examples and cases.¹

2 Game Theory

Game theory studies competitive and cooperative behavior in strategic environments, where the fortunes of several players are intertwined. It provides methods for identifying optimal strategies and predicting the outcome of strategic interactions.

The field of game theory began around 1900 when mathematicians began asking whether there were optimal strategies for parlor games such as chess and poker, and, if so, what these strategies might look like. The first comprehensive formulation of the subject came in 1944 with the publication of the book *Theory of Games and Economic Behavior* by famous mathematician John von Neumann and eminent economist Oskar Morgenstern. As its title indicates, this book also marked the beginning of the application of game theory to economics. Since then, game theory has been applied to many other fields, including political science, military strategy, law, computer science, and biology, among other areas. In 1994 three pioneers in game theory were awarded a Nobel Prize, marking the ‘arrival’ of the field.

Among the other applications, game theory today is finding its way into the world of business. (Pick up a business magazine or book and there is a good chance that it will use some game-theory jargon: zero-sum game, Prisoner’s Dilemma, win-win game, etc.) As well as learning the underlying theory in the course, we’ll be looking at how game theory can indeed be applied to business.

¹The course was developed jointly with Professor Ken Corts (Harvard Business School). I thank him for the many hours spent working on it together.

3 Course Content

The course consists of five modules, which proceed from simpler games to progressively more complicated ones.

3.1 Module: Thinking About What They're Thinking

In this module we begin with a tour of some of the best-known games studied in game theory. With these games in mind, we then ask the basic question: How can a player choose a good strategy when the best choice depends on what strategies the other players in the game choose? To answer, we will introduce techniques for thinking through the game from the position of the other players, and anticipating their choices. Topics covered in this module include:

- **Prisoner's Dilemma, Battle of the Sexes, Coordination Game:** How to play these and other games and how to classify different games; applications to market entry, technological standards battles, innovation, etc.
- **Winner-Take-All:** When a market is winner-take-all and when it is not; applications to network effects, technology wars, etc.
- **Unpredictability:** When to keep a strategy secret and when not to; applications

3.2 Module: Valuing the Players' Positions

In this module, we will examine how value is created by the players in a game and how that value is divided up among them. We will define the concept of added value, which determines how much value each player gets. We will see ways in which players can change their own added values and also the added values of other players. Topics covered in this module include:

- **Differentiation, Low-Cost, and Other Positioning Strategies:** How firms get added value by being different from the competition; application to the “generic strategies” and other business strategies
- **Games of Positioning:** When to match the competition and when to be different; application to “arms races” around advertising, innovation, etc.

3.3 Module: Moving First or Second

In this module, we look at games in which one player goes first, and then another player has to make a choice in response to what the first player did. As we will see, the basic way to analyze these games is to start at the end of the game and reason backwards to the beginning. We will ask the question: When is there a first-mover advantage in games of this kind, and when is there a second-mover

advantage? Finally, we will see the importance of being able to commit to particular moves in the game. Topics covered in this module include:

- **Games of Innovation:** Why incumbents and challengers in a business face different incentives to innovate; as an incumbent, when to “eat-your-own-lunch” and when to be a “fast follower;” as a challenger, when to keep your strategy secret
- **Commitment:** Why it can be effective to reduce the number of one’s options, rather than increase the number; application to entry and exit

3.4 Module: Being Rational or Irrational

In this module, we look at more complicated games in which one player moves, then another player responds, then the first player moves again, etc. This is where strategies of bluffing, signalling, etc. come into play. The players can try to shape or influence what other players think about the game. We will see that a player will sometimes want other players to believe that it is acting rationally; and sometimes want other players to believe that it is acting irrationally! Topics covered in this module include:

- **Games of Bluffing:** How bluffing works; and application to market entry
- **Games of Signalling:** What a signal is, how to make a signal credible, and why what one doesn’t do also sends a signal; applications to “wars of attrition,” contracts, etc.

3.5 Module: Linking Games

In this final module, we look at how separate games can be linked together to make a larger game. We’ll see how a player may do better—or worse—by playing the larger game rather than the smaller ones. Topics covered in this module include:

- **Repeated Interaction:** How playing a game repeatedly can help players cooperate; application to joint ventures
- **Bundling:** How selling separate products as a bundle affects the game
- **Judo Strategy:** How a challenger can link games to turn an incumbent’s strength into weakness; applications

4 Course Format

The course will consist of lectures, exercises, discussions, and some case studies and other business readings.

In class, I will introduce the game-theory ideas that we'll study. Then we will work through the assigned exercises together, going over both the technical and conceptual aspects of the material. Then we'll apply the theory to business situations and cases.

The exercises are mathematical, but not in the sense that they contain a lot of numbers or are heavy on techniques. Rather, they require an interest in following detailed logical arguments. We will always pay close attention to what exactly we're assuming, and where exactly those assumptions lead.

Please note that the course presupposes no knowledge of game theory. This said, it should also be of interest to people who have already taken a course in the subject, since it contains quite a bit of theory that isn't covered in many courses. Also, most of the applications to business strategy were developed especially for this course.

5 Reading

The course is largely self-contained. I will hand out notes explaining the underlying theory as we go. I will also hand out complete solutions to the analytical exercises.

Apart from this material, there are two books that are recommended for the course. Both books apply game theory to business strategy, and I'll suggest readings from them during the course. The books are:

Co-opetition, by Adam Brandenburger and Barry Nalebuff (Doubleday 1996)

Thinking Strategically, by Avinash Dixit and Barry Nalebuff (Norton 1991)

(The second book is chock full of games and mini-case studies.) Two articles we'll refer to are:

"Knowledge and Equilibrium in Games," by Adam Brandenburger (*Journal of Economic Perspectives*, 6, 1992, 83-101)

"Value-Based Business Strategy," by Adam Brandenburger and Harborne Stuart (*Journal of Economics & Management Strategy*, 5, 1996, 5-24)

(The first explains the concept of Nash equilibrium and gives conditions under which it arises. The second gives definitions of value creation and added value, and connects these concepts to business strategy.) A very good textbook on the underlying theory is:

A Course in Game Theory, by M. Osborne and A. Rubinstein (MIT Press 1994)

Other readings I'll be referring to during the course include:

The Evolution of Cooperation, by Robert Axelrod (Basic Books 1984)

The Selfish Gene, by Richard Dawkins (Oxford University Press 1976)

The Tipping Point: How Little Things Can Make a Big Difference, by Malcolm Gladwell (Little, Brown 2000)

Strategy in Poker, Business & War, by John McDonald (Norton 1950)

Prisoner's Dilemma: John von Neumann, Game Theory, and the Puzzle of the Bomb, by William Poundstone (Doubleday 1992)

Information Rules: A Strategic Guide to the Network Economy, by Carl Shapiro and Hal Varian (Harvard Business School Press 1998)

The Handicap Principle: A Missing Piece of Darwin's Puzzle, by Amotz and Avishag Zahavi (Oxford University Press 1997)