IE 640 Behavioral and Experimental Methods in Operations Management

Course Syllabus Fall 2020-2021

Version v.1

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Lecture hours: Mondays, 14:40-15:30, Wednesdays 10:40-12:30

Course Content

In this course, we study how human beings make decisions in the face of uncertainty and risk. We investigate individual and strategic decision making issues using a **supply chain context**.

- First, we use the standard newsvendor problem to discuss decisions involving only a single individual. This problem is concerned with the order quantity decision of a retailer that faces probabilistic demand.
- Then, we consider a simple manufacturer-retailer supply chain where the retailer faces the newsvendor problem, and her problem parameters are determined by the "contract" (the wholesale price etc.) that the manufacturer offers. This scenario allows us to study what happens to decisions when two individuals interact strategically with each other.

To understand human behavior, we study experimental research that is based on **decision-making experiments with human subjects**. In addition to published research papers, we also use data from our own experiments conducted here at Sabanci University. In these experiments, student subjects play the roles of manufacturer and retailer, making contract and order quantity decisions for around 40 rounds. Comparing experimental data with theoretical model predictions, we aim to answer questions such as:

- Do subjects make decisions as predicted by theory? If not, what are the factors that affect their decisions?
- Do subjects use certain decision heuristics in making decisions?
- Can we build statistical models to better predict human behavior?
- Do different subject pools exhibit different behavior?
- Do subjects learn to make better decisions over time?

We also study the effects of strategic human interaction between the two parties in a supply chain. Relevant questions include

- Do the subjects behave as predicted by the game theoretical equilibrium?
- Can the manufacturer anticipate the retailer's reaction when determining contract parameters?
- Do manufacturers care about fairness when offering the contract?
- What factors affect the retailer's contract rejection decision?
- Can we explain subject decisions using personality data?

We consider these questions under different supply chain contracts, including wholesale price, buyback and revenue sharing contracts. We aim to compare the experimental performance of these contract with each other, and also with theoretical predictions.

These topics have important practical implications in the design of decision support systems, incentive systems as well as supply chain contracts. Understanding human decision making under risk and in strategic interactions is also a prerequisite for developing successful Artificial Intelligence platforms that will work with human managers.

Target Audience

- IE 640 is not an advanced level course. Both new coming and advanced graduate students (MS or PhD) are welcome.
- There is no prerequisite other than undergraduate level statistics. Relevant statistical concepts will be reviewed.

The course will be particularly valuable for students who

- are interested in understanding how humans make decisions (individually and in strategic relationships)
- want to improve their statistical and data-analysis abilities
- interested in the topic of supply chain coordination
- might want to work on decision or supply chain related topics in their thesis study.

Course Conduct

Students are required to

- Attend lectures. Students that miss a lecture session will need to complete extra assignments to make up the loss.
- Read assigned papers, complete short assignments and engage in classroom discussion.
- Complete a course project that may potentially turn into a research paper.

Grading

- Research project, 25%
- Homework assignments, 10%
- Short quizzes and Top Hat questions, 25%
- Midterm Exam-1, 20%
- Midterm Exam-2, 20%

<u>Topics</u>

- Introduction:
 - o Decision experiments in Operations Management
- Part I: Individual decisions
 - The newsvendor model
 - Newsvendor experiments
 - Pull to center effect, decision heuristics
 - Effects of learning and feedback
 - Behavioral models to explain newsvendor decisions
 - Subject-level versus average analysis
- Part II: Strategic interaction between individuals
 - \circ $\;$ Supply chain coordination and the double marginalization problem
 - o Game-theoretic analytical solution under different contracts
 - o Comparing analytical predictions with experiment data
 - o Building behavioral models to explain manufacturer and retailer decisions
 - Using subjects' personality data to explain decisions.

Learning Outcomes

Upon successful completion of this course, students are expected to:

- Use the newsvendor model to investigate stochastic inventory problems.
- Discuss the heuristics and biases observed in human newsvendor experiments.
- Explain supply chain coordination and describe the mechanics of fundamental supply chain contracts.
- Describe the factors that affect strategic long-run interactions between human decision makers.
- Conduct hypothesis testing and build regression models on experiment data.