

Game Theory with Applications in Operations, Marketing and Public Policy

ENMG 698G

Professor: Georges Zaccour

I. General description

The course is divided into two parts. The first part is dedicated to a general introduction to non-cooperative and cooperative game theory. The second part is devoted to applications of game theory in supply chain management, marketing and public policy related to environmental problems. For each application area, the topic and the main issues are first introduced, and some specific problems are next discussed.

II. Objectives

The objectives of the course are the following:

- Introduce the students to the different concepts of game theory;
- Learn about applications of game theory in different areas;
- Give the students the necessary background to access the ever-growing game theory literature in management science and engineering;
- Help the students develop a critical thinking with respect to the role played by game theory in our understanding and solving managerial problems.

III. Pedagogical material

Book chapters and articles

IV. Grading

(i)	Three assignments	30 points
(ii)	Mid-term exam	30 points
(ii)	Final exam	40 points

V. Sessions

Sessions 1- 4: A general introduction to the theory of non-cooperative games

Readings:

Haurie, A., Krawczyk, J. and Zaccour, G., *Games and Dynamic Games*, World Scientific, 2012, Chap. 2-4.

Zaccour, G., Game Theory, *Encyclopedia of Management Theory*, Sage Publications, 2013.

Additional readings:

Bierman, H.S. and Fernandez, L., *Game Theory with Economic Applications*, Addison-Wesley Publishing Company, Inc., 1993, Chap. 4-5, p. 67-99.

Fudenberg, D. and Tirole, J., *Game Theory*, MIT Press, Cambridge, Massachusetts, 1991, Chap. 1, p. 3-44, and Chap. 3, p. 67-100.

Session 5: Introduction to repeated games

Reading:

Haurie, A., Krawczyk, J. and Zaccour, G., *Games and Dynamic Games*, World Scientific, 2012, Chap. 5.

Additional reading:

Fudenberg, D. and Tirole, J., *Game Theory*, MIT Press, Cambridge, Massachusetts, 1991, Chap. 5, p. 145-203. (Reserve)

Sessions 6-7: Cooperative games and bargaining solutions

Readings:

Parilina, E., Reddy, V. and Zaccour, G., A Refresher on Cooperative Games, mimeo.

Osborne, M.J. and Rubinstein, A., *A Course in Game Theory*, MIT Press, Cambridge, Massachusetts, 1994, Chap. 13-15, p. 257-275; Chap. 14, p. 277-298.

The book is available online with limited permission.

Session 8: Mid-term exam

Sessions 9- 11: Applications of game theory to supply chain management

- Main issues in coordination of supply chains
- Price coordination mechanism
 - Wholesale price contract
 - Revenue sharing
 - Price discount and two-part tariffs
- Non-price coordination mechanisms
 - Cooperative advertising
 - Marketing services
- Coordination of closed-loop supply chains
 - Importance of closing the loop (recycling, remanufacturing, etc.)
 - Responsibilities (manufacturers, retailers and third parties)

Readings:

Erhun, F., Keskinocak, P., *Game Theory in Business Applications*, 2003.

Dantas, D., Taboubi, S., Zaccour, G., Which Business Model for Ebook Pricing, *Economics Letters*, 25(1), 126-129, October 2014.

S. Karray, G. Zaccour, Effectiveness of Coop Advertising Programs in Competitive Distribution Channels, *International Game Theory Review*, Vol. 9, 2, 151-167, 2007.

De Giovanni, P., Zaccour, G., A Two-Period Game of a Closed-Loop Supply Chain, *European Journal of Operational Research*, 232, 22-40, 2014.

De Giovanni, P., Zaccour, G., Optimal Quality Improvements and Pricing Strategies with Active and Passive Product Returns, *Omega: The International Journal of Management Science*, 88, 248–262, 2019.

Additional readings:

Ingene, C., Taboubi, S., Zaccour, G., Game-Theoretic Coordination Mechanisms in Distribution Channels: Integration and Extensions for Models without Competition, *Journal of Retailing*, 88, 4, 476-496, December 2012.

Souza, G.C., Closed-Loop Supply Chain: A Critical Review, and Future Research, *Decision Sciences*, 44(1), 7-38, 2013.

Jørgensen, S. G. Zaccour, “Cooperative Advertising in Marketing Channels: Game Theoretic Analyses, *European Journal of Operational Research*, 237, 1–14, 2014.

De Giovanni, P., Zaccour, G., A Selective Survey of Game-Theoretic Models of Closed-Loop Supply Chains, *4OR*, 17(1), 1-44, 2019.

Session 12: Applications of game theory in marketing

- Competitive pricing decisions
- Advertising competition
- Franchising systems

Reading:

Moorthy, S.K., Competitive Marketing Strategies: Game Theoretic Models, in *Handbooks in Operations Research and Management Science*, Volume 5, Marketing, edited by J. Eliashberg and G.L. Lilien, Chap. 4, 143-192, 1993.

Additional reading:

Jørgensen, S., and Zaccour, G., Differential Games in Marketing, *International Series in Quantitative Marketing*, Kluwer Academic Publishers, Chap. 2, 5-28, 2004.

Sessions 13- 14: Game theory in environmental economics and management

Readings:

Cioni, L., Game Theory as a Tool for the Management of Environmental Problems and Agreements, mimeo.

Zaman, H., Zaccour, G., Optimal Government Scrappage Subsidies in the Presence of Strategic Consumers, under review.

Pazoki, M., Zaccour, G., A Mechanism to Promote Product Recovery and Remanufacturing, *European Journal of Operational Research*, 274 (2), 601-614, April 2019.

Pazoki, M., Zaccour, G., Extended Producer Responsibility: Regulation Design and Responsibility Sharing Policies for a Supply Chain, *Journal of Cleaner Production*, 236, 2019, 117516.

Eyland, T., Zaccour, G., Carbon Tariffs and Cooperative Outcomes, *Energy Policy*, 65, 718-728, 2014.

Additional reading:

Jørgensen, S. Martín-Herrán, G., Zaccour, G., Dynamic Games in the Economics and Management of Pollution, *Environmental Modeling & Assessment*, 15, 6, 433-467, 2010.