

## PhD Course: Game Theory in Supply Chain Management

### 1. Course details

Semester:	1
Credit rating:	2 ECTS
Teaching units	30
Pre-requisite(s):	No background beyond first year graduate microeconomics is required, although familiarity with contract theory and information economics is useful.
Lecturers:	Benny Mantin, LCL
Administrator:	Roswitha Glorieux
Tutors:	None
Seminar times and rooms:	please see Point 3
Tutorial times and rooms:	None
Communications	It is important that students should regularly read their University e-mails, as important information will normally be communicated this way.
Mode of assessment:	Attendance is required; Assignments are planned; A term paper along with a presentation will be scheduled.
Examination Periods:	TBA
Course WebPage:	<a href="http://Moodle.uni.lu">Moodle.uni.lu</a>

## 2. Aims and objectives

This course will cover advanced game theory concepts and their applications within supply chains and related economic domains. Classic operations management literature has evolved considerably in recent decades and, among others, seeks to capture the challenging interactions between various agents along supply chains. The course will start with a brief introduction into some of the fundamental game theoretical concepts necessary for contemporary applications in supply chains and proceed with concepts such as fixed-point theorems, supermodularity, cooperative and non-cooperative games, coalition formation as well as bargaining.

Note: This course bears very limited overlap with a related course that was delivered in 2019, and hence shall be perceived as a complementary subject.

## 3. Plan of semester

Dates 2021	Room	Time	Notes
11 Jan	BE01-17	13:00 – 16:00	
12 Jan	BE01-17	13:00 – 16:00	
18 Jan	BE01-17	13:00 – 16:00	
19 Jan	BE01-17	13:00 – 16:00	
25 Jan	BE01-17	13:00 – 16:00	Guest speaker Dr. Hermel, Assistant Professor, Teaching stream, Rotman School of Management, University of Toronto
26 Jan	BE01-17	13:00 – 16:00	Guest speaker Dr. Sanjith Gopalakrishnan, Assistant Prof., Desautels Faculty of Management, McGill University
1 Feb	BE01-17	13:00 – 16:00	
22 Feb	BE01-17	13:00 – 16:00	PRESENTATION

## 4. Course details (by topics)

Below the main topics are outlined along with some key references.

- 1 *The fundamental modeling of supply chains and the concept of coordination*
  - Jeuland, A. P., & Shugan, S. M. (1983). Managing channel profits. *Marketing science*, 2(3), 239-272.
- 2 *Elements of game theory*
  - 2.1 *Two-person zero-sum games*
  - 2.2 *Noncooperative n-person games*
  - 2.3 *Nash equilibrium*
  - 2.4 *Fixed points and related theorem*
    - Vohra, R (2005) *Advanced Mathematical Economics*.
- 3 *Lattices and Supermodularity*
  - Topkis, D. M. (1998) *Supermodularity and complementarity*.
- 4 *Cooperative games*
  - 4.1 *The core*
  - 4.2 *Coalition formation*
    - Yin, S. (2010). Alliance formation among perfectly complementary suppliers in a price-sensitive assembly system. *Manufacturing & Service Operations Management*, 12(3), 527-544.
    - Huang, X., Boyacı, T., Gümüş, M., Ray, S., & Zhang, D. (2015). United we stand or divided we stand? Strategic supplier alliances under order default risk. *Management Science*, 62(5), 1297-1315.
    - Nagarajan, M., & Sošić, G. (2009). Coalition stability in assembly models. *Operations Research*, 57(1), 131-145.
    - Gopalakrishnan, S., Granot, D., Granot, F., Sošić, G., & Cui, H. (2020). Incentives and emission responsibility allocation in supply chains. *Management Science*.

#### 4.3 Farsightedness

- Chwe, M. S. Y. (1994). Farsighted coalitional stability. *Journal of Economic theory*, 63(2), 299-325.
- Mauleon, A., & Vannetelbosch, V. (2004). Farsightedness and cautiousness in coalition formation games with positive spillovers. *Theory and Decision*, 56(3), 291-324.

#### 4.4 Bargaining and negotiations (time dependent)

- Bernstein, F., & Nagarajan, M. (2012). Competition and cooperative bargaining models in supply chains. *Foundations and Trends in Technology, Information and Operations Management*, 5(2), 87-145.
- Granot, D., Hermel, D., Katok, H., & Nagarajan, M. (2020) Bargaining in Supply Chains with a Single Pivotal Player, working paper.

### 5 Additional topics (time dependent):

#### 5.1 Strategic consumers

- Aviv, Y., & Pazgal, A. (2008). Optimal pricing of seasonal products in the presence of forward-looking consumers. *Manufacturing & Service Operations Management*, 10(3), 339-359.

## 5. Further information about assessment

Examination(s)      Assignment(s) and a term paper

Weighting:            50% + 50%

Date:                    22/02/2021

Length:                Report/Term Paper

Structure:            Each student will pick a recently published paper related to game theory in supply chains utilizing one of the key concepts covered in the course (e.g., coalitions, Supermodularity). The student will then present this paper in the class focusing on its game theoretical merit and will submit a short paper (2-3 pages) with further reflections on possible applications of the framework developed in class.