OPM 701 – Research Seminar Supply Chain Management
FSS 2020

General Information:

1. The goal of this seminar is to introduce the participants to the conducting of scientific research. It thereby prepares the students for the writing of their MSc thesis. The seminar is geared towards students intending to write their thesis at the Chair of Logistics.

2. Each participant will explore one of the research papers listed below. The task is to review and critically assess the assigned research paper and to relate it to the corresponding stream of scientific literature. Each participant presents his/her findings in a written report (about 20 pages) as well as an in-class presentation (20 min + 20 min discussion).

3. Each participant also acts as a discussant for one of the other presentations. The discussant is responsible for critically assessing the presented work and for opening the ensuing discussion.

4. A **kick-off meeting** for all participants will be held on **Wednesday, 4 December 13:45** in room **SO 318**. During this meeting, general guidelines for conducting a scientific literature review will be discussed and the tasks of seminar will be explained in detail.

5. The written reports have to be **submitted** electronically and as a hard copy in two-fold by **27 April**.

6. The **presentations** will be held as a blocked session around week 19, most probably on 7 and 8 May (exact times and rooms to be announced, might still be subject to change!). Attendance at all presentations is **obligatory**.

7. The final grade for the seminar is composed of the following components: Written report (60%), presentation (30%), contribution to discussion (10%).

8. As the seminar is usually attended by a class of international students, the report and the presentations should be delivered in English.

9. There is a joint application process for all seminars offered by the chairs of the Area Operations Management. In the FSS 2020, this includes the following seminars:

    - OPM 701: Research Seminar Supply Chain Management (Chair of Logistics and Supply Chain Management), **topics labeled with 'L'**

    - OPM 761: Research Seminar Production Management (Chair of Production Management), **topics labeled with 'P'**

    - OPM 781: Research Seminar Service Operations (Chair of Service Operations Management), **topics labeled with 'S'**

    - OPM 792: Applied Seminar Procurement (Chair of Procurement), **topics labeled with 'B'**

    Detailed information on the seminar topics is available on the home pages of the respective chairs. In their application, students can indicate three to five preferred topics from all seminars.

10. Applications are open from **1** until **15 November**. Students have to join the ILIAS group **Seminar Application Area Operations** (link) and complete the **application form** there.

11. Additionally, students applying for a topic of OPM 701 must send an e-mail to logistik@bwl.uni-mannheim.de titled "Seminar Application Documents", including a current **CV** and a **grades overview** (the one you can print yourself is enough). If you are applying for topics of the other chairs, please check if you have to send documents to them as well.

12. For any questions concerning the seminar feel free to contact Kilian Seifried at kilian.seifried@bwl.uni-mannheim.de.

Seminar topics

Each participant will be assigned one of the topics listed below. The task then is to identify the main issues addressed by the paper, explain its methodology, including potential quantitative models, position it in the corresponding stream of scientific literature, and critically assess the paper's contribution to the literature as well as to practice.

<u>Topic L01:</u> Ahmadi, R.; Iravani, F.; & Mamani, H. (2017). Supply chain coordination in the presence of gray markets and strategic customers. Production and Operations Management 26: 252—272.

The practice of diverting genuine products to unauthorized gray markets continues to challenge companies in various industries and creates intense competition for authorized channels. Recent industry surveys report that the abuse of channel incentives is a primary reason for the growth of gray market activities. Therefore, it is crucial that companies take the presence of gray markets into consideration when they design contracts to distribute products through authorized retailers. This issue has received little attention in the extensive literature on contracting and supply chain coordination. In this study, we analyze the impacts of gray markets on two classic contracts, wholesale price and quantity discount, in a supply chain with one manufacturer and one retailer when the retailer has the opportunity to sell to a domestic gray market. Our analysis provides interesting and counterintuitive results. First, a classic quantity-discount contract that normally coordinates the supply chain can perform so poorly in the presence of a gray market that the supply chain would be better off using a wholesale price contract instead. Second, the presence of gray market can also degrade the performance of the wholesale price contract; therefore, a more sophisticated contract is needed for coordinating the supply chain. We show that contracts that solely depend on retailer's order quantity cannot coordinate the supply chain, and provide the conditions for coordinating the supply chain with price-dependent quantity discount contracts. We also provide comparative statics and show that when there is a gray market, coordinating the supply chain enhances total consumer welfare.

<u>Topic L02:</u> Chen, X.; Benjaafar, S.; & Elomri, A. (2019). On the effectiveness of emission penalties in decentralized supply chains. European Journal of Operational Research 274: 1155—1167.

In recent years, the emission of harmful pollutants, such as greenhouse gases, due to industrial activities have received considerable interest from both business and scientific communities. As a result, an increasing number of voluntary and governmental initiatives that penalize emission generated by businesses have been witnessed. In this research, we examine the extent to which imposing penalties on the emission of harmful pollutants can successfully reduce overall emissions in decentralized supply chains. Using a buyer–vendor supply chain framework, we show that penalizing each firm for the emissions for which it is directly responsible can sometimes lead to higher overall supply chain emissions. We show that this phenomenon occurs because firms, in their efforts to reduce their own emissions, can make decisions that adversely impact the emissions of other firms in its supply chain. Moreover, we show that centralizing the supply chain—contrary to what one may think at first glance—is not always the appropriate solution to mitigate this effect. We provide some potential remedies and evaluate their relative effectiveness. We also present a detailed numerical example using realistic problem parameter values to examine the extent to which emission reduction efforts by individual firms are successful in reducing overall emissions.

<u>Topic L03:</u> Jagabathula, S. & Rusmevichientong, P. (2019). A nonparametric joint assortment and price choice model. Management Science 63: 3128—3145.
The selection of products and prices offered by a firm significantly impacts its profits. Existing approaches do not provide flexible models that capture the joint effect of assortment and price. We propose a nonparametric framework in which each customer is represented by a particular price threshold and a particular preference list over the alternatives. The customers follow a two-stage choice process; they consider the set of products with prices less than the threshold and choose the most preferred product from the set considered. We develop a tractable nonparametric expectation maximization (EM) algorithm to fit the model to the aggregate transaction data and design an efficient algorithm to determine the profit-maximizing combination of offer set and price. We also identify classes of pricing structures of increasing complexity, which determine the computational complexity of the estimation and decision problems. Our pricing structures are naturally expressed as business constraints, allowing a manager to trade off pricing flexibility with computational burden.

<u>Topic L04:</u> Visser, T. R. & Savelsbergh, M. W. P. (2019). Strategic time slot management: A priori routing for online grocery retailing. Working paper, Erasmus University Rotterdam, the Netherlands.
Time slot management refers to the design and control of the delivery time slots offered to customers during the online ordering process. Strategic time slot management is an innovative variant in which only a single time slot is offered each day of the week and a priori delivery routes are used to guide time slot availability. Strategic time slot management simplifies time slot control and fulfillment center operations. We propose a 2-stage stochastic programming formulation for the design of a priori delivery routes and time slot assignments and a sample average approximation algorithm for its solution. An efficient dynamic program is developed for calculating the expected revenue of an a priori route. An extensive computational study demonstrate the efficacy of the proposed approach and provides insights in to the benefits of strategic time slot management.

<u>Topic L05:</u> Bozorgi-Amiri, A.; Jabalameli, M. S.; Mirzapour Al-e-Haschem, S. M. J. (2013). A multi-objective robust stochastic programming model for disaster relief logistics under uncertainty. OR Spectrum 35: 905—933.

Humanitarian relief logistics is one of the most important elements of a relief operation in disaster management. The present work develops a multi-objective robust stochastic programming approach for disaster relief logistics under uncertainty. In our approach, not only demands but also supplies and the cost of procurement and transportation are considered as the uncertain parameters. Furthermore, the model considers uncertainty for the locations where those demands might arise and the possibility that some of the pre-positioned supplies in the relief distribution center or supplier might be partially destroyed by the disaster. Our multi-objective model attempts to minimize the sum of the expected value and the variance of the total cost of the relief chain while penalizing the solution's infeasibility due to parameter uncertainty; at the same time the model aims to maximize the affected areas' satisfaction levels through minimizing the sum of the maximum shortages in the affected areas. Considering the global evaluation of two objectives, a compromise programming model is formulated and solved to obtain a non-dominating compromise solution. We present a case study of our robust stochastic optimization approach for disaster planning for earthquake scenarios in a region of Iran. Our findings show that the proposed model can help in making decisions on both facility location and resource allocation in cases of disaster relief efforts.

<u>Topic L06:</u> Govindan, K. & Fattahi, M. (2017). Investigating risk and robustness measures for supply chain network design under demand uncertainty: A case study of glass supply chain. International Journal of Production Economics 183: 680—699.

This paper addresses a multi-stage and multi-period supply chain network design problem in which multiple commodities should be produced through different subsequent levels of manufacturing processes. The problem is formulated as a two-stage stochastic program under stochastic and highly time-variable demands. To deal with the stochastic demands, a Latin Hypercube Sampling method is applied to generate a fan of scenarios and then, a backward scenario reduction technique reduces the number of scenarios. Weighted mean-risk objectives by using different risk measures and minimax objective are examined to obtain risk-averse and robust solutions, respectively. Computational results are presented on a real-life case study to illustrate the applicability of the proposed approaches. To compare these different decision-making situations, a simulation approach is used. Furthermore, by several test problems, the performance of the stochastic model is investigated and the scenario generation method is evaluated in terms of in-sample and out-of-sample stability. Finally, sensitivity analysis on main parameters of the problem is performed to drive some managerial insights.

<u>Topic L07:</u> Astashkina, E.; Belavina, E.; & Marinese, S. (2019). The environmental impact of the advent of online grocery retailing. Working paper, INSEAD, France.
This study assesses the environmental impact of the advent of online grocery retailing. We model the grocery supply chain before and after the emergence of online grocery retail. The models include suppliers, offline and online retailers, the delivery infrastructure, and households. All firms and households optimally manage their inventory; online retailers also optimally manage deliveries. We compare food waste and transportation emissions before and after the advent of online grocery retail. We isolate three key factors that drive the difference: (i) which households switch to online shopping, (ii) their shopping patterns, and (iii) how the first two factors change where inventories are held. In general, moderate online grocery prices and delivery fees lead to (desirable) adoption primarily by households located "far" from offline stores, neither too frequent shopping nor too large basket sizes by these online households, and enough beneficial inventory centralization—and a consequent reduction in emissions. Numerical calibration using industry and demographic data reveals that in most US cities the advent of online grocery should be beneficial, leading to an eventual 8-41% reduction in emissions; more congested, wealthier, lower offline-store-density cities have the most substantial gains. Finally, making online deliveries from existing offline stores further enhances environmental benefits.

<u>Topic L08:</u> Lang, M. A. K.; Cleophas, C.; & Ehmke, J. F. (2019). Anticipative dynamic slotting for attended home deliveries. Working paper, RWTH Aachen, Germany.
When customers order goods that require attended deliveries, they expect narrow delivery time slots that fit their personal schedules. This makes attended deliveries costly and complex for retailers. Dynamic slotting aims to profitably assign time slots to orders by controlling the set of ordered time slots per arriving order request. To implement this, the retailer has to weigh a request's immediate reward with the opportunity cost of promising a time slot within milliseconds. Opportunity cost anticipate an order's fit into delivery schedules and its impact on future collectable value while accounting for stochastic customer choice behaviour from heterogeneous demand segments.
To find good solutions quickly, we present dynamic slotting approaches that let an extensive, simulation-based preparation phase inform decisions on order request arrival. These approaches approximate the opportunity cost of accepting orders for a time slot based on approximate value function models. Moreover, they feature different variants of delivery schedule anticipation by solving a team orienteering problem on sample arrival streams. In an extensive computational study, we compare the dynamic slotting approaches on both synthetic and empirically-validated demand scenarios. The results provide decision support when weighing value-add and effort in method selection for a specific problem scenario. In particular, we find that the impact of route anticipation highly depends on demand segments' basket value and location distributions.

<u>Topic L09:</u> Ehrenthal, J. C. F.; Honhon, D.; & Van Woensel, T. (2014). Demand seasonality in retail inventory management. European Journal of Operational Research 238: 527—539.

We investigate the value of accounting for demand seasonality in inventory control. Our problem is motivated by discussions with retailers who admitted to not taking perceived seasonality patterns into account in their replenishment systems. We consider a single-location, single-item periodic review lost sales inventory problem with seasonal demand in a retail environment. Customer demand has seasonality with a known season length, the lead time is shorter than the review period and orders are placed as multiples of a fixed batch size. The cost structure comprises of a fixed cost per order, a cost per batch, and a unit variable cost to model retail handling costs. We consider four different settings which differ in the degree of demand seasonality that is incorporated in the model: with or without within-review period variations and with or without across-review periods variations. In each case, we calculate the policy which minimizes the long-run average cost and compute the optimality gaps of the policies which ignore part or all demand seasonality. We find that not accounting for demand seasonality can lead to substantial optimality gaps, yet incorporating only some form of demand seasonality does not always lead to cost savings. We apply the problem to a real life setting, using Point-of-Sales data from a European retailer.

We show that a simple distinction between weekday and weekend sales can lead to major cost reductions without greatly increasing the complexity of the retailer's automatic store ordering system. Our analysis provides valuable insights on the tradeoff between the complexity of the automatic store ordering system and the benefits of incorporating demand seasonality.

<u>Topic L10:</u> Ferreira, K. J.; Simchi-Levi, D.; Wang, H. (2018). Online network revenue management using Thompson sampling. Operations Research 66: 1586—1602.

We consider a price-based network revenue management problem in which a retailer aims to maximize revenue from multiple products with limited inventory over a finite selling season. As is common in practice, we assume the demand function contains unknown parameters that must be learned from sales data. In the presence of these unknown demand parameters, the retailer faces a trade-off commonly referred to as the "exploration-exploitation trade-off." Toward the beginning of the selling season, the retailer may offer several different prices to try to learn demand at each price ("exploration" objective). Over time, the retailer can use this knowledge to set a price that maximizes revenue throughout the remainder of the selling season ("exploitation" objective). We propose a class of dynamic pricing algorithms that builds on the simple, yet powerful, machine learning technique known as "Thompson sampling" to address the challenge of balancing the exploration-exploitation trade-off under the presence of inventory constraints. Our algorithms have both strong theoretical performance guarantees and promising numerical performance results when compared with other algorithms developed for similar settings. Moreover, we show how our algorithms can be extended for use in general multiarmed bandit problems with resource constraints as well as in applications in other revenue management settings and beyond.