The Eighth POMS – HK International Conference

Boundless Opportunities in Operations Management

7 – 8 January, 2017

HKUST BUSINESS SCHOOL 香港科大商學院
WORLD CLASS IN ASIA

Center for Marketing and Supply Chain Management
市場營銷與供應鏈管理研究中心

The Eighth POMS-HK International Conference Presentation Schedule

Time	Tutorial (LSK 1003)	Session 1A (LSK 1033)	Session 1B (LSK 1034)	Session 1C (LSK 1005)	Session 1D (LSK 1026)	Session 1E (LSK G012)	Session 1F (LSK G007)
Day 1	**A Framework for Data Integrated Prescriptive Operations Management**	**Pricing and Advertising** **Chair: Sean Zhou**	**SC & Service Mgmt** **Chair: Xin Wang**	**Topics in OM** **Chair: Renyu Zhang**	**Shared Transportation Systems Ops** **Chair: Long He**	**New Directions in Inventory Control** **Chair: Linwei Xin**	**Inventory Management** **Chair: Xiting Gong**
9:00 - 10:30	Prof. J. George Shanthikumar	**Dynamic Pricing for Hotel Rooms When Customers Request Multiple-Day Stays** Yun Fong Lim, Selvaprabu Nadarajah, Qing Ding **Advertising Competition, Consumer Satisfaction and Purchase Reinforcement Effects** Chaolin Yang, Sean Zhou, Liang Guo **Dual-Channel Management with Strategic Customers** Qianbo Yin, Sean Zhou, Guoming Lai	**Clinical Ambiguity and Conflicts of Interest In Interventional Cardiology Decision-making** Xiaofang Wang, Tinglong Dai, Chao-Wei Hwang **Crowdfunding in Green Energy Investment** Ying Xu, Ronghuo Zheng, Nilanjan Chakraborty, Katia Sycara **Omni-Channel Retail in the Present of Operational Frictions** Xiaomeng Guo, Panos Kouvelis, Danko Turcic **Supply Diversification under Correlated Random Yields** Guang Xiao, Lingxiu Dong, Nan Yang	**Bayesian Dynamic Learning and Pricing with Strategic Customer** Xi Chen, Zizhuo Wang **Dynamic Inventory Management under Stockout Substitutions** Tianxiao Chen, Xiting Gong **Dynamic Pricing and Inventory Management under Network Externalities** Renyu (Philip) Zhang, Nan Yang **On the Adoption of Smart Home Appliance** Wenbin Wang, Yannan Jin	**Pricing for a Last Mile Transportations System** Yiwei Chen, Hai Wang **Dynamic Service Management of One-Way Car Sharing Systems** Guangrui Ma, Ho-Yin Mak **The Optimal Pricing Strategy for Two-sided Platform Delivery in the Sharing Economy** Ling-Chieh Kung, Guan-Yu Zhong **An Adaptive Distributionally Robust Approach for Fleet Repositioning in Car Sharing** Long He, Zhenyu Hu, Meilin Zhang	**Asymptotically-Optimal Inventory Control for Assemble-to-Order Systems with a General Bill of Materials and Deterministic Lead Times** Qiong Wang, Martin I. Reiman, Haohua Wan **Population Monotonicity in Newsvendor Game** Zhenyu Hu, Xin Chen, Xiangyu Gao, Qiong Wang **Inventory Models with Random Capacities** Xiangyu Gao, Xin Chen, Zhan Pang **Distributionally Robust Inventory Control when Demand is a Martingale** Linwei Xin, David A. Goldberg	**Price-setting Newsvendor Problem with Partial Information of Demand Distribution** Rongchuan He, Ye Lu **Preservation of Additive Convexity and Its Applications in Stochastic Optimization Problems** Tong Wang, Xiting Gong **Managing Multi-echelon Supply Chains with Guaranteed Service and Expediting** Xiaobei Shen, Yimin Yu
Day 1	**Best Student Paper Comp Finalists (LSK 1026)** **Chair: Man Yu**	**Session 2A (LSK 1003)** **Matching Supply with Demand** **Chair: Xuan Wang**	**Session 2B (LSK 1033)** **Strategic Consumer Behavior** **Chair: Xu Guan**	**Session 2C (LSK 1034)** **Financial Engineering and Risk Mgmt** **Chair: Ning Cai**	**Session 2D (LSK 1005)** **Emerging Topics in SC Mgmt** **Chair: Qijun Qiu**	**Session 2E (LSK G012)** **Info and Incentives in Emerging Areas of SC** **Chair: Shouqiang Wang**	**Session 2F (LSK G007)** **Economics Models in OM** **Chair: Tao Li**
10:45 - 12:15	**Dynamic Recommendation at Checkout under Inventory Constraint** Will Ma, Xi Chen, David Simchi-Levi, Linwei Xin **Instantaneous Control of Brownian Motion with a Positive Lead Time** Zhen Xu, Jiheng Zhang, Rachel Q. Zhang **Dynamic Joint Pricing and Order Fulfillment for E-commerce Retailers** Yanzhe (Murray) Lei, Stefanus Jasin, Amitabh Sinha **Managing Perishable Inventory Systems as Non-perishable Ones** Hailun Zhang, Jiheng Zhang, Rachel Q. Zhang	**Robust Dynamic Pricing with Strategic Customers** Yiwei Chen, Vivek F. Farias **Product Geographical Distribution under the Risk of Recall** Ying Rong, Long He, Max Shen **Online Resource Allocation with Limited Flexibility** Xuan Wang, Arash Asadpour, Jiawei Zhang	**Incentive Provision for Demand Information Acquisition: The Optimality of Quantity Discounts** Song Huang, Wenqiang Xiao **Dynamic Management of Opaque Selling When Customers Use Anecdotal Reasoning** Zhe Yin, Tingliang Huang **Dynamic disclosure, Word of Mouth Bias and Social Learning** Guangrui Ma, Xu Guan **Information Disclosure with Reference-Dependent Consumers** Xu Guan, Yulan Wang, Ying-Ju Chen	**Impulse Control with Applications in Finance** Haolin Feng, Kumar Muthuraman, Daniel Mitchell **Pure Jump Models for Pricing and Hedging VIX Derivatives** Lingfei Li, Jing Li, Gongqiu Zhang **On the Optimality of Deductibles with Heterogeneous Beliefs** Yichun Chi **A Unified Approach to Pricing Equity and Credit Derivatives within a General Framework** Ning Cai, Haohong Lin	**Direct Mechanism Design under Hidden Rebate Problem in a Supply Chain** Xiaoshuai Fan, Ying-Ju Chen, Christopher Tang **Joint Decision Marketing of Dynamic Pricing and Duration for Discounted Airfares** Yanli Fang, Yan Chen **Supply Chain Joint Financing Based on an Ex-ante Credit Limit** Jinjin Zhang, Yan Chen **Social Learning and Information Provision Policy** Shihong Xiao, Ying-Ju Chen	**Altruistic Rationality: The Values of Strategic Farmers and (Non-)Profit Firms in Crop Planting Decisions** Wenbin Wang, Ming Hu, Yan Liu **Information Sharing in Technology Adoption** Wenxin Xu **Subsidy Policies with Network Externalities** Saed Alizamir **Managing Audit Evasion** Shouqiang Wang, Peng Sun, Francis De Vericourt	**Is Electricity Storage Green? A Study on Commercial Building** Yangfang Helen Zhou **Quick Response and Information Sharing in a Co-opetitive Supply Chain** Chen Kanglin, Niu Baozhuang, Fang Xin **A Price-Setting Retailer Sourcing from Competing Suppliers Facing Disruptions** Tao Li, Xi Shan, Suresh Sethi
14:00-15:30	**Welcome Speech by Prof Kar Yan Tam & Keynote presentation by Prof. Hau L. Lee**						
Day 1	**Session 3A (LSK 1003)** **Supply Chain Management** **Chair: Ye Lu**	**Session 3B (LSK 1026)** **Consumer Choice & Assortment Optimization** **Chair: Yan Liu**	**Session 3C (LSK 1033)** **Pricing Decisions** **Chair: Yue Dai**	**Session 3D (LSK 1034)** **Appointment Scheduling** **Chair: Rowan Wang**	**Session 3E (LSK 1005)** **Behavioral Operations** **Chair: Zhijian Cui**	**Session 3F (LSK G012)** **Ecommerce** **Chair: Gajanan B. Panchal**	**Session 3G (LSK G007)** **Game Theory and Competition** **Chair: Tian Quan**
15:45 - 17:15	**Joint Replenishment and Transshipment For Three Locations - Asymptotics and Bounds** Yin Xu, David D. Yao, Sean X. Zhou, Weifen Zhuang **Joint Pricing and Inventory Management with Strategic Customers** Yiwei Chen, Cong Shi **Joint Pricing and Inventory Control with Fixed and Convex or Concave Variable Production Costs** Peng Hu, Ye Lu, Miao Song **Learning Valuation Distributions From Bundle Sale**s Will Ma, David Simchi-Levi	**Online Assortment Optimization when Consumers Refine Their Search** Zhichao Feng, Dorothee Honhon, Shengqi Ye **Assortment Optimization Under a Synergistic Version of the Multinomial Logit Model** Venus Lo, Huseyin Topaloglu **Efficiency and Performance Guarantees for Choice-based Network Revenue Management Problems with Flexible Products** Wang Chi Cheung, David Simchi-Levi **Dynamic Nonlinear Pricing of Inventories over Finite Sales Horizons** Yan Liu, Guillermo Gallego, Michael Z.F. Li	**Dynamic Mix-Bundling with Limited Inventory** Peng Liao, Li Jiang, Heng-Qing Ye **Dynamic Channel Control and Pricing of a Single Perishable Product on Multiple Distribution Channels** Boqian Song, Michael Z.F. Li **Sensitivity Analysis on Responsive Pricing and Production under Imperfect Demand Updating** Geoffrey A. Chua, Yan Liu **Managing Cross-Channel with Uniform Pricing: Theory and Empirical Findings** Yue Dai, Yuxin Chen, Zhe Zhang	**A Comparison of Traditional Overbooking and Pre-charge Strategies for Appointment System** Yang Zhan, Zizhuo Wang, Guohua Wan **MY-ATLAS: Mapping HCC Tumor Biology to Compute Equitable Exception Points** Ngai-Hang Zachary Leung, Mustafa Akan, Sridhar Tayur, James Markmann, Heidi Yeh **Markov Decision Process for Outpatients Scheduling with Eligibility Constraints** Huiqiao Su, Shan Wang **Appointment Systems under Service Level Constraints** Rowan Wang, David Chen, Zhenzhen Yan, Saif Benjaafar, Oualid Jouini	**A Behavioral Game Model for Solving an Abnormality in the Capacity Allocation Game** Peijun Guo, Chao Wang **Scheduling Service Packages with Acclimation and Memory Decay: Model and Algorithm** Yifu Li, Xiangtong Qi **Do Employees Leave their Jobs in Herds? An Empirical Study of Employee Turnover** Zhijian Cui, Lilun Du, Qing Li	**Why and How do Branders Sell New Products on Flash Sales Platforms?** Mingyang Zhang, Juliang Zhang, T.C.E. Cheng, Guowei Hua **Integrated Model to Adopt Online Shopping in India: A Quantitative Approach** Amit Sachan, Rajiv Kumar **Big Data Analytics for E-commerce Logistics in Various Countries** Chun-Chen Lin, Pei-Ju Wu **E-Commerce Demand Planning in a FMCG Market** Gajanan B. Panchal, Hassan Mirzahosseinian, Robert de Souza, James Ang, Kok Choon Tan	**The Comparison of Two Outsourcing Strategies under Competition and Asymmetric Cost Information** Fei Lv, Xu Guan **Leadership and Information Exchange in a Supply Chain with Group Buying** Maosen Zhou, Qingyu Zhang **Information Sharing in Competing Supply Chains with Green Innovations** Tian Quan

The Eighth POMS-HK International Conference Presentation Schedule

Day 2 09:00-10:30	Keynote Presentation by Prof. Awi Federgruen								
	Session 4A (LSK 1003)	**Session 4B (LSK 1026)**	**Session 4C (LSK 1033)**	**Session 4D (LSK 1034)**	**Session 4E (LSK 1005)**	**Session 4F (LSK G012)**	**Session 4G (LSK G007)**	**Session 4H (LSK 1032)**	**Session 4I (LSK 1027)**
	Innovations in OM **Chair: Xin Fang**	**Recent Development in SCM and Service** **Chair: Anyan Qi**	**Retail Promotions and Revenue Sharing** **Chair: Ling-Chieh Kung**	**Supply Chain Performance** **Chair: Karthik Natarajan**	**Social & Economic Networks** **Chair: Yang Zhang**	**Logistics Planning** **Chair: Odkhishig Ganbold**	**Sustainable Operations Management** **Chair: Xin Wang**	**Data Driven Research** **Chair: Yong-Hong Kuo**	**Service Operations** **Chair: Shan Wang**
10:45 - 12:15	**Incentive Issues in the Implementation of Urban Consolidation Centers** Xin Fang, Yun Fong Lim **Capacity Reservation Strategy Under Consumer Panic Buying** Lin Zhou, Jing Hou, Shan Zhao **An Improved NSGA-II Algorithm for Petrol Station Replenishment Problem with Drivers' Workload Balancing** Lijun Sun, Haiyang Shi, Xiangpei Hu	**Strategic Rationale for Hedging in a Bilateral Supply Chain** Yixuan Xiao, Xiaole Wu, Panos Kouvelis **Decision Structure and Performance of Networked Technology Supply Chains** Jingqi Wang, Xiaole Wu, Vish Krishnan **Does More Private Information by Service Providers Always Hurt Customers?** Li Jiang, Chunyan Gao **Optimal Procurement Mechanisms for Assembly** Anyan Qi, Bin Hu	**Conditional Promotions and Consumer Overspending** Thunyarat (Bam) Amornpetchkul, Hyun-Soo Ahn, Ozge Sahin **Signaling Machine Reliability through Revenue Sharing for Radiation Treatments: Impact of Hospital Management Type** Yu-Hung Chen, Ling-Chieh Kung, Jun-Yu Yu, Hsin-Jung Tsai, Yu Jen Wang **Online In-store Referrals for Products with Heterogeneous Quality** Ling-Chieh Kung, Pei-Yu Sun, Chien-Yu Huang, Wei-Che Lee	**Supply Chain Performance with A Target-oriented Retailer** Qinshen Tang, Lucy Gongtao Chen, Melvyn Sim **Relationship between Upstream and Downstream Supply Chain Networks and Performance** Manpreet S. Hora, Marcus Bellamy, Soumen Ghosh **The Benefit of Scale: Capacity Allocation in Differentiated Service System** Guodong Lyu, Mabel Chou, Chung-Piaw Teo, Zhichao Zheng, Yuanguang Zhong **Asymmetry and Ambiguity in Newsvendor Models** Karthik Natarajan, Melvyn Sim, Joline Uichanco	**Fashion and Homophily** Zhigang Cao, Boyu Zhang, Xiaoguang Yang, Chengzong Qin **Inventor Diversification in Technology Networks** Jianxi Luo, Jeffrey Alstott, Giorgio Triulzi, Bowen Yan **The Coevolution of Constrained Network Formation and Minimum-Effort Games** Zhiwei Cui, Fei Shi **Optimal Nonlinear Pricing in Social Networks under Asymmetric Network Information** Yang Zhang, Ying-Ju Chen	**City-center Supply of Airport Ancillary Goods** Hanxiang Zhang, Czerny, Achim Ingo **A Heterogeneous Fleet Two-echelon Capacitated Location-routing Model for Joint Delivery Arising in City Logistics** Zhao Quanwu, Wang Wei **Cross-border E-commerce Solutions for China and Europe: Interview Survey** Odkhishig Ganbold, Tsai Yao-Te, Ang Ming Sze, James Ang Soo Keng, Robert de Souza	**Impacts of Contracts on a Supplier's Environmental Innovation under Emission Tax on a Manufacturer** Kun Soo Park, Se-Youn Jung, Bosung Kim **The Optimal Reverse Channel Choice under Supply Chain Competition** Yu Zhou, Xiaole Wu **Revisiting an intelligent Particle Swarm Optimization Algorithm** Hui-Ming Wee, Yen-Deng Huang **Green Technology Development and Adoption: Competition, Regulation, and Uncertainty - A Global Game Approach** Xin Wang, Soo-Haeng Cho, Alan Scheller-Wolf	**The Data-driven Analytics for Investigating Food Logistics Management** Po-Chu Huang, Pei-Ju Wu **Developing a Simulation Model of a Tram Network by using Historical RFID Data** Henry K.F. Cheung, Yong-Hong Kuo, Janny M.Y. Leung, David S.W. Lai, Joshua Hiew **A Location Based System for Managing Cart Operations at a Mail Facility** Yong-Hong Kuo, Chun Hung Cheng	**Service Segment Competition: Size or Target, Which Matters?** Weixiang Huang, Wenhui Zhou, Pengfei Guo **Banks' Efficiency and Its Determinants: Evidence from Chinese Mainland and His two SARs** Lei Peng, Xinhua Gu, Zhaotong Lian **Managing Appointment-based Services in the Presence of Walk-in Patients** Shan Wang, Nan Liu, Guohua Wan
Day 2	**Session 5A (LSK 1003)**	**Session 5B (LSK 1026)**	**Session 5C (1033)**	**Session 5D (LSK 1034)**	**Session 5E (LSK 1005)**	**Session 5F (LSK G012)**	**Session 5G (LSK G007)**	**Session 5H (LSK 1032)**	**Session 5I (LSK 1027)**
	Warranty and Quality Management **Chair: Anshu Dai**	**Logistics Management** **Chair: Yihuan Yang**	**Strategic Consumers and Robust Optimization** **Chair: Daniel Long**	**Contract Design** **Chair: Shantanu Bhattacharya**	**Channel and Purchasing Management** **Chair: Chun-Hung Chiu**	**<CANCELLED> Robust Optimization and Risk**	**Supply Chain Management** **Chair: Qiao Wang**	**Business Analytics for Decision Making** **Chair: Hsiao-Hui Lee**	**Economics and Operations Management** **Chair: Huiqiang Mao**
14:00 - 15:30	**How does the Manufacturer's Extended Warranty Policy Affect its Original Basic Warranty?** Yaqi Lou, Shuguang He **Quality Disclosure Strategies for the Firms in a Competitive Marketplace** Ciwei Dong, Ming Zhao **Study on the Flexible Preventive Maintenance Strategy for Products Sold with Two-dimensional Warranty** Anshu Dai, Shuguang He, Zhen He, Zixian Liu	**Routing Optimization of Hazmat Multimodal Transportation Based on CVaR Assessment** Rongxue Du, Liping Liu **Container Assignment with Elastic Demand** Shuaian Wang **A Stakeholder Analysis of Logistics Synchronization with Consolidation Strategy in Food Supply Chain** Kok Choon Tan, James Soo Keng Ang, Gajanan Bhanudas Panchal **Generating Delivery Plans in Real Time by Dynamically Evaluating Multiple Scenarios** Yihuan Yang, Xiangtong Qi	**To Ration Or Not To Ration? Selling To Strategic Customers Under Shortage Effect** Hanqing Liu, Peng Hu , Stephen Shum **Modeling with Infinitely Constrained Ambiguity Sets** Zhi Chen, Melvyn Sim, Huan Xu **Mitigating the Price Fluctuation in Quota Systems** Zheng Cui, Daniel Zhuoyu Long **Cost Sharing for Capacity Transfer in Cooperating Queueing Systems** Yinlian Zeng, Lianmin Zhang, Xiaoqiang Cai, Jun Li	**Hotel Online Booking Segmentation for Heterogeneous Customers** Ting Wei, Zhaowei Miao, Yongquan Lan **Contract Design and Renegotiation under Loss-aversion in Public Projects** Yiwen Zhang, Zhuo Feng, Shuibo Zhang **Rights of First Negotiation and Rights of First Refusal in New Product Development Partnerships** Shantanu Bhattacharya, Guangyu Wan, Sameer Hasija, Niyazi Taneri	**Manufacturer's Channel Selection and Pricing Strategies under E-commerce** Lili Shangguan, Yongquan Lan, Zhaowei Miao **Dual-channel Service and Pricing Strategy Based on Service Free-riding** Xidong Li, Shihua Ma **Coordinating Supply Chains: Impacts of Channel Leadership and Information Asymmetry** Chun-Hung Chiu, Tsan-Ming Choi, Xun Li, Cedric Ka-Fai Yiu		**Free Rider and Deterrence of Supply Chain Encroachment** Qinquan Cui **Research on Supply Chain Lead Time Optimization Based on Shelf Life** Zhirong Wu, Shihua Ma **Sourcing Strategy of Strategic Items by Considering the Total Supply Chain Cost and Order Allocation to Suppliers in an Auto Industry** Sunil Kumar Ambati, Priyanka Verma **Optimal Timing of Product Introductions When Consumers Exhibit Context-dependent Preferences** Wang Qiao, Chiang Wei-yu Kevin	**Flexible Market Response Model with Price-Dependent Heteroscedasticity** Sirong Luo **An Easy-to-implement Variable Selection Method for Models Following Heredity** William Li **Simulation Based Predictive Analytics for Dynamic Queueing Systems** Huiyin Ouyang **Reducing Inventory Waste: Optimal Order-Up-to Level with Service Level Agreements in a Finite Horizon** Qi Deng, Yinliang Ricky Tan, Anand Paul, Lai Wei	**On the Interaction between Product Rollover Strategy and Pricing Scheme** Jingchen Liu, Lihua Chen, Xin Zhai **Performance Evaluation and Optimization of Gaming Industry in Macau during 2007-2014** Qiang Deng, Zhaotong Lian, Xinhua Gu **Impacts of Carbon Policies under Imperfect Competition: The Real Price of Carbon Reduction** Huiqiang Mao, Yanzhi Li
Day 2	**Session 6A (LSK 1033)**	**Session 6B (LSK 1026)**	**Session 6C (LSK 1033)**	**Session 6D (LSK 1034)**	**Session 6E (LSK 1005)**	**Session 6F (LSK G012)**	**Session 6G (LSK G007)**	**Session 6H (LSK 1032)**	**Session 6I (LSK 1027)**
	Logistics and Supply Chain Management **Chair: Guodong Lyu**	**OM in Health Care Systems** **Chair: Tinglong Dai**	**Interface between OM and Marketing** **Chair: Rui Zheng**	**Supply Chain Management** **Chair: Zelong Yi**	**Green Efforts and Location Management** **Chair: Qi Fu**	**The OR/OM models and their applications** **Chair: Jiheng Zhang**	**Healthcare Operations Management** **Chair: Jin Qi**	**Technology Management** **Chair: Jingqi Wang**	**Supply Chain Management** **Chair: Liu Jing**
15:45 - 17:15	**Assessing Uncertainty: A Model-output Oriented Approach** Achim I. Czerny, Erik T. Verhoef, Anming Zhang **Experimental Analysis of the Newsvendor Problem with Minimum Order Quantity Contracts** Özge Tüncel, Niyazi Taneri, Sameer Hasija **Multi Criteria Optimization Model for Prepositioning of Relief Items: A Case Study of Chennai Floods 2015** Ashish Kumar Kaushal, Ravi Shankar	**Network Analysis of Patient Transfer Behavior in a Hierarchical Medical System** Runkang Ding, Jingui Xie, Yugang Yu **Tax/Subsidy and Capacity Decisions in A Two-tier Health System with Welfare Redistributive Objective** Weifen Zhuang, Qu Qian **Conspicuous by Its Absence: Diagnostic Expert Testing Under Uncertainty** Tinglong Dai, Shubhranshu Singh	**Promotion Planning of Network Goods** Ningyuan Chen, Saed Alizamir, Vahideh Manshadi **Analysis of Gray Markets in Differentiated Duopoly with Different Power Structures** Hai Li, Stuart X. Zhu **Who Compensates the Sales Agent?** Duo Shi, Panos Kouvelis **Pricing in Social Networks with Strategic Consumers** Rui Zheng, Biying Shou	**Financing a Small Capital-constrained Community Firm Based on Advance Selling and Social Ties** Shuang Xiao, Song Alex Yang, Yiangos Papanastasiou **The Decisions of Supplier and Capital Constrained Retailer with Marketing Expansion** Wen Ding, Wenhui Zhao, Panos Kouvelis, Guohua Wan **How to Finance Agricultural-Product Suppliers?** Zelong Yi, Ying-Ju Chen, Yulan Wang	**Vertical or Horizontal Cooperation in a Competitive Supply Chain for Investing Greening Efforts** Peng Ma **The Evolutionary Game Analysis of Collaboration on Carbon Reduction Behavior by Manufacturer and Retailer in Supply Chain** Yuan Bai-yun **A New Method to Stabilize the Grand Coalitions of Unbalanced Uncapacitated Facility Location Games** Lindong Liu, Xiangtong Qi, Zhou Xu **An Inventory Model with Transshipment and Demand Substitution** Qi Fu	**Analysis of Pooling Effect for Multiple Products Using a Single Warranty Reserve** Zhang Ruijie, Xie Wei , Zhong Yuanguang, Zhou Yongwu **Beyond Heavy-traffic Regimes: Universal Bounds and Controls for the Single-server Queue** Junfei Huang, Itai Gurvich **The Cost of Skipping the Line** Chen Xiaole, Li Yang, Huang Junfei **Capacity Design and Allocation in Unbalanced Networks with Flexibility** Jingui Xie, Marcus Ang, Mabel C. Chou, David D. Yao	**Optimal Resource Allocation in Breast Cancer Screening with Different Risk Groups** Qingxia Kong, Susana Mondschein **Personalized Medical Decision Making for Type II Diabetes Treatment** Shasha Han, Joel Goh, Melvyn Sim **Allocation of ICU Beds during Periods of High Demand** Huiyin Ouyang, Nilay T. Argon, Serhan Ziya **Markov Decision Process based Nurse Night Shift Assignment with Burn-Out Considered** Geng Na, Zhou Chun-meng, Andrea Matta	**Demand Learning and Agreement Delay in Technology Adoption** Wei Zhang, Reza Ahmadi, Sriram Dasu **Investment Strategies in Technology Adoption: Chase the New or Walk with the Old?** Haiping Hui, Wei Zhang, Hsiao-Hui Lee **Supply-Chain Innovation Spillover and New Product Introduction** Hsiao-Hui Lee, Haiping Hui, Po-Hsuan Hsu	**Supply Chain Coordination Using Revenue-Sharing Contract with Perishable Products** Renfei Luo, Zhaotong Lian **Performance Bounds and Asymptotic Optimality of (r;Q) Policies for Stochastic Distribution Inventory Systems** Han Zhu **Store Brand and Asymmetric Demand Information in a Decentralized Supply Chain** Liu Jing, Ke Fu, Weixin Shang

KEYNOTE SPEECH

Prof. Hau L. Lee

Thoma Professor of Operations, Information and Technology
Stanford University

Title: One Belt One Road - One Great Opportunity for POM Research

The One Belt One Road Initiative, introduced by Chinese President Xi Jinping in 2013, promised to be one of the most important and powerful initiatives that could change the economic order and well-being of major parts of the world. While the whole journey is still being unfolded, this talk is a forward looking one. It is my subjective view that there lie great opportunities for the OM community to make advances with this exciting initiative. I will integrate some past and current research that fit such opportunities, and describe what new research can be developed. I hope the talk can stimulate the audience's thoughts, and hopefully, result in POM being a full participant of this initiative in the years going forward. The POM community can make an impact and significant contributions to this major effort.

About the speaker:

Hau L. Lee is the Thoma Professor of Operations, Information and Technology at the Stanford Graduate School of Business. His areas of specialization include global value chain innovations, supply chain management, global logistics, inventory modeling, and environmental and social responsibility. He is also the faculty director of the Stanford Institute for Innovations in Developing Economies, and is a co-director of the Stanford Value Chain Innovation Initiative.

Professor Lee has published widely in journals such as Management Science, Operations Research, Harvard Business Review, Sloan Management Review, Supply Chain Management Review, IIE Transactions, and Interfaces, etc. He has served on the editorial boards of many international journals, such as Operations Research, Manufacturing and Service Operations Management, IIE Transactions, Supply Chain Management Review, Sloan Management Review, and the Journal of Production and Operations Management. From 1997-2003, he was the Editor-in-Chief of Management Science.

Professor Lee was elected to the National Academy of Engineering in 2010. He received the Harold Lardner Prize for International Distinction in Operations Research, Canadian Operations Research Society, 2003. He was elected a Fellow of Manufacturing and Service Operations Management, INFORMS, 2001; Production and Operations Management Society, 2005; and INFORMS, 2005. In 2006, he was President of the Production and Operations Management Society. His article, “The Triple-A Supply Chain,” was the Second Place Winner of the McKinsey Award for the Best Paper in 2004 in the Harvard Business Review.

In 2004, his co-authored paper in 1997, “Information Distortion in a Supply Chain: The Bullwhip Effect,” was voted as one of the 10 most influential papers in the history of Management Science. In 2014, his co-authored paper in 2013, “The Impact of Logistics Performance on Trade,”

received the Wickham Skinner Best Paper Award from the Production and Operations Management Society.

Professor Lee has consulted extensively in the public and private sectors. He is a co-founder of DemandTec, which went public in 2007. He is on the board and advisory board of several logistics services and supply chain software companies. He has also given executive training workshops on supply chain management and global logistics in Asia, Europe, and America.

Professor Lee obtained his B.Soc.Sc. degree in Economics and Statistics from the University of Hong Kong in 1974, his M.Sc. degree in Operational Research from the London School of Economics in 1975, and his MS and PhD degrees in Operations Research from the Wharton School of the University of Pennsylvania in 1983.

KEYNOTE SPEECH

Prof. Awi Federgruen

Charles E. Exley Professor of Management Columbia Business School

Title: Competition in Multi Echelon Supply Chains

There is well established literature on supply chain models under oligopolistic competition. Until recently, almost all of this literature was confined to two echelon settings with a single supplier selling to several competing retailers, or, conversely, several suppliers competing for the business of a single buyer. Typically, only a single product, or at best a given product assortment was considered. Our community has enriched this literature by analyzing the impact sf various service characteristics, such as fill rates, waiting time standards etc., considering settings where firms compete in prices, service characteristics, yield distributions, or combinations thereof. In this presentation, we start with a brief overview of these models. The second part of our talk covers recent general models for a supply chain with a general number of echelons, in which, at each echelon of the supply process, an arbitrary number of firms compete, offering one or multiple products to some or all of the firms at the next echelon. Firms at the most downstream echelon sell to the end consumer. At each echelon, the offered products are differentiated Prices are set sequentially and non-cooperatively by echelon, starting with firms at the top echelon, followed by those at the next echelon , etc. Most importantly, in these models the product assortment offered in the market depends on what prices are selected, in equilibrium.

About the speaker:

Awi Federgruen is the Charles E. Exley Professor of Management and Chair of the Decision, Risk and Operations Division of the Graduate School of Business at Columbia University, at which school he served as Senior Vice Dean from 1997-2002.

Professor Federgruen joined the Columbia University faculty in 1979 after receiving his doctorate in Operations Research at the University of Amsterdam in the Netherlands, and after being a Research Fellow at the Mathematical Centre in Amsterdam and a faculty member at the Graduate School of Management of the University of Rochester. He holds a courtesy appointment in Columbia's School of Engineering and Applied Sciences.

Professor Federgruen is a world renowned expert in the development and implementation of planning models for supply chain management and logistical systems, in particular in the areas of production, inventory and distribution planning for supply chain management, and the design and analysis of operations strategies for service systems. He is also a prime contributor to various areas of quantitative methodology, in particular the areas of applied probability models and dynamic programming.

The recipient of the 2004 Distinguished Fellowship Award by the Manufacturing, Service and Operations Management society for Outstanding Research and Scholarship in Operations Management, Professor Federgruen is a former Departmental Editor for the Department of Manufacturing, Service and Operations of Management Science , Associate Editor of Operations Research, and current Senior Editor of Manufacturing, Service and Operations Management and Associate Editor of Naval Research Logistics, the flagship journals of his profession. He is the author of over one hundred and twenty publications, in the premier journals of his field, and he has authored a book on Markovian Control problems and numerous book chapters for important survey text books. The recipient of a series of National Science Foundation and ARPA grants, his Ph.D. students are affiliated with some of the most influential university departments and industrial research laboratories (the Wharton School of the University of Pennsylvania, the Fuqua School of Duke University, the Olin School of Washington University, the Simon School of the University of Rochester, the Business and Engineering Schools of Tel_Aviv University, the Business School and Statistics Department of the Hebrew University, IBM, AT&T Bell Laboratories, Merck).

In addition to many engagements in the financial services industry, Professor Federgruen frequently consults on various supply chain management problems and planning models for companies in a variety of industries, including the pharmaceutical, natural gas, consumer electronics, food, chemical, newspaper and airline industries, both in the United States and overseas. He has also served as a principal consultant for the Israel Air Force, in the area of logistics and procurement policies.

TUTORIAL

Prof. J. George Shanthikumar

Richard E. Dauch Chair in Manufacturing and Operations Management
Krannert School of Management, Purdue University

Title: A Framework for Data Integrated Prescriptive Operations Management
(Joint work with Q. Feng)

Abstract

We provide a framework for data integrated modeling for prescriptive operations Management. Specific attention is shown to overcoming structural and statistical errors. This is achieved through operational statistics and objective operational learning which are built on the basis of data integration and cross validation. We will illustrate how regularization in sample approximation approaches and data driven robust optimization with cross validation relates to operational objectives and operational statistics. Applications in pricing and revenue management, inventory control and staffing in service systems will be demonstrated.

BEST STUDENT PAPER COMPETITION FINALISTS

Dynamic Recommendation at Checkout under Inventory Constraint

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This work is motivated by a new checkout recommendation system at Walmart's online grocery, which offers a customer an assortment of up to 8 items that can be added to an existing order, at potentially discounted prices. We formalize this as an online assortment planning problem under limited inventory, with customer types defined by the items initially selected in the order. Multiple item prices, combined with customer withdrawal when their initially selected items stock out, pose additional challenges for the development of an online policy. We overcome these challenges by introducing the notion of an inventory protection level in expectation, and presenting an algorithm with bounded competitive ratio when the arrival sequence is chosen adversarially. We further conduct numerical experiments which compare the performance of our algorithm with several existing benchmarks.

Keywords: revenue management, online algorithms, assortment optimization, personalized e-commerce

Instantaneous Control of Brownian Motion with a Positive Lead Time

Zhen Xu, Jiheng Zhang, and Rachel Q. Zhang
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Consider a storage system where the content is driven by a Brownian motion absent control. At any time, one may increase or decrease the content at a cost proportional to the amount of adjustment. A decrease of the content takes effect immediately, while an increase is realized after a fixed lead time <. Holding costs are incurred continuously over time and are a convex function of the content. The objective is to find a control policy that minimizes the expected present value of the total costs. Due to the positive lead time for upward adjustments, one needs to keep track of all the outstanding upward adjustments as well as the actual content at time tas there may also be downward adjustments during [t,t+<), i.e., the state of the system is a function on [0,ℓ]. To the best of our knowledge, this is the first paper to study instantaneous control of stochastic systems in such a functional setting. We first extend the concept of L♮-convexity to function spaces and establish the L♮-convexity of the optimal cost function. We then derive various properties of the cost function and identify the structure of the optimal policy as a state-dependent two-sided reflection mapping making the minimum amount of adjustment necessary to keep the system states within a certain region.

Keywords: functional state space, instantaneous control, L♮-convexity, reflection mapping

BEST STUDENT PAPER COMPETITION FINALISTS

Dynamic Joint Pricing and Order Fulfillment for E-commerce Retailers

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Stephen M. Ross School of Business, University of Michigan

We consider an e-commerce retailer (e-tailer) who sells a catalog of products to customers from different regions during a finite selling season and fulfills orders through multiple fulfillment centers. The e-tailer faces a Joint Pricing and Fulfillment (JPF) problem: At the beginning of each period, she needs to jointly decide the price for each product and how to fulfill an incoming order. The objective is to maximize the total expected profits defined as total expected revenues minus total expected shipping costs (all other costs are fixed in this problem). The exact optimal policy for JPF is difficult to solve; so, we propose two heuristics that have provably good performance compared to reasonable benchmarks. Our first heuristic directly uses the solution of a deterministic approximation of JPF as its control parameters whereas our second heuristic improves the first heuristic by adaptively adjusting the original control parameters at the beginning of every period. An important feature of the second heuristic is that it decouples the pricing and fulfillment decisions, making it easy to implement. We show theoretically and numerically that the second heuristic significantly outperforms the first heuristic and is very close to a benchmark that jointly re-optimizes the full deterministic problem at every period.

Keywords: dynamic pricing, fulfillment policies, e-commerce retail, asymptotic analysis.

Managing Perishable Inventory Systems as Non-perishable Ones

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The Hong Kong University of Science and Technology

In this paper, we will approach the classic perishable inventory problem from a different angle by exploring its asymptotic behavior. We first show that the perishable inventory system can be managed pretty much like a non-perishable one asymptotically when the system is large enough and clearance of inventory before expiration, if any, will only occur at the beginning of the planning horizon. We then develop several simple heuristic policies for the original problem and establish theoretical error bounds that provide lower bounds of the system size that guarantee any given desired error rate. Numerical studies show that such simple policies perform well for reasonable, sometimes small sized problems.

Keywords: perishable inventory, asymptotical analysis, news vendor problem

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SESSION 1-A: PRICING AND ADVERTISING

Dynamic Pricing for Hotel Rooms When Customers Request Multiple-Day Stays

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Selvaprabu Nadarajah
University of Illinois, Chicago
Qing Ding
Huazhong University of Science and Technology

Many hotels quote a booking price of a particular type of rooms on each day and dynamically update these prices over time. We present a novel Markov decision process formulation that determines the optimal booking price for a single type of rooms under this strategy, while considering the availability of rooms throughout the multiple-day stays requested by customers. We highlight the importance of modeling multiple-day stays by comparing the optimal policy with a single-day decomposition approach (SDD). Our analysis of the optimal policy around peak-demand events (such as public holidays or conferences) suggests that hotels should substantially raise the booking prices for some high-demand days, and simultaneously, significantly lower the booking prices for the low-demand days that are immediately adjacent to these high- demand days. This finding can be used to potentially simplify the implementation of pricing policies. Since computing an optimal policy is intractable, we develop heuristics based on a fluid approximation and approximate linear programming (ALP). We numerically benchmark them against a SDD and an adaptation of a fixed-price heuristic. The ALP-based heuristic (i) outperforms the other methods; (ii) generates up to 7% and 6% more revenue than the SDD and fixed-price heuristic respectively; and (iii) incurs a revenue loss of only less than 1% when using our pricing structure around peak-demand events, which supports the use of this simple pricing profile. Our findings are potentially relevant beyond the hotel domain for applications involving dynamic pricing of capacitated resources used by multiple products.

SESSION 1-A: PRICING AND ADVERTISING

Advertising Competition, Consumer Satisfaction and Purchase Reinforcement Effects

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CUHK Business School
The Chinese University of Hong Kong

A product is rarely perfect and people are hard to please. Two important factors that affect consumers purchase (and repurchase) decisions are usage experience and advertising. We consider a market, in which each firm marketing one brand of a frequently purchased consumer good. In each period, consumers' usage experience, i.e., satisfied or not, on the brand they purchased in the last period is determined by a random variable, i.e., satisfaction probability (SP). Their utility of a brand is determined by their past usage experience and advertising spending (Ads) of the firms. There are two types of consumers in the market, which we refer to as the (brand) ``loyals" and the (brand) `` switchers", respectively. In the market, there is a fixed proportion of consumers are the loyals while the rest are the switchers. We aim to answer the following questions in this paper. First, how does consumer satisfaction affect firms' advertising competition, as well as the resulting market shares and profits? In particular, does higher consumer satisfaction always benefit a firm? Second, how do different reactions of consumers to satisfaction/dissatisfaction affect the market equilibrium?

Dual-Channel Management with Strategic Customers

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The Chinese University of Hong Kong
Guoming Lai
McCombs School of Business
The University of Texas at Austin

This paper studies how a manufacturer should sell its product via an indirect channel (i.e., either in the peak season only or in the whole season) in the presence of strategic customers. We find when the retailer has market power, selling in the peak season only is optimal if customers are not very strategic and the market share of the indirect channel is not very large or if customers are sufficiently strategic. However, when the manufacturer has market power, selling in the whole season is always optimal. Several extensions are presented to test the robustness of these results.

Clinical Ambiguity and Conflicts of Interest in Interventional Cardiology Decision-making

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Tinglong Dai, Chao-Wei Hwang
Affiliation: Johns Hopkins University

Cardiovascular disease is the leading cause of death in the United States, and coronary artery disease (CAD) is the major underlying culprit. Percutaneous coronary intervention (PCI) has proven to be beneficial to patients with acute coronary syndrome, yet its benefit to stable CAD patients is more nuanced. Indeed, unnecessary PCI procedures for stable CAD patients have contributed to wasteful health spending and, in certain cases, patient harm. In this paper, we model both clinical ambiguity and conflicts of interest in interventional cardiology decision-making. Among other results, we show the PCI usage may be non-monotonic in the conflict-of-interest level.

Keywords: clinical ambiguity, conflicts of interest, interventional cardiology decision-making

Crowdfunding in Green Energy Investment

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Ronghuo Zheng
The University of Texas at Austin
Nilanjan Chakraborty
Stony Brook University
Katia Sycara
Carnegie Mellon University

This paper studies a new green energy investment model --- green crowdfunding, in which a green energy project is financed by many small individual investors. In this paper we develop a sequential game theory model to study the factors that would affect the total green energy investment volume in such green crowdfunding. Surprisingly, we find that the total volume might decrease as crowdfunders are more aware of the environmental benefit of green energy investment, especially when the installation cost of green energy project is low. Moreover, the impact of the crowdfunders' awareness is affected by the business structure of crowdfunding.

Keywords: renewable energy, crowdfunding, game theory

Omni-Channel Retail in the Present of Operational Frictions

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The Hong Kong Polytechnic University
Panos Kouvelis, Danko Turcic
Olin Business School, Washington University in St. Louis

When a manufacturer sells products through his own direct online channel, in addition to a traditional brick-and-mortar retailer, he usually has two possible strategies to operate his two selling channels: traditional dual-channel strategy or omni-channel strategy. One of the main differences between the two strategies is whether the products and prices offered in the two selling channels are consistent. Our paper provides a game-theoretical model to compare the two strategies from the perspective of consistent product and price. We analyze under what conditions the omni-channel strategy could benefit the manufacturer and the retailer.

Keywords: omni-channel retail, multi-channel retail, interface of operations and marketing, channel competition, pricing

Supply Diversification under Correlated Random Yields

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Lingxiu Dong
Olin Business School, Washington University in St. Louis
Nan Yang
School of Business Administration, University of Miami

Supply Diversification is regarded as an effective tool to mitigate supply risks and has been widely studied in Operations Management literature. The common insight obtained is “cost is an order qualifier, reliability is an order winner”, which is derived under independent supply risks. Whether this rule continues to hold under correlated supply risks remains an open question. In this talk, we study a monopoly firm’s sourcing and diversification decisions when procuring from unreliable suppliers with correlated yield risks. We provide unique insight regarding the impact of yield correlation on the firm’s diversification and supplier selection decisions.

Keywords: correlated random yields, sourcing and procurement, supply diversification

Bayesian Dynamic Learning and Pricing with Strategic Customer

Xi Chen
New York University
Zizhuo Wang
University of Minnesota Twin Cities

In this talk, we study a learning problem when the customer is aware of the seller's policy, and thus may behave strategically when making a purchase decision. We propose a randomized Bayesian policy (RBP), which updates the posterior belief of the customer in each period with a certain probability. We show that the seller can learn the customer type exponentially fast with the RBP even if the customer is strategic, and the regret is bounded by a constant. We also propose policies that achieve asymptotically optimal regrets when only a finite number of price changes is allowed.

Keywords: revenue management, Bayesian learning, strategic customers, pricing

Dynamic Inventory Management under Stockout Substitutions

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The Chinese University of Hong Kong

In this paper, we study a periodic-review inventory control problem with two products which can be substituted if one of them is out of stock. We formulate the optimal control problem as a dynamic program and establish the concavity and submodularity of the value functions for a wide range of problem parameter values. Based on these properties, we further characterize the structure and asymptotic bounds of the optimal control policy.

Keywords: inventory management, stockout substitution, dynamic programming, optimal policy

On the Adoption of Smart Home Appliance

Wenbin Wang, Yannan Jin
Shanghai University of Finance and Economics

Smart home appliance can shift energy consumption in response to energy price and thus hold great potential for reducing energy cost. The paper uses a game theoretical approach to analyze the consumers' decisions on smart home appliance. We study how the adoption decisions are affected by the pricing decisions of the appliance manufacturer and the utility company as well as government subsidy. We find that to increase the consumers' welfare, the government may need to interfere with incentive programs by the manufacturer.

Key words: green technology adoption, energy shifting, smart appliance.

Dynamic Pricing and Inventory Management under Network Externalities

Renyu (Philip) Zhang
New York University Shanghai
Nan Yang
University of Miami

We study the impact of network externalities upon a firm's pricing and inventory policy under demand uncertainty. A customer's willingness-to-pay and, thus, the potential demand are increasing in the past sales of the product. We show that network externalities give rise to the trade-off between generating current profits and inducing future demands, thus having several important implications upon the firm's operations decisions. We also propose a dynamic look-ahead heuristic policy that achieves very small optimality gaps.

Keywords: joint pricing and inventory management, network externalities.

Pricing for a Last Mile Transportations System

Yiwei Chen
Singapore University of Technology and Design
Hai Wang
Singapore Management University

The Last Mile Problem refers to the provision of travel service from the nearest public transportation node to a home or other destination. We consider a Last Mile Transportation System (LMTS) with multi-type passengers, such as adults, senior citizens, children and students. The level of the last mile service (in terms of passenger waiting time) is approximated by using a batch arrival, batch service, multi-server queueing model. The LMTS designer determines the price for each type of passengers, the last mile service vehicle capacity, and the service fleet size (number of vehicles) in each individual last mile region to maximize social welfare generated from having the LMTS. The LMTS designer's optimal decisions and the optimal social welfare are obtained from solving a constrained non-linear optimization problem. The pricing model is implemented in numerical experiments by using real data in Singapore. We show that by restricting the LMTS designer to offer discounted prices to some special groups of passengers, such as senior citizens, children and students, the optimal annual social welfare (measured in Singapore dollars) created from having the LMTS countrywide relative to the fraction of Singapore GDP contributed by Singapore public land transportation service industry is 17.4%. We also analyze a counterpart LMTS where the LMTS designer sets the identical price for all types of passengers. We find that in the absence of price discounts for special groups of passengers, social welfare has almost no change, but the consumer surplus of passengers who are in special groups are significantly hurt.

Keywords: last mile transportation system, social welfare, pricing

An Adaptive Distributionally Robust Approach for Fleet Repositioning in Vehicle Sharing

Long He, Zhenyu Hu, Meilin Zhang
National University of Singapore

We study the repositioning problem in free floating car sharing systems, in order to balance the fleet and meet the demands. We first formulate the problem as a dynamic program and discuss the optimal policy for the special case. To solve the problem in practical scale, we then develop an adaptive distributionally robust approach that is computationally efficient. In the case study with operations data from Car2Go, a car sharing system in California, we evaluate the the performance of the solution approach.

Keywords: vehicle sharing, repositioning, dynamic program, robust optimization

SESSION 1-D: SHARED TRANSPORTATION SYSTEMS OPERATIONS

Dynamic Service Management of One-Way Car Sharing Systems

Guangrui Ma
Tianjin University
Ho-Yin Mak
University of Oxford

Emerging flexible car sharing model is becoming a popular solution to balance individual mobility needs and sustainability. However, the unbalanced usage behavior makes it difficult to match driving demand and vehicle availability. Vehicle stock-outs happen frequently at some stations, while at the same time surplus vehicles are unutilized at others. We propose to use operational strategies that can influence users driving behavior and improve the revenue. In particular, two strategies are analyzed and compared, i.e. dynamic service blocking and dynamic surcharge fees. To address the curse of dimensionality, we take approximate dynamic programming approach to generate state-dependent operational policies.

Keywords: car sharing, repositioning, dynamic pricing, discrete choice modeling, queueing network

The Optimal Pricing Strategy for Two-sided Platform Delivery in the Sharing Economy

Ling-Chieh Kung, Guan-Yu Zhong
National Taiwan University

Owing to the advances in technology, new types of service delivery spring up in the sharing economy. In particular, some platforms emerge to provide delivery services by having independent shoppers to deliver groceries from independent retailers to consumers. Owning no warehouse and hiring no full-time shippers, this platform delivery model demonstrates its impact and potential in the delivery industry. To understand the optimal way to price this service, we formulate a platform owner's profit maximization problem by considering network externality and solve for its optimal pricing strategy. We put particular focus on the profitability of three common pricing strategies, membership-based pricing, transaction based pricing, and cross subsidization. It is shown that these three strategies are equally good in incentivizing the players in this system. As membership-based pricing is the best in collecting money early, our analysis explains its popularity in practice. With some model frictions, we also demonstrate that this insight is not prone to the marginal transaction cost, how the number of shoppers affects the service quality, and diversity of shoppers' delivery cost.

Keywords: sharing economy, delivery service, two-sided platform, network externality, game theory

Asymptotically-Optimal Inventory Control for Assemble-to-Order Systems with a General Bill of Materials and Deterministic Lead Times

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University of Illinois at Urbana-Champaign
Martin I. Reiman
Department of IEOR, Columbia University
Haohua Wan
Department of Industrial and Enterprise Systems Engineering,
University of Illinois at Urbana-Champaign

We consider the minimization of the long-run average inventory cost for Assemble-to-Order Systems with a general Bill of Materials and deterministic, but non-identical component replenishment lead times. The replenishment policy may deviate from constant base stock policies to accommodate non-identical lead times. The component allocation policy prioritizes service to demands of different values. Depending on cost parameters, the priority can be fixed or vary with the system state. Based on the use of stochastic programming, we design control policies for these systems and demonstrate the performance advantage of these policies by proving they are asymptotically optimal.

Keywords: Assemble-to-Order systems, stochastic programing, inventory control, asymptotic optimality.

Population Monotonicity in Newsvendor Game

Zhenyu Hu
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Xin Chen, Xiangyu Gao and Qiong Wang
Department of Industrial and Enterprise Systems Engineering, UIUC

It is well-known that the core of the newsvendor game is non-empty and one can use duality theory in stochastic programming to construct an allocation belonging to the core, which we refer to as dual-based allocation scheme. In this work, we identify conditions under which the dual-based allocation scheme is a population monotonic allocation scheme (PMAS), which also requires each player's cost decreases as the coalition to which she belongs grows larger. Specifically, we show that independent and log-concave demand is sufficient to guarantee this. In general, the dual-based allocation scheme is a PMAS if the growth of the coalition does not increase the dependence structure between each player and the coalition.

Keywords: newsvendor game, population monotonicity, inventory pooling

Inventory Models with Random Capacities

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Xin Chen, (Partly) Zhan Pang
University of Illinois at Urbana-Champaign, City University of Hong Kong

In many production environments, various factors, such as unexpected machine breakdowns, unplanned maintenance, and rework of defective times, etc., may cause production capacities to be highly uncertain. This leads to challenging inventory control problems because the resulting optimization models are usually not convex programs due to the truncation of decision variables by uncertainties. We develop a transformation technique to convert such non-convex programs to equivalent convex programs, and illustrate how the transformed problems can be solved effectively using decision rule approximations.

Keywords: random capacity, (non-)convex program, transformation, decision rule approximation

Distributionally Robust Inventory Control when Demand is a Martingale

Linwei Xin
University of Illinois at Urbana–Champaign
David A. Goldberg
Georgia Institute of Technology

Independence of random demands across different periods is typically assumed in multi-period inventory models. In this talk, we consider a distributionally robust model in which the sequence of demands must take the form of a martingale with given mean and support. We explicitly compute the optimal policy and worst-case distribution. We prove that at optimality the worst-case distribution corresponds to the setting in which inventory may become obsolete at a random time, a scenario of practical interest. We also compare to the analogous setting in which demand is independent across periods, and identify interesting differences between these two models.

Keywords: inventory control, distributionally robust optimization, martingale, robust Markov decision process, demand forecasting

Price-setting Newsvendor Problem with Partial Information of Demand Distribution

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Department of Management Sciences, City University of Hong Kong

We study the price-setting newsvendor problem with partial information of the demand distribution. In this problem, the sellers only process partial information (e.g. the expected demand at several price levels and the shape of uncertainty), and need to make price and order quantity decisions simultaneously to maximize the expected profit. We build a minmax regret model and derive optimal decisions for both additive and multiplicative model. Our result is easy to compute and hence can be easily used in practice. We also test our result on real data set and it shows a good performance.

Keywords: robust optimization, minmax regret, price-setting newsvendor, partial information, data-driven

Preservation of Additive Convexity and Its Applications in Stochastic Optimization Problems

Tong Wang, Xiting Gong
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The Chinese University of Hong Kong

In this paper, we establish two new preservation results of additive convexity for a class of optimal transformation problems and a class of optimal disposal problems. For both classes of problems, there are multiple resources and the optimal policies provide different priorities to transform/dispose these resources; and we prove that the additive-convexity property preserves under the optimal transformation/disposal decisions. We demonstrate the applications of our preservation results to three important stochastic optimization problems in operations management: stochastic inventory management with remanufacturing, dynamic inventory rationing with multiple demand classes, and dynamic capacity management with general upgrading.

Keywords: dynamic programming, additive convexity, remanufacturing systems, inventory rationing, capacity management

SESSION 1-F: INVENTORY MANAGEMENT

Managing Multi-echelon Supply Chains with Guaranteed Service and Expediting

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Yimin Yu
Department of Management Sciences, City University of Hong Kong

We consider the optimal coordination of inventory ordering and expediting in serial supply chains with guaranteed service. Any new customer orders are guaranteed to be fulfilled within a fixed time. We allow inventory expediting to provide in-time service. We show that a calibrated echelon base stock policy is optimal for the ordering decisions: the optimal calibrated echelon base stock level is either a constant or a variable of demand state but independent of inventory state. For the inventory expediting and demand fulfillment strategy, we find that a weakly coupled rationing level policy is optimal where the optimal weakly coupled rationing level is either a constant or a variable of inventory state but independent of demand state. We obtain our results by using generalized weak decomposition, which allows us to obtain the optimal policies efficiently.

Keywords: multi-echelon systems, guaranteed service, inventory expediting, generalized weak decomposition

SESSION 2-A: MATCHING SUPPLY WITH DEMAND

Robust Dynamic Pricing with Strategic Customers

Yiwei Chen
Singapore University of Technology and Design
Vivek F. Farias
Massachusetts Institute of Technology

We consider a revenue management problem wherein a seller sells an inventory of some product over a finite horizon via an anonymous, posted price mechanism. Customers arrive randomly over time. Customers are forward looking, who strategize about their time of purchase. Customer product valuations decay over time and customers incur monitoring costs; both are private information. We propose an anonymous posted price mechanism that captures at least 29% of the revenue under an optimal dynamic mechanism. The seller can compute our proposed policy without any knowledge of the distribution of customer discount factors and monitoring costs.

Keywords: algorithmic mechanism design, dynamic pricing, revenue management, forward-looking customers

SESSION 2-A: MATCHING SUPPLY WITH DEMAND

Product Geographical Distribution under the Risk of Recall

Ying Rong
Shanghai Jiaotong University
Long He
National University of Singapore
Max Shen
University of California, Berkeley

When product recalls happen, companies not only have to deal with additional logistics costs but also a damaged reputation. To alleviate the severe consequences of product recall, we develop a model to compare the dedicated and uniform product geographical distribution strategies under the risk of recall. For a risk neutral firm, we show that dedicated strategy outperforms uniform strategy under their respective optimal sourcing plans. However, when the consequences of product recall are severe, the mean variance analysis shows that neither distribution strategy dominates for a risk averse firm.

Keywords: product recall, geographical distribution, sourcing

Online Resource Allocation with Limited Flexibility

Xuan Wang
The Hong Kong University of Science and Technology
Arash Asadpour, Jiawei Zhang
New York University

We consider a class of online resource allocation problems with multiple types of resources and demand classes. The resources are flexible in that each resource can serve multiple demand classes. We study a special class of structures with limited flexibility, the long chain design, in an online stochastic environment where each request is drawn from a known probability distribution over the different demand classes. We show the effectiveness of the long chain in mitigating supply-demand mismatch under a myopic online allocation policy. We provide an upper bound on the expected total number of lost sales that is irrespective of how large the market size is.

Keywords: resource allocation, online algorithm, flexibility

Incentive Provision for Demand Information Acquisition: The Optimality of Quantity Discounts

Song Huang
South China Agricultural University
Wenqiang Xiao
New York University

We consider a supplier selling to a retailer who can exert a fixed cost to acquire private demand information. In this setting, the supplier's optimal contract should be able to not only elicit the retailer's demand information, but also incentivize the retailer to acquire such information in the first place. Our main finding is that the quantity discount contract, which has been widely recognized in the supply chain contracting literature as an effective tool in differentiating among retailers with distinct demand prospective, is also excelling in encouraging the retailer to costly acquire demand information, whenever doing so is beneficial to the supplier.

Specifically, we further show that the supplier should offer a quantity discount contract, which is independent of the retailer's information acquisition cost, to induce the retailer to acquire information when the retailer's information acquisition cost is below a threshold, above which the supplier should just offer a single contract to discourage the retailer from acquiring information.

Keywords: quantity discount contract, information acquisition, game theory.

Dynamic Management of Opaque Selling When Customers Use Anecdotal Reasoning

Zhe Yin
Shanghai University
Tingliang Huang
Boston College

In this paper, we intend to answer a practically important question: How should opaque selling be managed in a firm's daily operations? We develop a dynamic programming framework to capture the dynamic nature of the problem in multiple periods when customers boundedly rationally expect the firm's product-offering strategies through anecdotal reasoning. We characterize the firm's optimal product offering policy depending on the market environment and show that the optimal policy involves selling the opaque product by cyclically oscillating between two product-offering probabilities under certain conditions. We then develop some intuitive and easy-to-implement heuristics for solving the general problem.

Keywords: opaque selling, dynamic programming, pricing, anecdotal reasoning

Dynamic Disclosure, Word of Mouth Bias and Social Learning

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A consumer normally can learn the product quality information via two channels. One is from the firm's disclosure behavior and the other is from early consumer's quality review. However, unlike the firm's disclosure is generally objective, the consumer's review is inevitably biased that combines her personal shopping experience. This paper investigates the strategic impact of consumer's subjective quality review on a firm's voluntary disclosure strategy. We build a dynamic disclosure model and characterize the firm's equilibrium disclosure and pricing strategies. We show that consumer review can induce the firm to disclose more/less quality information and increase/decrease the firm's payoff under certain conditions.

Keywords: word of mouth marketing, dynamic disclosure, game theory

Information Disclosure with Reference-Dependent Consumers

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This paper investigates a seller's voluntary disclosure strategy for two groups of consumers who arrive sequentially and are reference dependent on product quality. The seller decides whether to disclose his private quality information to the consumer who arrives early and has to rely on this consumer to disseminate her quality assessment to the second consumer. We show that The seller's equilibrium disclosure strategy varies significantly relative to the magnitude of reference effect and the boundary of consumer's quality assessment. the seller may deliberately withholds some relative high quality information when the magnitude of reference effect is low or discloses some extremely high quality information when the magnitude of reference effect is high.

Keywords: information disclosure, reference-dependent preference, sequential selling, game theory

Impulse Control with Applications in Finance

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We study the instantaneous control of an Ito diffusion process on the real line. Two types of costs are incurred: the running cost and the control cost. While the running cost is incurred at all times, the control cost which has both fixed and proportional components is only incurred whenever intervention occurs. This is an impulse control problem. The objective is to minimize the total expected discounted cost. We develop a scheme to convert the resulted free-boundary problem into a sequence of fixed boundary problems. Theoretical guarantee of the method as well as some application examples in finance are discussed.

Keywords: impulse control, free boundary problem, Ito diffusion

Pure Jump Models for Pricing and Hedging VIX Derivatives

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We develop a novel class of parsimonious pure jump models with infinite jump activity and infinite variation for VIX, which capture empirical features found for VIX by non-parametric statistical analysis of VIX data. Our models are analytically tractable for pricing VIX futures and European options and are able to achieve excellent fit for the VIX implied volatility surface which typically exhibits very steep skews. To hedge VIX options, we develop an efficient dynamic strategy which protects instantaneous jump risk while controlling transaction cost.

Keywords: VIX, option pricing, hedging, jump models.

On the Optimality of Deductibles with Heterogeneous Beliefs

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This talk discusses an optimal insurance choice problem under heterogeneous beliefs. When the insurance premium depends only upon the expected indemnity and the admissible insurance policies follow the principle of indemnity and the incentive compatible condition, the deductible insurance is shown to be optimal for a risk averse insured if and only if the insurer is more optimistic about the positive loss than the insured in monotone hazard rate order. Moreover, the optimal deductible level is derived explicitly for expected value principle, and its effects by the insured's risk aversion, the insurance price and belief heterogeneity are studied in detail.

Keywords: Arrow's theorem, deductible insurance, ex post moral hazard; heterogeneous beliefs, monotone hazard rate order

A Unified Approach to Pricing Equity and Credit Derivatives within a General Framework

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Researchers and practitioners have increasingly realized the close connections between equity derivatives markets and credit derivatives markets. We study the pricing problems of equity and credit derivatives within a general hybrid equity-credit framework, i.e., under generalized jump to default extended exponential Levy models with local volatilities, which include many popular hybrid equity-credit models as special cases. More precisely, under this general model, we propose a unified approach to pricing various equity and credit derivatives, including defaultable corporate bonds, European options, barrier options, CDS, and EDS. Numerical results indicate that our pricing methods are accurate, efficient, and easy to implement.

Keywords: hybrid equity-credit models, equity derivatives, credit derivatives

Direct Mechanism Design under Hidden Rebate Problem in a Supply Chain

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Hidden rebates between third-party manufacturers and intermediary is a well-known "secret". With hidden rebates, retailers may have to pay a higher price. This paper investigates how to mitigate this problem. We demonstrate that advocating a transparent supply chain is a win-win strategy. By taking duties into consideration, we show that retailers are more inclined to use sophisticated mechanisms and the mechanism performance is better. In addition, we prove that it is beneficial for the retailer to seek manufacturers' information from the market; however, it may not be a wise choice when considering the incidence of market distortion and hidden rebates.

Keywords: mechanism design, hidden rebate, transparent supply chain

Joint Decision Marketing of Dynamic Pricing and Duration for Discounted Airfares

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In today's competitive airline industry, discounted airfare is often offered by different airlines to increaser their revenue. This paper discusses how the passengers' utility function will change over time when they decide to purchase their air tickets After that, a nonlinear mathematical programming model is established to help airline companies to decide the price for the discounted airfare and how long the discounted price will last based on the customers' utility function. At last, a numerical example involving the realistic data collected from the website of a well-known airline company is provided to demonstrate the application of the proposed method.

Keywords: revenue management, pricing strategy, utility function, discounted airfare

Supply Chain Joint Financing based on an Ex-ante Credit Limit

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A cash-constrained two-level supply chain with a supplier and a retailer facing stochastic demand is considered in this paper. Two different financing strategies are investigated and the resulting expected return of the supplier, retailer, and bank are examined. We show that in the equilibrium, a lower ex-ante credit limit or lower informational transparency will promote an increase in supplier revenue. Our numerical study shows that through supplier's an ex-ante credit limit, by sharing revenue and risk among all three partners, the joint financing strategy can improve the expected revenue of all three partners by satisfying customer's need better.

Keywords: supply chain finance, an ex-ante credit limit, revenue sharing, joint financing

Social Learning and Information Provision Policy

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This paper studies a monopoly's information provision and pricing problem when it sells one experience product to two heterogeneous regions in two periods. Consumers have uncertainty in product quality and regional preference. Second-period consumers rely on ratings by first-period consumers to evaluate product.

We consider three information provision policies: (i) consumers see ratings from two regions, (ii) consumers see ratings from their own regions, and (iii) consumers see the average of both ratings. We find policy (i) is optimal to firm. When product variation is small and regional difference is large, policy (ii) is better than (iii); and vice versa.

Keywords: social learning, information provision, two-attribute product

SESSION 2-E: INFORMATION AND INCENTIVES IN EMERGING AREAS OF SUPPLY CHAIN

Altruistic Rationality: The Values of Strategic Farmers and (Non-) Profit Firms in Crop Planting Decisions

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Price fluctuations in agricultural markets impede the poverty reduction for small-scale farmers in developing countries. We study how farmers, under price fluctuations, make crop-planting decisions over time to maximize their incomes. We consider both strategic farmers who rationally anticipate the near-future prices as a basis for making planting decisions, and naïve farmers who shortsightedly react to recent crop prices. The latter behavior may cause recurring over- or under-production which leads to price fluctuations.

We find it important to cultivate capable strategic farmers, because their self-interested behavior alone, enabled by information on the market, is sufficient to reduce price volatility and is beneficial to all the farmers. Surprisingly, even a tiny amount of strategic farmers may be enough. In the absence of strategic farmers, a well designed pre-season procurement contract offered by a non-profit or for-profit firm can bring benefit to all the farmers as well as to the firm itself and reduce income disparity among farmers. However, a contract of inappropriate design may distort the market and drive non-contract farmers out of their business.

Keywords: price fluctuation, strategic farmers, non-profit, procurement

Information Sharing in Technology Adoption

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An interesting phenomenon is that a firm may publicly disclose its success of adopting a new technology, whereas the conventional wisdom suggests that such information disclosure is detrimental because it leads more potential competitors. This paper examines these firms' incentive of information sharing in a technology adoption problem.

Keywords: technology adoption, information sharing, disclosure

SESSION 2-E: INFORMATION AND INCENTIVES IN EMERGING AREAS OF SUPPLY CHAIN

Subsidy Policies with Network Externalities

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Many products exhibit network externality: a customer who has purchased the product makes his/her neighbors or friends more likely to buy the same product. This includes eco-friendly products such as electric vehicles and solar panels. The government subsidizes customers to promote such products. We find that it is optimal for the government to stop the subsidy when the total externality of the adopters reaches a threshold, which depends on the spectrum of the externality matrix. The optimal stopping time is not monotone in the strength of the externality between customers. We investigate how the structure of the network affects the stopping time and the optimal subsidy level set by the government.

Keywords: subsidy, network externality, optimal stopping

Managing Audit Evasion

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In supply chains, firms are typically exposed to negative impacts resulting from random adverse events that occur at and are privately observable to their suppliers. The firm can use fiscal instrument as well as inspections to uncover and hence remediate the adverse event. The supplier, however, prefers to conceal and even deliberately hide such adverse event so as to evade its responsibility. The goal of this paper is to devise optimal strategies for firms to induce the supplier's prompt disclosure in the presence of such evasive behavior.

Keywords: audit, evasion, disclosure, principal-agent, private information

SESSION 2-F: ECONOMIC MODELS IN OM

Is electricity storage green? A Study on Commercial Buildings

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Electricity storage facilities, such as industrial batteries, are considered the "holy grail" in decarbonizing the electrical grid. They are being widely installed in commercial buildings, e.g., hospitals, shopping centers. We model the problem of managing electricity storage in a commercial building as a Markov Decision Process. Our numerical results, based on models calibrated to the electricity load profiles of 100 commercial buildings in the U.S., show that for a majority of electricity load profiles, storage operation may increase carbon emission. This result continues to hold for the case where commercial buildings are covered with solar panels.

Keywords: electricity storage, commercial building, carbon emission, demand charge

Quick Response and Information Sharing in a Co-opetitive Supply Chain

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We consider a co-opetitive supply chain comprising a manufacturer with quick response (QR) ability and an original equipment manufacturer (OEM) with better demand signal, where the manufacturer acts as both the OEM's upstream partner and downstream competitor. We characterize firms' strategic choice between efficiency (early production without QR) and responsiveness (delayed production with QR) in equilibrium. We find that in the presence of competition, being responsive does not always benefit a firm because information value resulting from responsiveness is diminished by competition and early commitment value obtained through early production. Firms' strategic choice is influenced by their information acquiring and processing capacity (IAPC) and competition intensity. Both the two firms choose to be responsive when they are both poor in IAPC, while one chooses to be efficient and the other chooses to be responsive when they both have high IAPC. When their IAPC varies in a moderate range, their strategic choice depends on competition intensity. In the case where competition is sufficiently intense, the OEM chooses to be efficient because her information value is seriously reduced by intense competition, while the manufacturer chooses to be responsive to enjoy both information value and spillover value from the OEM's commitment value. Interestingly, when competition is not very intense, the OEM chooses to be responsive because if she chooses to be efficient instead, she will suffer from a significant cost increment paid to the manufacturer for contract manufacturing. The manufacturer chooses to be efficient because he can achieve either great performance in both self-branded business and contract manufacturing business, or higher market share in both "stock" and "increment". We also investigate the impact of information sharing on firms' efficient-responsive choice.

Keywords: quick response, efficient-responsive, demand signal, co-opetition, information sharing

On the Structural Properties of Wholesale Price Contracts within Random Yield Supply Chains

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We consider a bilateral supply chain with deterministic demand and supply random yield, and propose three variants of wholesale price contracts, which induce different risk allocations between the supply chain parties. We completely characterize the Pareto set of different contract type combinations to fully explore the price negotiation possibilities and profit improvement opportunities within the supply chain. Our analysis uncovers interesting structural properties among the three contract types and provide the underlying rationale for the good performance of wholesale price contracts within random yield supply chains.

Keywords: random yield, supply chain, wholesale price contract

A Price-Setting Retailer Sourcing from Competing Suppliers Facing Disruptions

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We study the problem of a price-setting retailer who sources from two strategic suppliers subject to independent or correlated disruptions and sets the retail price upon delivery. We model this problem as a Stackelberg-Nash game with the suppliers as leaders and the retailer as a follower, and obtain explicitly the equilibrium of the game. We show that the total order quantity in equilibrium does not exceed the abundant supply, defined as a threshold above which extra units will be salvaged. We study cases in which the retailer orders from one perfectly reliable supplier and one unreliable supplier, and from two correlated unreliable suppliers. In the latter case, the suppliers chosen are based on combining consideration of wholesale prices and reliabilities. In the responsive pricing scheme, for one reliable and one unreliable supplier, the retailer prefers the unreliable supplier having a higher reliability, because higher reliability will intensify the competition between suppliers and leave the retailer a higher equilibrium profit. For two unreliable suppliers, it is consistent with the literature that the equilibrium retailer profit increases in the supplier disruptions correlation, but the equilibrium suppliers' 'profits can increase in that correlation. We also show that the random disruption assumption is not a particular case of the random capacity assumption. We also consider the committed pricing scheme leading to a lower equilibrium retailer pro…fit. With one reliable and one unreliable supplier, single sourcing is always optimal for the retailer. With two unreliable suppliers, single sourcing is optimal sometimes and requires Bertrand competition between the two suppliers.

Keywords: Stackelberg-Nash game, disruption, responsive pricing, competing suppliers

Joint Replenishment and Transshipment for Three Locations – Asymptotics and Bounds

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We study a common problem faced by many firms in their supply chains. At the beginning of some selling season, the firm needs to order/distribute finished goods to a set of stocking locations. Over the selling season, if and when there is a supply-demand mismatch somewhere, a re-distribution or transshipment will be needed. Previous researches have shown some results for two distribution outlets/stores. Here, we expand it to three distribution stores. Applying a stochastic dynamic programming (DP) formulation to a three-location model with compound Poisson demand processes, we identify the optimal supply/transshipment policy and show the monotone structural properties. While due to the curse of dimensionality of the DP, we study two downward transshipment models and fully characterize the optimal polices. We develop upper and lower bounds on the DP value function, and show the asymptotic optimality of bounds. Based on bounds, we develop effective heuristics.

Keywords: inventory, transshipment, stochastic dynamic programming, bounds, asymptotic optimality

Joint Pricing and Inventory Control with Fixed and Convex or Concave Variable Production Costs

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This work considers a periodic-review joint pricing and inventory control problem for a single product where production incurs a fixed cost plus a convex or concave variable cost, and the objective is to maximize the expected discounted profit over the entire planning horizon. We fully characterize the optimal policy for the single-period problem, and develop a well-structured heuristic policy for the general problem, where a worst-case performance bound on the profit gap between the heuristic policy and the optimal policy is provided.

Keywords: inventory control, pricing, fixed and convex/concave cost

Joint Pricing and Inventory Management with Strategic Customers

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We consider a joint pricing and inventory management problem wherein a seller sells a single product over an infinite horizon via dynamically determining anonymous posted prices and inventory replenishment quantities. Customers arrive over time with a deterministic arrival rate but heterogeneous product valuations. Unlike typical inventory models, we assume that customers are forward-looking, who can strategize their times of purchases. A customer exerts efforts in monitoring price dynamics and thus incurs price monitoring cost. We allow the customer price monitoring cost to be heterogeneous among customers with an arbitrary distribution and have an arbitrary correlation with the customer arrival time. A customer incurs disutility from waiting for the product delivery since his arrival. A customer's arrival time, valuation, and price monitoring cost are all private information. The seller incurs fixed ordering cost and inventory holding cost. The seller seeks a joint pricing and inventory policy that maximizes her long-run average profit. We show that the optimal policy is cyclic, i.e., the seller repeats the pricing and ordering decisions over cycles of the same length. The optimal policy can be obtained without requiring the seller to have any knowledge about the customer price monitoring cost, such as its distribution or its correlation with the customer arrival time. Under the optimal policy, strategic customer equilibrium behaviors are proven to be myopic. The seller's optimal long-run average profit in the presence of strategic customers is the same as her optimal profit in an auxiliary classical backlogging model wherein customers are myopic that they make their purchasing decisions immediately upon their arrivals. Our results allow firms to incorporate strategic customer behaviors with little modeling and computational overhead. We adopt a mechanism design approach to prove the optimality of our proposed policy in the presence of strategic customers.

Keywords: mechanism design, joint pricing and inventory control, strategic customers, cyclic policy

Learning Valuation Distributions from Bundle Sales

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Bundling has been widely studied in the literature as a form of price discrimination. We show that it can also be used as a form of price experimentation - a mixed bundling scheme allows the firm to quickly learn the customer valuation distributions without having to change any prices. We present an iterative algorithm to reverse-engineer the valuations based on bundle sales, with theoretical convergence guarantees assuming the valuations are independent. Our extensive numerical experiments demonstrate that optimizing over the learned parameters extracts close to 100% of the optimal profit obtainable had we known the exact parameters.

Keywords: demand learning, bundling, revenue management

Online Assortment Optimization when Consumers Refine Their Search

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When shopping online, a consumer often searches a keyword and checks the products displayed by the e-retailer. In many cases, the e-retailer has numerous products matching the keyword, with different features, but is only able to show a subset of them due to limited displaying space. The assortment shown by the e-retailer influences the consumer's decision to buy or not. In addition, the assortment may trigger the consumer's interest in a specific product feature, leading the consumer to refine her search, and focus only on products with this feature. Taking this into consideration, we study the e-retailer's optimal assortment decision.

Keywords: consumer choice model, assortment optimization, online retailing

Assortment Optimization under a Synergistic Version of the Multinomial Logit Model

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We consider the revenue management problem of offering an optimal subset of goods when there are product synergies. The traditional multinomial logit choice model suffers from Independence of Irrelevant Alternatives and offering a larger subset must decrease each goods' choice probabilities. Our synergistic model has a similar structure but offering selected pairs of goods together can boost their choice probabilities. In the special case where synergy exists in a linear fashion, we provide an efficient dynamic program and show that the optimal subset can be found in one step by solving a simple linear program.

Keywords: assortment optimization, synergy

Efficiency and Performance Guarantees for Choice-based Network Revenue Management Problems with Flexible Products

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We consider the choice-based network revenue management problem (NRM). The LP relaxation, Choice-based Deterministic Linear Program (CDLP), has been proposed to mitigate the curse of dimensionality of the choice-based NRM. However, CDLP has an exponential size, which is still intractable for general choice models. We propose the Potential Based algorithm (PB) and Approximate Column Generation (ACG) that solves CDLP to near-optimality, assuming an approximation algorithm for the underlying single period assortment optimization problem. PB runs in polynomial time, while ACG is empirically efficient; both are shown to be more efficient than the classical Column Generation method on moderate size instances.

Keywords: revenue management, choice-based deterministic linear program, assortment optimization, choice model

Dynamic Nonlinear Pricing of Inventories over Finite Sales Horizons

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We present three dynamic pricing models in a setting where customers can be incentivized to purchase multiple units. The dynamic linear pricing (DLP) model charges a uniform price that depends on the time-to-go and the remaining capacity. The dynamic nonlinear pricing (DNP) model allows complete freedom in pricing different bundle sizes. We also study dynamic block pricing (DBP) as an intermediate scheme where prices are linear within each block, where the block can be either fixed or flexible.

Keywords: revenue management, multi-unit demand, customer choice, nonlinear pricing

Dynamic Mix-Bundling with Limited Inventory

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Consider a revenue-maximizing supplier who holds inventories for two components and sells a line of products made up of individual components and a package comprising these two components over a finite horizon. We develop dynamic mix-bundling methods, which control the quantity, the price, or both, to maximize the expected total revenue. We obtain the structural properties of the bid prices for these methods and illustrate the benefit of these dynamic pricing through empirical studies.

Keywords: revenue management, bundling, bid price, dynamic pricing

Dynamic Channel Control and Pricing of a Single Perishable Product on Multiple Distribution Channels

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In this article, we study the dynamic channel selection and pricing issue of a single perishable product faced by a multichannel seller over a fixed horizon. We first derive the optimal channel control policy, which is the decision rule on whether or not to select an available distribution channel as time elapses. We show that the optimal channel control policy is uniquely determined by the magnitude of the opportunity cost of capacity. Then, we characterize the structural properties of the optimal channel control policy. Finally, we explore the impact of the channel substitution effect on the optimal channel control.

Keywords: revenue management, dynamic pricing, multiple distribution channels, substitution effect, channel control policy.

Sensitivity Analysis on Responsive Pricing and Production under Imperfect Demand Updating

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We consider a pricing newsvendor who can postpone either the pricing or production decision until better market information is obtained and demand forecast is updated. Under a bivariate normal forecast updating model, we demonstrate for multiplicative demand that both strategies are similar to classic pricing newsvendor with reduced uncertainty. We also find that the performance of responsive production is sensitive to first-stage decision, while performance of responsive pricing is insensitive. We then characterize performance sensitivity of responsive pricing to parameter estimates. Our results suggest that a posterior rationale provides a simple yet near-optimal first-stage production heuristic for responsive pricing.

Keywords: responsive pricing, responsive production, sensitivity analysis, imperfect updating, interface between OM and marketing

Managing Cross-Channel with Uniform Pricing: Theory and Empirical Findings

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We assume the product has two attributes where the value of one attribute could be communicated to consumers online and that of the other requires visiting the store at a search cost. The firm's optimal prices for strategic consumers under both uniform and dual pricing are derived and compared. When the search cost is low, the uniform pricing outperforms the dual pricing; otherwise, the firm is better off with the latter. We demarcate conditions under which the firm's profit increases or decreases with the search cost. The theoretical results are assessed by the real data from Suning Appliances.

Keywords: uniform pricing, dual pricing, multiple attributes, cross-channel

SESSION 3-D: APPOINTMENT SCHEDULING

A Comparison of Traditional Overbooking and Pre-charge Strategies for Appointment System

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To migrate the negative effects of patient no-shows, a pre-charge strategy, which charges a deposit when requesting an appointment, is applied to some clinics' appointment systems. This paper considers two policies including to refund or not to refund the deposit, respectively. We compare them with the traditional overbooking strategy, i.e., accepting more appointments than the capacity. For both static and dynamic appointment scheduling, we find that the full refund policy sufficiently outperforms the traditional overbooking strategy in terms of net profits. For static scheduling, we drive the condition under which the refund policy outperforms the no-refund policy.

Keywords: appointment system, no-shows, refund, overbooking

MY-ATLAS: Mapping HCC Tumor Biology to Compute Equitable Exception Points

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In the United States, a significantly higher proportion of patients with hepatocellular carcinoma (HCC) receive liver transplantation than patients with end-stage liver disease (ESLD). We propose objective priority scores for HCC candidates based on the candidate's liver function and tumor biology. To evaluate our proposed policy, we build a validated computer simulator model of the liver allocation system. Our simulator predicts that our proposed policy will reduce the gap in the proportions of HCC and ESLD candidates transplanted from 15% to 5%; and result in a 7.5% increase in the 5-year transplant benefit.

Keywords: equity and efficiency, data driven decision making, simulation

SESSION 3-D: APPOINTMENT SCHEDULING

Markov Decision Process for Outpatients Scheduling with Eligibility Constraints

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Motivated by the outpatients scheduling problem in practice, we take the real life circumstance, the eligibility of physicians, into consideration. This paper aims to minimize the cost resulting from outpatients' waiting line. In our model, we consider two types of physicians serving two types of outpatients with random arrival time and service time. Modeling the problem as a Markov Decision Process, we solve this problem by policy iteration algorithm. We also show how our algorithm outperforms than two polices implemented in practice by conducting the simulation. Finally, we test the flexibility of our policy by numerical experiments.

Keywords: outpatients scheduling, Markov decision process, eligibility constraints, healthcare

Appointment Systems under Service Level Constraints

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We consider a new model of appointment scheduling where customers are given the earliest possible appointment times under the service level constraint that the expected waiting time of each individual customer cannot exceed a given threshold. We apply the theory of majorization to analytically characterize the structure of the optimal appointment schedule. We show that, the optimal inter-appointment times increase with the order of arrivals. That is, the optimal inter-arrival time between two customers later in the arrival process is longer than that between two customers earlier in the arrival process. We study the limiting behavior of our system, and prove that, when customer service times follow an exponential distribution, our system converges asymptotically to the D/M/1 queueing system as the number of arrivals approaches infinity. We also extend our analysis to systems with multiple servers.

Keywords: appointment scheduling; service level constraint; waiting time; majorization

A Behavioral Game Model for Solving an Abnormality in the Capacity Allocation Game

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We consider how to solve an abnormality in a capacity allocation game with two retailers and one supplier where the total demand of retailers exceeds the supplier's inventory and the limited capacity is allocated to each retailer proportional to his order quantity. The abnormality is that Nash Equilibrium predicts that each retailer's order quantity is infinity (or a set upper bound) while experimental data indicates a different trend in retailers' behavior. We propose a behavioral game model with the One-Shot Decision Theory to delineate retailers' mental procedure in the decision making process. Utilizing the model, we solve the abnormality.

Keywords: behavior operations management, capacity allocation game, one-shot decision theory

Scheduling Service Packages with Acclimation and Memory Decay: Model and Algorithm

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Designing memorable services is one of the key issues for many industries focus on consumer experience. In considering the effect of memory decay and acclimation, researchers have shown how the services should be sequenced and timed to maximize the customer satisfaction. Specifically, crescendo or U-shape schedule is suggested, but only heuristic algorithms are proposed for designing a schedule. We develop a dynamic programming algorithm to optimally solve the problem. We find that the proposed heuristics may have a substantial relative error versus the optimal schedule. We also discuss several management insights and further application of the model.

Keywords: service design, service scheduling, dynamic programming, behavior operations

SESSION 3-E: BEHAVIORAL OPERATIONS

Do Employees Leave their Jobs in Herds? An Empirical Study of Employee Turnover

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We use a secondary data set from a large distribution center on its monthly employee turnover to evaluate whether employees leave their jobs voluntarily in herds. We find that herding behavior is prevalent in employee turnover. Herding behavior manifests itself in three different ways. First, employees' leave/stay decisions in the same month are positively correlated. Second, voluntary turnovers over time are positively correlated. Third, a high voluntary turnover, surprisingly, is followed by a high involuntary turnover. This may suggest that a high voluntary turnover increases the intension of leaving among the remaining employees, which affects their job performance.

Keywords: herd effect, employee turnover, behavioral operations management, empirical study, panel data

SESSION 3-F: ECOMMERCE

Why and How do Branders Sell New Products on Flash Sales Platforms?

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Flash sales (FS) is a marketing mode under which brander firms sell products at discounted prices within a specified time. Studying why and how branders exploit FS to sell new products, we construct a model in which a brander sells a new product in two periods: first on an FS platform with some members and then in a bricks-and-mortar shop. We characterize the brander's optimal policy under the fixed-fee and two-part tariff charging mechanisms for using the FS platform. We show that the main aim of using the FS platform is for product promotion. In some special cases, the brander uses the FS platform as a profit source. We conduct numerical studies to assess the impacts of the model parameters on the brander's optimal policy.

Keywords: e-commerce, new product, pricing, network effect, flash sales

SESSION 3-F: ECOMMERCE

Integrated Model to Adopt Online Shopping in India: A Quantitative Approach

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Online shopping has become a key competitive strategy for online retailers (e-retailers). The purpose of this study was to examine the factors that impact attitude towards online shopping among Indian consumers. Variables of the extended technology acceptance model (TAM) and their antecedents were examined. Further trust and SERVQUAL constructs are integrated into the model. Data were collected from 326 online customers. The result highlights key antecedents, such as self-efficacy, time consumption, price saving, and connectedness, suggesting the importance of creating safe, interactive, and fun e-commerce platform. Empathy, reliability, responsiveness, assurance and trust as influencing factors were also identified.

Keywords: online shopping, e-commerce, adoption, India, TAM

Big Data Analytics for E-commerce Logistics in Various Countries[1]

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The rapid growth of e-commerce has complicated logistics management. However, few attempts have been made to investigate e-commerce logistics models, especially for differences between countries. Accordingly, this study develops a data mining approach to investigate e-commerce logistics of various countries. The empirical results of big data analytics reveal that e-commerce logistics in different countries have dissimilar characteristics such as detailed packaging information in France, secure box and electric vehicles in Germany and UK, advance payment in Netherlands, nearfield communication (NFC) in Singapore, and underground logistics network in Switzerland. The implications of these findings are also discussed.

Keywords: e-commerce, logistics management, data mining, big data analytics

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SESSION 3-F: ECOMMERCE

E-Commerce Demand Planning in a FMCG Market

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Increasingly, managing the e-commerce channel efficiently and effectively has become a critical success factor for many companies. Industry practitioners are keen to devise innovative ways to shape their e-commerce demand channels in a way that demand pattern shaping can be effectively executed. This paper focuses on identifying key business drivers of e-commerce from the literature which are then validated with a real case in FMCG. The e-commerce traffic sources are analysed, and key drivers are identified by grouping promotional events. Also, the relative importance of these drivers, which may be used to determine conversion rates of drivers, is measured.

Keywords: e-commerce, demand planning, non-parametric regression analysis, machine learning

SESSION 3-G: GAME THEORY AND COMPETITION

The Comparison of Two Outsourcing Strategies under Competition and Asymmetric Cost Information

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We consider a supply chain that consists of one supplier, two competing original equipment manufacturers (OEMs) and one contract manufacturer (CM) who produces products for these two OEMs. Each OEM may either directly procure the input from the component supplier (consignment), or delegate the procurement task to the CM (turnkey), but their purchase prices are different and remain unknown to each other. We study the OEMs' procurement game, and find that a larger market size will make both OEMs prefer consignment rather than turnkey.

Keywords: outsourcing, consignment, turnkey, asymmetric cost information, competition

Leadership and Information Exchange in a Supply Chain with Group Buying

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We study the problem of group buying in a supply chain composed of one GPO and two manufacturers competing in quantity. Our game-theoretic model investigates two power structures, in terms of different leaderships of group purchasing, and three information structures, in terms of whether the manufacturers share their information about the uncertain demand with the GPO and whether the GPO leaks the shared information. By analyzing the effects of quantity discounts, competition intensity, and the power on the information and material flows in the supply chain, suggestions for optimizing the information and power structure of group buying will be provided.

Keywords: supply chain management, information sharing, group buying, competition, power structure

Information Sharing in Competing Supply Chains with Green Innovations

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We investigate the incentive for vertical information sharing in two competing supply chains where the manufacturers can invest in green innovations. The retailers have private demand information and engage in Cournot competition. We characterize the equilibrium information sharing outcome and conduct sensitivity analysis.

Keywords: information sharing, competing supply chains, green innovations

SESSION 4-A: INNOVATIONS IN OPERATIONS MANAGEMENT

Incentive Issues in the Implementation of Urban Consolidation Centers

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The growth of e-commerce worsens the traffic congestion in cities. An urban consolidation center (UCC) is a potential solution, but many UCC projects have failed due to the reluctance of carriers to cooperate. In this paper, we develop a game-theoretical model that captures carriers' incentives. We find that the price that carriers are willing to pay for UCC's service is too low for UCC to make a profit. We propose that UCC can work as information intermediary among carriers for capacity sharing. In this case, UCC can always make a profit from commissions, and carriers have stronger incentives to cooperate.

Keywords: e-commerce, last-mile delivery, collaborative logistics, game theory, platform

Capacity Reservation Strategy under Consumer Panic Buying

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Consumer panic buying under public crisis has become a great threat to society stability in China. To ease the shortage risk of medicine caused by irregular buying, we study the retailer's strategy of capacity reservation under consumer panic buying. We consider that demand is determined by consumer's behavior and the utility of medicine, and the retailer reserves capacity from a backup supplier to deal with the demand fluctuation. The retailer's expected profit and optimal decisions of reserved quantity and order quantity from the regular supplier are analyzed. A numerical study is also developed to examine the features of retailer's decisions.

Keywords: consumer behavior, panic buying, capacity reservation

SESSION 4-A: INNOVATIONS IN OPERATIONS MANAGEMENT

An Improved NSGA-II Algorithm for Petrol Station Replenishment Problem with Drivers' Workload Balancing

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The new algorithm improves two aspects of the NSGA-II algorithm. Firstly, we design the balance objective in the form of the sum of differentia between driver's workload and make it become the fitness function. Secondly, instead of Split procedure for chromosome representation and evaluation in traditional genetic algorithm, a Split_Assign_procedure is proposed to optimize both the total cost and the driver's workload balance simultaneously. Computational results show that the proposed algorithm can generate a non-dominated solution set corresponding to distribution plans that perform well both in the total distribution cost and drivers' workload balance.

Keywords: petrol station replenishment problem, NSGA-II algorithm, workload balance

SESSION 4-B: RECENT DEVELOPMENT IN SUPPLY CHAIN MANAGEMENT AND SERVICE SYSTEM

Does More Private Information by Service Providers Always Hurt Customers?

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We investigate the functioning of a service system that consists of a self-interested service provider and a continuum of customers. Each customer has either a serious or a minor service need, and the service provider has either a high or a low qualification in treating customers. The service provider knows her qualification and, through a costless examination, learns about the customer's service need that however remains privy to the customer. She ex-ante offers a menu of charges (pricing strategy) and, after knowing the customer's actual need, ex-post recommends a service with the associated charge from the menu (recommendation strategy). The customer accepts the recommended service if the charge is less than the value he expects to receive based on his updated belief about his need and the provider's qualification. Our results reveal that the value of service by the provider with different qualifications, in absolute and relative terms, intricately influences the provider's pricing and recommendation strategies and the customer's service acceptance. Circumstances exist in which the service provider exaggerates about the customer's need by recommending an over-charged treatment and the customer may decline service. In this situation, the provider's fraudulent behavior and the customers' service rejection generates market inefficiency. However, customers do not necessarily suffer from their ex-ante uncertainty about the service provider's qualification.

Keywords: signaling, pooling equilibrium, separating equilibrium, fraudulent behavior, social welfar

SESSION 4-B: RECENT DEVELOPMENT IN SUPPLY CHAIN MANAGEMENT AND SERVICE SYSTEM

Strategic Rationale for Hedging in a Bilateral Supply Chain

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Washington University in St. Louis

We study hedging cash flow risks in a bilateral supply chain. Hedging reduces expected cost for firms due to the convexity of production cost in capital investment, while not hedging provides the flexibility for firms to adjust their operational decisions in response to different cash flow realizations. We quantify the tradeoff between the cost reduction effect and the flexibility effect of hedging, and characterize the firms' hedging decisions in the supply chain.

Keywords: hedging, supply chain, risk management, flexibility

Decision Structure and Performance of Networked Technology Supply Chains

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Supply chains in key growth industries increasingly commercialize a critical piece of technology invented by an upstream technology supplier. The focal technology is licensed to specialist design firms and designed into products, which are fabricated by dedicated large-scale manufacturers. We examine a technology supplier's licensing decision in such emerging three-party networked supply chains in which a downstream design firm's capability may not be publicly known. We find that the supply chain and firm profits are critically affected by whether or not a license agreement between a technology supplier and a design firm is kept confidential from a manufacturer. Instead of licensing to two downstream firms, a technology supplier may also license to an integrated firm with both design and manufacturing capabilities, which forms a conventional vertical supply chain. We compare a networked supply chain with a vertical supply chain, and show that the network model can outperform the integrated configuration and conditionally produce gains for all supply chain entities. In particular, a downstream firm can be better off decentralized, with design and manufacturing functions taken by different firms. Our research helps explain the emergence of such networked supply chains and offer prescriptions for structuring them for superior outcomes.

Keywords: technology supply chain, licensing, networked supply chain, information asymmetry

SESSION 4-B: RECENT DEVELOPMENT IN SUPPLY CHAIN MANAGEMENT AND SERVICE SYSTEM

Optimal Procurement Mechanisms for Assembly

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The University of Texas at Dallas

We consider an OEM's contracting mechanism to procure multiple inputs from different suppliers to be assembled into its product under simultaneous and sequential contracting. We derive optimal mechanisms under both contracting scenarios, and show that they can be implemented by simple tiered-pricing contracts which are widely used in industry assembly settings. We find that optimal simultaneous and sequential procurement mechanisms for assembly are revenue-equivalent for all parties, despite them having different asymmetric information structures. All results are extended to general convex costs and concave revenues, confirming that the results capture fundamental properties of optimal procurement mechanisms for assembly.

Keywords: mechanism design, screening, tiered prices, contracting timing, informed principal

SESSION 4-C: RETAIL PROMOTIONS AND REVENUE SHARING

Conditional Promotions and Consumer Overspending

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This paper investigates the effects of conditional promotions on consumer behavior and seller's profit. We model a market where consumers can be heterogeneous in two dimensions: willingness to pay for the product and deal-proneness to a price discount. Two types of conditional promotions are examined: i) all-unit discount, where a price reduction applies to every unit of a purchase once the minimum requirement is met, and ii) fixed-amount discount, where a fixed amount of discount is awarded to the total expense that meets the requirement. We show that the all-unit discount outperforms the fixed-amount discount if and only if the regular price of the product is sufficiently high relative to the consumer valuation of the product.

Keywords: conditional promotions, price discounts, deal-prone, overspending

Signaling Machine Reliability through Revenue Sharing for Radiation Treatments: Impact of Hospital Management Type

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We study the contracting problem between an equipment manufacturer and a hospital for radiation treatment. The manufacturer has private equipment reliability information that prevents the hospital to pay a high price for a reliable machine. In this environment, we show that the popular revenue sharing contract can serve as a signaling device and enhance the system efficiency. It is shown that signaling through revenue sharing is more effective for not-for-profit hospitals than for for-profit ones.

Keywords: medical management, revenue sharing, signaling, information asymmetry

Online In-store Referrals for Products with Heterogeneous Quality

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E-commerce retailing pioneers started to display the links of competitors' products directly on their web pages to generate revenues through revenue sharing mechanisms. By studying two competing retailers having heterogeneous product qualities in a game-theoretic manner, we examine how product quality and revenue sharing ratio influence the retailers optimal contract design in terms of in-store direct referrals. We find that the low-quality retailer has more incentives to refer the high-quality product. Nevertheless, when the quality difference is small enough, no referral will take place in a market equilibrium. Finally, a revenue sharing mechanism helps the establishment of a referral relationship.

Keywords: online in-store referrals, heterogeneous quality, vertical differentiation, game theory

Supply Chain Performance with A Target-oriented Retailer

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In a supply chain with one profit-maximizing supplier and one target-oriented retailer whose goal is to attain a target profit, we investigate how the retailer's target-oriented preference affects the supply chain performance. We show that the supplier and the supply chain can significantly benefit from the retailer's target-attaining behavior and a more interesting finding is that, the target-oriented retailer can sometimes help the supply chain achieve the same efficiency level as in a centralized system. We also use experimental data to verify our linear target formation model, and extend our analysis to the information asymmetric scenario.

Keywords: target-oriented retailer, target models, supply chain performance

Relationship between Upstream and Downstream Supply Chain Networks and Performance

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We examine firms' upstream cost concentration and downstream revenue concentration and their relationship with operating performance. We also provide evidence on how supply chain network structure act as catalysts in influencing this relationship. To test our hypotheses, we use cost and revenue supply chain relationship data for manufacturing firms in the electronics industry. Our results suggest that while operating performance is influenced concentration both upstream (as a customer) and downstream (as a supplier), this effect can be attenuated or enhanced by the way that its supply network is structured.

Keywords: supply chain network, cost concentration, revenue concentration

The Benefit of Scale: Capacity Allocation in Differentiated Service System

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We study the capacity pooling problem under Type 1 service level constraints. Two classes of capacity allocation polices, responsive and anticipative rules, that differ on whether using realized demand or not, are proposed to attain the desired service levels. We show that the capacity required using randomized anticipative rules is much smaller than the one using fixed priority rules. There is essentially no safety capacity required when the number of customers is large. Interestingly, while the incremental benefits from using responsive rules may not be large, we propose a new responsive allocation rule to characterize the optimality of capacity needed.

Keywords: Blackwell approachability theorem, capacity pooling, type 1 service level

Asymmetry and Ambiguity in Newsvendor Models

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A basic assumption of the newsvendor model is that the probability distribution of the demand is known. However, often only partial information is available. In this work, we introduce a measure of asymmetry in distributionally robust newsvendor problems using partitioned statistics. With mean, variance and semivariance information, we derive a closed-form expression. For multivariate demand, we develop a lower bound through semidefinite programming. We demonstrate in numerical experiments that asymmetry information reduces expected profit loss when the true distribution is heavy-tailed. We provide evidence with automotive spare parts data that partitioned statistics helps outperform the covariance based model.
Keywords: risk management, revenue management

Fashion and Homophily

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We analyze the evolution of fashion based on a network game model. Each agent in this model is either a conformist or a rebel. A conformist prefers to take the action that is most common among her neighboring agents, whereas a rebel prefers the opposite. When there is only one type of agents, the model possesses an exact potential function, implying that fashion cycles are unlikely to emerge in a homogeneous population. The homophily index, a basic measure for networks with multiple types of nodes, is shown to play the key role! in the emergence of fashion cycles. Our main finding is that a lower homophily index, in general, promotes the emergence of fashion cycles. We establish this result through a potential analysis, a partial potential analysis, and a stability analysis of a system of ordinary differential equations that is approximated from a stochastic best response dynamic. Numerical simulations based on a variety of networks confirm that the approximate analysis is reliable.

Keywords: network games, matching pennies, fashion cycle, homophily

Inventor Diversification in Technology Networks

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Inventors may follow different patterns and strategies to diversify across technology domains in their constant search for new innovation opportunities. However, we still do not have a systematic picture on the patterns of inventor diversification and the performance implications of different diversification patterns. In this study, we created a network map of 629 technology domains and their relationships, using citation data from 4 million patents to measure if each pair of domains interacted more than would be expected by chance. We show that inventors well followed the network map structures when they diversified -- an inventor who has previously patented in a domain is more likely to successfully patent in a more connected new domain in the network, over a less connected one, and to continue to patent more in a more connected domain despite a lower value of the patents. The technology network map can help individuals, organizations and governments to make more informed strategic decisions on technology diversification.

Keywords: innovation, diversification, networks, patents

The Coevolution of Constrained Network Formation and Minimum-Effort Games

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This paper develops a co-evolutionary model, where agents playing a minimum-effort game have to choose not only the effort levels but also with whom they would like to play the game. Each agent's payoff depends on both the minimum effort among the choices of all the agents playing the game together and the number of her partners, which is constrained by a common up per bound M. We find that, in the long run, every player will choose M partners. Further, if M is small, the coordination on high effort will be selected; if M is large, the coordination on low effort will be selected; remarkably, if M is intermediate and the marginal payoff of coordinating on the medium effort is large enough, the coordination on the medium effort will be selected.

Keywords: minimum effort game, network formation, learning, equilibrium selection

Optimal Nonlinear Pricing in Social Networks under Asymmetric Network Information

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We study the optimal nonlinear pricing of products / services in social networks, where customers are strategic and their consumptions exhibit local externality. Our model concerns information asymmetry: customers know about their local network characteristics while the selling firm only has knowledge of global network. We allow the firm to adopt nonlinear pricing scheme to serve customers with heterogeneous and unobservable network positions. The firm's profit maximization resembles a principal-agent problem, complicated with the externalities in agents' payoffs. We develop a novel solution approach using calculus of variations to tackle this non-standard principal-agent problem. We show that the optimal pricing scheme can be either quantity premium or quantity discount, which is in strict contrast with the linear pricing case. Applying our results to the random graph, we find that the pricing scheme should not discriminate by network positions; consequently, the firm can offer a simple uniform price.

Keywords: local network effects, game theory, information asymmetry, nonlinear pricing

City-center Supply of Airport Ancillary Goods

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We consider an airport that offers runways and ancillary goods such as souvenirs and food & beverages. The airport is a monopoly supplier of runways but competes a la Bertrand with a city-center company in the area of ancillary businesses. To our knowledge, this is the first paper that considers the price rivalry of an airport with city-center companies. In the Bertrand-Nash pricing equilibrium, the airport and city-center price markups for ancillary goods are (strictly) positive and equal even in the absence of capacity constraints. This provides one explanation why ancillary businesses are attractive for airports in a competitive environment.

Keywords: airports, ancillary goods, welfare-neutrality, equilibrium pricing

A Heterogeneous Fleet Two-echelon Capacitated Location-routing Model for Joint Delivery arising in City Logistics

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City logistics is about finding efficient and effective ways to transport goods in urban areas while taking into account the negative effects on congestion, safety and environment. This paper focuses on optimization in designing Intermediate Depots(IDs) for joint delivery alliances in parcel deliveryindustry, explicitly taking into account heterogeneous fleet and practices of joint delivery alliances in China. The objective is to determine the set of IDs to open and the routes originating from each of them to minimize a total cost comprised of the setup costs of IDs and the total variable cost of the routes. A powerful cooperative approximation metaheuristic is developed and successfully applied to a benchmark instance. Extensive analyses are performed to empirically assess the effect of various problem parameters, such as the comparison between heterogeneous and homogeneous fleets, demand change on key performance indicators, including operational costs, emissions and traffic congestion.

Keywords: city logistics, last mile, joint delivery

SESSION 4-F: LOGISTICS PLANNING

Cross-border E-commerce Solutions for China and Europe: Interview Survey

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Businesses are increasingly adopting cross-border e-commerce model as it provides competitive advantage of easily reaching customers, fulfilling their needs in international markets, and increasing profit, without any heavy upfront investments in market testing, while reducing inventory-related costs and risks. Cross-border e-commerce supply chain comprises multiple parties: manufacturers, e-retailers and platforms as a supplier side; consolidators, freight forwarders and postal operators as a logistics side; and end-customers. This study examines future opportunities for a European postal organization to enter B2C China to Europe e-commerce market, via interview survey with potential customers of manufacturers, e-retailers/platforms, and consolidators; and discusses survey results.

Keywords: B2C cross-border e-commerce, China, Europe, postal organization

SESSION 4-G: SUSTAINABLE OPERATIONS MANAGEMENT

Impacts of Contracts on a Supplier's Environmental Innovation under Emission Tax on a Manufacturer

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Many governments impose a tax on manufacturers' pollutant emissions. Under such an emission tax, manufacturers are motivated to seek emission reduction technology (i.e., environmental innovation) in their production processes. While a large portion of such innovation can be conducted by an upstream supplier in a supply chain, stimulating a supplier's environmental innovation by a manufacturer is a challenging task; the cost of environmental innovation is incurred to the supplier whereas the tax abatement achieved from emission reduction belongs to the manufacturer. To mitigate this incentive conflict, we analyze three popularly used supply chain contracts on supplier's environmental innovation.

Keywords: environmental innovation, supply chain, emission tax, contracts

The Optimal Reverse Channel Choice under Supply Chain Competition

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This paper extends the model of Savaskan et al. (2004) to examine the impact of supply chain competition on the optimal reverse channel choice of manufacturers who remanufacture their own products. Even for two identical supply chains, asymmetric equilibria of strategic reverse channel choices may arise, in which one prefers retailer-managed collection and the other prefers manufacturer-managed collection. There exists a prisoner's dilemma in which the Pareto optimal solution is for both manufacturers to use manufacturer-managed collection, but retailer-managed collection is a dominant strategy.

Keywords: supply chain management, remanufacturing, reverse channel choice

Revisiting an intelligent Particle Swarm Optimization Algorithm

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In earlier works, many researchers have observed several potential disadvantages of the original Particle Swarm Optimization (PSO) algorithm. One of the disadvantages is the tendency of the algorithm to cluster toward a local optimum. In other words, the original PSO algorithm tends to cause a premature convergent phenomenon. In this article, we develop an intelligent PSO algorithm to eradicate the problem. The algorithm has potential application in supply chain management and sustainable operations management.

Keywords: sustainable operations management, meta-heuristics, particle swarm optimization, swarm intelligence algorithms

SESSION 4-G: SUSTAINABLE OPERATIONS MANAGEMENT

Green Technology Development and Adoption: Competition, Regulation, and Uncertainty – A Global Game Approach

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When a government is considering tightening a standard on a pollutant, their decision often is influenced by the number of firms being able to meet the tightened standard, because a higher number indicates a more feasible standard. We study how such regulation may affect a firm's incentive to develop a new technology to reduce a pollutant. We find that regulation that considers industry capability, compared with regulation that ignores it, can more effectively motivate development of a new green technology. Surprisingly, uncertainty in the payoff can also promote development of a new green technology.

Keywords: environment, global game, regulation, sustainability, technology

SESSION 4-H: DATA DRIVEN RESEARCH

The Data-driven Analytics for Investigating Food Logistics Management[3]

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Food logistics plays an essential role in fulfilling food delivery requirements. Nonetheless, little effort has been made to investigate business models of food logistics. Hence, this study aims to tackle food logistics issues through big data analytics. Specifically, this study proposes a framework of data-driven analytics to extract essential business models of food logistics. The analytical results of text mining reveal that food logistics companies with rich distribution experience, high technology, and superior customer service are more likely to have better performance in the ranking of food logistics companies. The implications of these findings are further discussed.

Keywords: logistics management, data-driven analytics, food logistics, text mining

[3] This work is partially supported by Ministry of Science and Technology, Taiwan, R.O.C under grant MOST 105-2221-E-035-020.

Developing a Simulation Model of a Tram Network by Using Historical RFID Data

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In this talk, we will present a real-world application that utilizes historical RFID data for the development of a simulation model of a tram network. The historical data about the tram locations are used to model the travel times of trams at different times of the day. Our simulation model allows the tram company to examine the impacts of different tram schedules on the service requirements and other performance measures.

Keywords: disruption management, tram network, simulation, optimization, big data

A Location Based System for Managing Cart Operations at a Mail Facility

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We have developed a location based system for managing cart operations at a mail facility. The RFID-tag attachments to carts and reader mounts at the top of the building allows the facility operators to locate target carts quickly. We have also conducted an initial analysis of data collected using this technological infrastructure to understand issues on cart movements and operational efficiency.

Keywords: cart operations, mail facility, distribution centre, RFID, big data

Service Segment Competition: Size or Target, Which Matters?

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We obtain the structural properties of the bid prices for these methods and illustrate the benefit of these dynamic pricing through empirical studies. We consider a service market with two firms that provide regular and premium services respectively. Customers are delay sensitive and heterogeneous on evaluating the service level. We show that the service differentiation, together with customer heterogeneity, results in market segmentation. We then study two competition games that differ in segmentation-marketing strategies. One is the segment-target competition, and the other is the segment-size competition. For both games, the Nash equilibrium always exists, and the (Pareto dominating) equilibrium is unique. Interestingly, the premium service provider's effective arrival rate can be increasing in the firm's competitor's service rate in the segment-target game. Moreover, we capture the condition for the equilibrium market as either a monopoly or a duopoly and show that segmentsize competition helps sustain the service variety. We also show that the premium (regular) service provider serves more (fewer) customers in the segment-target game than in the segmentsize game. Numerical results illustrate that the number of customers who get served, the customer surplus and social welfare are higher, while the prices and total revenue are lower in the segment-target game than in the segment-size game, thus indicating that the competition is more intensive in the segment-target game than in the segment-size game.

Keywords: queueing economics, differentiated services, market segmentation, strategic customers, equilibrium analysis.

Banks' Efficiency and Its Determinants: Evidence from Chinese Mainland and His two SARs

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China, being the only country which has two SARs, is on the way to global market-oriented banking system. Using super-efficiency DEA model, we focus on banks' efficiency between Chinese mainland and his two SARs during 2008-2015. During the consolidation period, bank efficiency among these three areas shows different developing trend. And our empirical evidences certify the general wisdom that increasing diversification benefits banks in terms of better efficiency. We further indicate that the higher the degree of economy freedom, the better the banks' efficiency, which provides support for Chinese economic openness.

Keywords: banks' efficiency, DEA, special administrative region, economic freedom

Managing Appointment-based Services in the Presence of Walk-in Patients

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Despite the prevalence and significance of walk-ins in healthcare, we know relatively little about how to plan and manage the daily operation of a healthcare facility that accepts both scheduled and walk-in patients. In this paper, we develop the first optimization model to determine the optimal appointment schedule in the presence of potential walk-ins. We show that the natural formulation of the problem, which is difficult to deal with directly, can be reformulated as a two-stage stochastic integer program with a simple and tractable structure. This modeling framework is very flexible, and can accommodate random service times, patient-dependent and time-dependent no-show behaviors as well as patient preferences. We demonstrate that, with walk-ins, the structures of the optimal schedule are fundamentally different from those identified in the earlier literature which does not consider walk-ins. Using data from practice, we predict a significant cost reduction (20% reduction on average and max 59%) if providers were to switch from current practice to our proposed schedules. Though our work is motivated by healthcare, our models and insights can be applied to general appointment-based services in the presence of random walk-in customers.

Keywords: service operations management, healthcare, appointment scheduling, walk-ins, optimization.

How does the Manufacturer's Extended Warranty Policy Affect its Original Basic Warranty?

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This article examines the impact of manufacturer's extended warranty policy on its original basic warranty. The manufacturer involved in extended warranty business faces a dilemma when making their basic warranty policy. We develop a brand and warranty period-dependent demand model to determine and compare the optimal basic warranty periods under each scenario. We show that by taking the extended warranty into consideration, the manufacturer could provide a longer basic warranty bundled with the product to gain the maximum profit. Comparing to the step by step promotion, synchronous promotion would bring the manufacturer greater profits under shorter basic warranty.

Keywords: basic warranty, extended warranty, brand and warranty period-dependent demand

Quality Disclosure Strategies for the Firms in a Competitive Marketplace

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In this paper we use a game-theoretic approach to investigate the quality disclosure strategies. We consider that there are two firms with heterogenous product quality competing in a competitive marketplace. In the first stage of the game, each firm decides whether to disclose its quality information to customers through the retailer. In the second stage of the game, the firm decides the selling price, or it decides the wholesale price and the retailer decides the selling price, according to the disclosure strategies. By deriving the optimal disclosure and pricing strategies for the firms, we obtain some interesting results.

Keywords: quality disclosure, information asymmetry, competition

SESSION 5-A: WARRANTY AND QUALITY MANAGEMENT

Study on the Flexible Preventive Maintenance Strategy for Products Sold with Two-dimensional Warranty

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Due to lack of flexibility in the maintenance policy design for two-dimensional warranted products, a mathematical optimization model based on flexible preventive maintenance were developed, in which the number and degrees of preventive maintenance were decision variables and the minimizing the warranty cost of the manufacturer was the objective function. Through data experiments under two conditions, namely with and without preventive maintenance, the total warranty cost under the two conditions were compared. The results revealed that the two-dimensional warranty policy with flexible preventive maintenance strategy could effectively reduce warranty cost, but also satisfy the requirements of different customers.

Key words: two-dimension warranty, flexible preventive maintenance, usage rate, operations management.

SESSION 5-B: LOGISTICS MANAGEMENT

Routing Optimization of Hazmat Multimodal Transportation Based on CVaR Assessment

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Multimodal transportation plays a more significant role in the long distances transportation of hazardous materials. Considering that the risk of hazmat transportation has the characteristics of low probability and high consequences, this paper studies how $CVaR$ applied in the risk assessment of the hazmat multimodal transportation. Traditional calculation methods have weakened the extreme situations, however, $CVaR$ is widely used in financial markets to measure portfolio risk, and gets approval because of its better measurement in the tail loss. We build an risk assessment model based on the $CVaR$ risk measurement in this paper, and prove its effectiveness by a computational study of road-rail multimodal transportation. And to a certain extent, the results could provide reference for the hazmat suppliers to make routing decisions.

Keywords: hazmat, multimodal transportation, CVAR, risk assessment, route optimization

Container Assignment with Elastic Demand

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This paper proposes a practical tactical-level liner container assignment model for liner shipping companies, in which the container shipment demand is a non-increasing function of the transit time. Given the transit-time-sensitive demand, the model aims to determine which proportion of the demand to fulfill and how to transport these containers in a liner shipping network to maximize the total profit. Although the proposed model is similar to multi-commodity network-flow (MCNF) with side constraints, unlike the MCNF with time delay constraints or reliability constraints that is NP-hard, we show that the liner container assignment model is polynomially solvable.

Keywords: liner container assignment, multicommodity network-flow problem with side constraints, link-based formulation, linear programming

A Stakeholder Analysis of Logistics Synchronization with Consolidation Strategy in Food Supply Chain

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Efficient use of logistics resources - trucking capacities, loading/unloading docks, workforce, and storage space - is becoming a challenge in last-mile logistics. Success of the various strategies proposed to tackle this problem ultimately requires stakeholders' full participation. In this paper, we consider a strategy where deliveries in last-mile logistics are synchronized and consolidated to ensure higher truck load utilization with a challenge of meeting higher service levels. A stakeholder analysis was conducted to investigate the usability of this strategy in a food supply chain.

Keywords: last-mile logistics, stakeholder analysis, consolidation strategy, food supply chain

SESSION 5-B: LOGISTICS MANAGEMENT

Generating Delivery Plans in Real Time by Dynamically Evaluating Multiple Scenarios

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Many Internet sellers now commit a very short lead-time for delivery upon the confirmation of orders. This requires to generate a delivery routing plan in real time. This paper presents a solution framework that dynamically traces the buyers' ordering process. The core is a genetic algorithm designed to consider multiple possible delivery scenarios at the same time. It generates a pool containing situations which are more likely to happen and adjust the pool according to current customers' purchasing progress. With consideration of possible scenarios in advance, a delivery route with low cost can be obtained immediately after the cutoff time.

Keywords: delivery with multiple scenarios, TSP, genetic algorithm

SESSION 5-C: STRATEGIC CONSUMERS AND ROBUST OPTIMIZATION

To Ration or Not To Ration? Selling To Strategic Customers under Shortage Effect

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We consider the dynamic pricing and rationing policy of a firm facing strategic customers under the influence of shortage effect. We provide conditions under which it is optimal for the firm to ration. We also identify the necessary and sufficient conditions for the existence of steady state. We also characterize the firm's pricing and rationing policy under this steady state.

Keywords: shortage effect, rationing, strategic customers

Modeling with Infinitely Constrained Ambiguity Sets

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We propose and motivate a new class of infinitely constrained ambiguity sets in distributionally robust optimization. This class of ambiguity sets would allow ambiguous distributions to be characterized by potentially an infinite number of expectation constraints. We show how the infinitely constrained ambiguity set can be used to incorporate covariance and entropic dominance in its description. In particular, we demonstrate that our proposed entropic dominance approach can improve the characterization of stochastic independence over existing approach based on covariance information.

Keywords: distributional ambiguity, robust optimization

Mitigating the Price Fluctuation in Quota Systems

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Quota systems have been widely used to control some public-interest goods (e.g. greenhouse gases emission quota systems). A special feature of managing the quota for public-interest good is that usually the decision makers, such as the government, do not just focus on the profit. In this work, we consider the quota control decision, where the objective is to smooth the selling prices over time. We study the problem under the robust optimization framework and use Conditional Value-at-Risk (CVaR) as a convex approximation to the chance constraint. Computational studies to demonstrate the effectiveness of the proposed method.

Keywords: robust optimization, CVaR, public-interest goods

SESSION 5-C: STRATEGIC CONSUMERS AND ROBUST OPTIMIZATION

Cost Sharing for Capacity Transfer in Cooperating Queueing Systems

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This paper considers the problem where independent operators of queueing systems may cooperate to generate a win-win solution through capacity transfer among each other. We distinguish the capacity transfer problem in two queueing networks: a single-server queueing network and a multi-server queueing network. In the single-server network setting, service rates are considered to be capacities and are assumed to be continuous, while in the multi-server network setting, servers are treated as capacities and considered to be discrete. For each setting, we propose cost sharing schemes that belongs to the core of the corresponding cooperative game.

Keywords: queueing system, capacity transfer, cooperative game theory, cost sharing

SESSION 5-D: CONTRACT DESIGN

Hotel Online Booking Segmentation for Heterogeneous Customers

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This paper studies two types of hotel booking contract - booking with and without prepayment - appeared in the hotel online reservation system (ORS). The hotel uses them to segment heterogeneous customers who are different in both the willingness to pay and the arriving probability. We get the hotel's optimal pricing strategies and corresponding payoffs with and without capacity constraints. The results show that when capacity is limited and related small the hotel prefers single contract without prepayment while capacity is limited and relatively large the hotel prefers to take two contracts to segment different customers. However, when capacity is unlimited adopting the single contact without prepayment and adopting two contracts are undifferentiated for the hotel. Besides, we test related results through real data and extend our model by considering the hotel's service decision for two contracts.

Keywords: contract design, online reservation, market segmentation, capacity constraint

SESSION 5-D: CONTRACT DESIGN

Contract Design and Renegotiation under Loss-aversion in Public Projects

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In many sectors, the private operator operates the public projects on behalf of the government and obtains profit from project revenue and government subsidy. We characterize the contract between the government and the private operator by operation price and government subsidy. Since demand cannot be perfectly forecasted ex ante, the government may initiate renegotiation when demand changes. In this paper, by taking the initial contract as reference point, we investigate the effect of loss-aversion on subsequent renegotiation and derive the optimal renegotiated contract. By noting that the initial contract affects the likelihood of renegotiation, we have further investigated the optimal initial contract.

Keywords: contract design, subsidies, reference point, loss-aversion, renegotiation

Rights of First Negotiation and Rights of First Refusal in New Product Development Partnerships

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We compare the efficacy of offering the rights to first negotiation and the rights to first refusal in innovation partnerships between pharmaceutical firms and CROs like biotechnology firms in drug development. The setting is based on future development prospects based on a partnership on a current drug development project. We first show that without providing any rights to the partnering firm lowers the efforts of the partner in the current development project, and then compare the outcomes for the partners when the rights are offered by the biotech firm to the pharmaceutical firm.

Keywords: collaboration, New product development, contracting

Manufacturer's Channel Selection and Pricing Strategies under E-commerce

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This study investigates the channel selection and pricing strategies based on the existing direct channel of the manufacturer under e-commerce. We classify consumers into different segments according to their preference of the channels. Three kinds of channel models including the single channel model (Model D), the dual-channel model with and without service decision (Model DS and Model DE) are developed in this paper. We find that the manufacturer's selling price in the direct channel is unnecessarily lower than its e-tailer's though it naturally has cost advantage. Actually, it would be higher when the consumer preference is far less than (resp., less than) the e-tailer channel in Model DE (resp., Model DS). Direct channel helps the manufacturer to improve the profits by increasing the consumers' reference price through increasing the wholesale price and the direct price.

Keywords: channel selection/design, dual channel, e-commerce, reference price

Dual-channel Service and Pricing Strategy based on Service Free-riding

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There is a supply chain system which includes a manufacture and a retailer. Manufacture sells to their consumers through the online channel. Retailer sells directly to their consumers. Meanwhile, retailer gets the products from manufacture with the wholesale price W. Suppose that only the retailer offers service to the consumers. In reality, some of consumers tend to experience the product at the retail store before purchasing online. It indicates there exists free-riding problems. Our model focuses on the wholesale price and service level under service free-riding. So, in our research, manufacture how to set W and retailer how to set S are the two major problems to work out in this research.

Keywords: dual-channel, free-riding, wholesale price, service level

SESSION 5-E: CHANNEL AND PURCHASING MANAGEMENT

Coordinating Supply Chains: Impacts of Channel Leadership and Information Asymmetry

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This paper studies the effects of channel leadership and information asymmetry on supply chain coordination. Three all-units quantity discount (QD) contracts are examined: the manufacturer-led QD (MQD), the retailer-led QD (RQD), and the vendor managed inventory QD (VQD), which represent different channel leaderships. We find that any VQD that coordinates the supply chain has an equivalent RQD counterpart. MQD achieves coordination only if the actual supply chain's optimal quantity is known, but this condition is not needed for RQD, and a menu of RQD provider more flexibility for coordinating supply chain.
Keywords: channel leadership, supply chain coordination, asymmetric information

SESSION 5-G: SUPPLY CHAIN MANAGEMENT

Free Rider and Deterrence of Supply Chain Encroachment

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We study a supply chain in which the incumbent OEM is the quality leader and the encroaching CM is the quality follower. In this setting, we investigate the CM's encroaching conditions, and we show that, there is a threshold for CM's imitating capability, in excess which, the CM will encroach on the OEM's final market and product differentiation is not preferable. Then we study the OEM's deterring strategies: quality investment and legal weapon. We find that severe legal environment may not always be beneficial to both the OEM and CM, although it can prevent the CM's encroachment.

Keywords: quality competition, legal environment, deterrence of encroachment

Research on Supply Chain Lead Time Optimization Based on Shelf Life

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Consumers can quickly capture the information of products and result in behaviors of purchasing goods in E-commerce. Compared to traditional purchasing methods, the demand uncertainty is amplified in this background. Based on short shelf life, manufacturer tends to take MTO strategy, but MTO brings about long lead time, resulting in retailer's high stock level. Manufacturer can consider taking MTO-MTS strategy to increase the supply chain's ability of fast response, and reduce the risk of supply chain. In MTO-MTS, manufacturer how to hold stock, retailer and manufacturer how to synergy in shortening the lead time are the two major problems to work out in this research.

Keywords: lead time, MTS-MTO, supply chain, shelf life

Sourcing Strategy of Strategic Items by Considering the Total Supply Chain Cost and Order Allocation to Suppliers in an Auto Industry

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In this paper, automobile components are classified based on the kraljic matrix and suppliers based on supplier segmentation matrix. We develop an integrated production–distribution model considering suppliers of raw material for an auto industry in a multi-echelon supply chain. The developed model is solved by GAMS and analysis is carried out by changing order allocation to strategic raw material suppliers. Sourcing strategy is proposed based on total supply chain cost and order allocation to suppliers from the model output, demand-supply gap and supplier's technological capability.

Keywords: strategic sourcing, GAMS, supply chain, production-distribution, integrated model

SESSION 5-G: SUPPLY CHAIN MANAGEMENT

Optimal Timing of Product Introductions When Consumers Exhibit Context-dependent Preferences

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To achieve the most profitable discrimination, it is significant for a seller with vertically differentiated products to determine whether, how, and in which order to introduce the products. And evidence in behavioral economics suggests that individuals may compare available options, and preferences between options are often dependent of the specific choice context. Since the seller's optimal timing decisions on product introductions would define consumers' choice context, the account of context management, besides the discrimination goal, may generate implications beyond the current studies. Thus, we revisit the problem by considering consumers' context-dependent preferences and discuss the implications of our results.

Keywords: context-dependent preferences, behavioral economics, context management, product introduction, price discrimination

SESSION 5-H: BUSINESS ANALYTICS FOR DECISION MAKING

Flexible Market Response Model with Price-Dependent Heteroscedasticity

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Motivated by the fact that actual demand may have price-dependent heteroscedacity and skewed distributions, this paper proposes a flexible market response model in which the distribution of log-demand belongs to a location-scale family and the location and scale functions are price dependent. Furthermore, the nonlinear and irregular shapes of the price-demand relationship are modeled by using regression splines. We also construct a constrained maximum likelihood framework to estimate the location and scale functions. Based on this market response model, we also study the price-setting newsvendor problem. For rather general demand distributions, we demonstrate that the expected profit function is unimodal without assumption on the monotonicity of the demand variance. We further establish a unimodality condition under the standard log-normal assumption for demand estimation. This condition does not impose monotonicity constraint on either the demand variance or its coefficient of variation. Therefore, our demand model ensures no trade-off is needed between precision in estimation and efficiency in optimization when applying the price-setting newsvendor model in practice. Using real retail data, we demonstrate that the unimodality conditions are satisfied in a certain price range. Our empirical study shows that our demand model can significantly improve the prediction accuracy comparing with the existing parametric models.

An Easy-to-implement Variable Selection Method for Models Following Heredity

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In many practical regression problems, it is desirable to select important variables with heredity constraint satisfied. In other words, when an interaction term is selected, it is preferred to select all the corresponding main effects as well. In this paper, we propose a general strategy to maintain heredity in variable selection through a novel heredity-induced data standardization. After the standardization, any variable selection method (including stepwise selection, lasso, SCAD and others) can be applied and the selected model is automatically guaranteed to satisfy the heredity constraint. Furthermore, the same procedure works for all types of regression including linear regression, generalized linear regression and regression with censored outcome. Therefore, our proposed strategy is easy (almost effortless) to implement in practice to maintain the heredity. Simulations and real examples are used to illustrate the merits of the proposed methods.

Simulation Based Predictive Analytics for Dynamic Queueing Systems

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Simulation and simulation optimization have primarily been used for static system design problems based on long-run average performance measures. Control or policy-based optimization has been a weakness, because it requires a way to predict future behavior based on current state and time information. This work is a first step in that direction with a focus on congestion measures for queueing systems. The idea is to fit predictive models to dynamic sample paths of the system state from a detailed simulation.

SESSION 5-H: BUSINESS ANALYTICS FOR DECISION MAKING

Reducing Inventory Waste:

Optimal Order-Up-to Level with Service Level Agreements in a Finite Horizon

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We examine the behavior of the fill rate distribution over a finite horizon with positive lead time, and prove that the expected fill rate assuming an infinite performance review horizon exceeds the expected fill rate assuming a finite performance review horizon, which implies the existence of inventory "waste" (i.e., overstocking) when the traditional procedure is used. The primary implication is that ignoring the performance review horizon in an SLA will cause overstocking, and moreover, this problem is more severe when the lead time is large and the review horizon is small under the non-steady-state.

Keywords: service level agreement, fill rate, base-stock policy

SESSION 5-I: ECONOMICS AND OPERATIONS MANAGEMENT

On the Interaction between Product Rollover Strategy and Pricing Scheme

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When launching new products, firms use either single rollover or dual rollover strategy. To encourage new product sales, many firms offer trade-in program, allowing customers to return the old generation product and purchase the successive generation product with some trade-in rebate. To increase profit and sales, firms use both price skimming and penetration pricing scheme. To study the interaction between rollover strategy and trade-in program under given pricing scheme, we propose a two-period model incorporating market heterogeneity and consumers' forward-looking behavior. Results show that for either rollover strategy, firm is better off following price skimming when product salvage value is low enough, otherwise it is better off following penetration pricing. Secondly, for given pricing scheme, firm's optimal rollover strategy depends on product innovation incremental value, product salvage value, and how strategic the consumer is.

Keywords: product rollover, trade-in program, strategic consumer, pricing scheme, sequential innovation, market heterogeneity

Performance Evaluation and Optimization of Gaming Industry in Macau during 2007-2014

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This paper aims to investigate the development of Macau's gaming industry during 2007-2014, that is the period of 2008 financial crisis and Chinas ongoing anti-corruption. This has tracked tons of attention while little works has been done to measure the Macau's gaming industry from performance perspective. Moreover, past researches normally treat the data as deterministic and only cover limited periods. These issues may vastly affect the accuracy of the overall evaluation and the suitability of decisions. Therefore, in this study we present a 2-in-1 methodology that can improve the accuracy of the performance measures effectively in stochastic environment, this method is utilizing the simulation optimization technique and Data Envelopment Analysis (DEA). Data are collected from six Macau main casino concessionaires in the year of 2007-2014. The findings show that our model can effectively optimize the accuracy of the performance by 81.6%. The analysis result reveal that on the average, the efficiency of Macau's gaming industry is 82.3% and total factor productivity growth improved 17.4% for the period 2007-2014.

Keywords: Macau's gaming industry, data Envelopment Analysis (DEA), simulation optimization

Impacts of Carbon Policies under Imperfect Competition: The Real Price of Carbon Reduction

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Motivated by the divergence between empirical findings and conventional beliefs, this paper investigates the impacts of carbon policies on firms' profitability under imperfect competition. We consider firms' production and compliance decisions under carbon tax and examine how individual firms or the industry will be affected. We find that the cost of carbon reduction is not evenly distributed among firms. In fact, carbon-efficient firms may benefit from the introduction of carbon taxation while carbon-inefficient firms always hurt. The former effect may offset the latter and therefore the overall industry profit may improve. The negative impact of the regulation, if any, on the industry profit is shown limited. Carbon tax can always induce competing firms to make active compliance efforts. The analysis is extended to settings with cap-and-trade and carbon cap. The paper provides an additional explanation on the positive impacts of carbon policies observed in practice. It is hoped that the findings can facilitate the adoption of carbon policies.

Keywords: carbon regulation, horizontal competition, emission reductions, climate change

Assessing Uncertainty: A Model-output Oriented Approach

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Market outcomes can often be observed, while the underlying market structures and relations are difficult to identify. This paper takes up this notion in developing a framework for a firm to assess uncertain market outcomes. It considers model-output oriented uncertainty defined by the extent to which uncertainty affects the firm's optimized price markups and quantities. We show that model-output orientation can cover in a unifying way scenarios where additive, multiplicative and many more stochastic structures all occur with positive probabilities. We show that optimal inventories depend on the type of uncertainty and its distribution as defined according to our theory.

Keywords (3-5 keywords): Uncertainty; model-output orientation; monopoly; inventory; capacity.

Experimental Analysis of the Newsvendor Problem with Minimum Order Quantity Contracts

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Coordinating contracts have been shown to be suboptimal in experimental settings. We investigate an understudied contract that is often used in business-to-business transactions. After conducting experiments in which subjects adopt the supplier's role and interact with a computer that assumes the role of a profit maximizing retailer, we find that subjects tend to earn more with the MOQ contract, and the cognitive burden associated with MOQ contracts is lower than with either buyback or revenue-sharing contracts. Moreover, when given a choice, subjects tend to pick the MOQ contract more often, and tend to take less time to make decisions.

Keywords: minimum order quantity contract, behavioral operations management, newsvendor problem, bounded rationality

SESSION 6-A: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Multi Criteria Optimization Model for Prepositioning of Relief Items: A Case Study of Chennai Floods 2015

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Using pre-positioned warehouses at strategic locations around the disaster prone area is a method typically adopted by various humanitarian relief organizations to develop their capabilities to provide sufficient relief support within a comparatively smaller time frame. In this paper we consider the pre-positioning of warehouses for humanitarian relief organizations from both regional and local perspectives, and analyze the managerial implications of those decisions. Technical reports data and managerial level officers were interviewed in order to obtain data for an analysis of the pre-positioning of warehouses at regional and local levels. Through the use of the Interval Analytic Hierarchy Process (IAHP), the relative importance of individual criteria was determined and then Electre III, based on interval-valued intuitionistic fuzzy information was used to obtain the final ranking of locations. The contribution of this work is as follows: useful managerial insights and implications related to the pre-positioning of warehouses are provided; further, a range of potential location sites for prepositioning of resources is developed.

Keywords: pre-positioning, humanitarian supply chain, interval AHP, electre III, multi-criteria decision making

SESSION 6-B: OM IN HEALTH CARE SYSTEMS

Network Analysis of Patient Transfer Behavior in a Hierarchical Medical System

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We study the inpatients' transfer process in a hierarchical medical system of China. Taking both patient-level and hospital-level attributes into consideration, we investigate the utility and cost for patients and hospitals in the transfer process. Using a data set of 19,656,010 admission records during a 5-year period, we find that patients usually transfer many times before they get appropriate treatments. In addition, in the bipartite network of patients and hospitals, we identify that factors such as age, gender, distance, and local medical level etc. have the most important impact on patients' choice of hospitals and their transfer behaviors. Utilizing the transfer network, we recommend hospitals that will greatly save costs for the patients and increase the efficiency of the system.

Keywords: Transfer behavior, network analysis, hospital efficiency, patient choice, data mining

Tax/Subsidy and Capacity Decisions in a Two-tier Health System with Welfare Redistributive Objective

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We study the tax/subsidy and capacity decisions of the public sector in a two-tier health system with a welfare redistributive objective. Public care is considered as a public provision of private goods and can be used to achieve welfare redistribution. The public sector is financed through general taxation, offering free but delayed service. The private sector offers delay-free service at a price. Patients choose between public and private care to maximize their expected net surplus. The system planner assigns weights to patients with different delay sensitivities, with the objective of maximizing the total weighted patient welfare by choosing the tax/subsidy and capacity decisions. We show that if the system planner treats all patients equally, she tends to imposes a lower tax on or provide a higher subsidy to private care. In the case of equal weight, the larger the capacity of the public sector, the more the tax/subsidy policy can improve the total patient welfare. If the planner is more concerned about the welfare of patients with low delay sensitivities, she should subsidize private care only when the capacity of the public sector exceeds a threshold. The subsidy is then used to induce patients with high delay sensitivities to seek private care. With more patients being served in the private sector, the total cost incurred in the public sector is lowered, and so is the general tax burden borne by patients with low delay sensitivities. In the case of unequal weight, the tax/subsidy policy results in a larger welfare improvement when the public sector has either a small or a large capacity. Finally, we discuss the capacity decision of the public sector given a fixed tax/subsidy.

Keywords: OR in healthcare, subsidy, capacity, welfare redistribution

Conspicuous by Its Absence: Diagnostic Expert Testing Under Uncertainty

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A diagnostic expert, e.g., a medical doctor, helps customers assess their conditions and recommends courses of action. The expert service literature focuses on the case in which the expert can costlessly acquire customers' true conditions and, out of profit motive, may provide unnecessary services. Motivated by prevalent—albeit little explored—under-provision in the US healthcare setting, we study a scenario in which costly diagnostic testing is needed to acquire customers' true conditions and the expert's accuracy of diagnosis is unknown to customers. Using a generic Bayesian framework, we establish under-testing as the unique separating device. Our work is the first to formally link diagnostic uncertainty and information asymmetry.

Keywords: expert services, diagnostic uncertainty, signaling games, healthcare operations, under-testing

Promotion Planning of Network Goods

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Many products/services exhibit network externality. We provide a theoretical framework to analyze the firm's dynamic pricing decision for network goods. We demonstrate that it is optimal for the firm to offer a discount initially and start charging a regular price when the product becomes popular. The network structure has a significant impact on the decision and revenue: stronger connectivity makes the firm offer the discount for a longer period and charge a higher price; heterogeneity of customers' connectivity benefits the firm; the knowledge of the network structure may not be essential when the network is close to a regular graph.

Keywords: optimal stopping, network effect, graph structure, pricing

Analysis of Gray Markets in Differentiated Duopoly with Different Power Structures

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This paper investigates the gray-market issues in differentiated duopoly where different strategic interactions occur between two manufacturers in a market with a low customer willingness to pay. We develop a game-theoretic model and provide equilibrium results for two kinds of strategic interactions, i.e., Manufacturer Double Stackelberg and Manufacturer Nash game. By the analysis of the equilibrium results, we study the impact of gray markets on the manufacturers' optimal strategies and profits. Finally, by comparison of the equilibrium results and sensitivity analysis, some important managerial insights are obtained.

Keywords: interface between OM and marketing, gray markets, differentiated duopoly, power structures

Who Compensates the Sales Agent?

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We analytically study a value chain consisting of three segments: a manufacturer, a retailer, and a sales agent. Five distinct value-chain structures are considered: an integrated value chain, an integrated distribution channel (the manufacturer and the retailer) compensating the sales agent, non-integrated channels with the manufacturer compensating the sales agent, with the retailer compensating the sales agent, and with joint compensation. We compare the strategic implications across all these value-chain structures. We find that a partially integrated value chain may perform worse than a completely non-integrated value chain.

Keywords: interface between OM and marketing, salesforce compensation, value chain coordination, distribution channel

Pricing in Social Networks with Strategic Consumers

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We analyze a two-period optimal pricing problem in social networks with strategic consumers. Consumers who purchase in the second period can gain positive network externality from her neighbors who have purchased in the first period. We derive the equilibrium prices under general social network structures. We also show special properties for special networks, including complete, circle and star networks. Our analysis demonstrates that ignoring consumer network structure can cause significant profit loss. Furthermore, we compare uniform pricing and differential pricing policies and show that the network asymmetry among consumers benefits the seller under differential pricing but hurts under uniform pricing.

Keywords: social network, dynamic pricing, network externality, network structure

Financing a Small Capital-constrained Community Firm Based on Advance Selling and Social Ties

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To carry on normal operation, a small financially-constrained community firm has to borrow from a bank to cover the fixed investment. However, due to moral hazard issue the firm may face credit rationing, and the optimal effort level is not as high as that for the non-financially-constrained case even if the firm successfully obtains the bank loan. Alternatively, the firm can conduct advance selling to alleviate her financial constraint. Does the advance selling strategy really help in alleviating the firm's financial predicament? This paper attempts to answer this question by investigates the optimal selling and pricing strategy of the firm.

Keywords: capital constraint, bank financing, moral hazard, advance selling, social ties

The Decisions of Supplier and Capital Constrained Retailer with Marketing Expansion

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In this paper, we compare BCF(Bank Credit Financing) with TCF(Trade Credit Financing) in the condition that working capital constrained retailer invest in marketing. We show that the decisions of supplier and retailer are closely related to retailer's working capital budget. If the retailer's budget is very large, there is no difference between BCF and TCF. If the retailer has medium budget, supplier will get more in TCF， and retailer will order more, invest more in marketing promotion and obtain more profit in TCF. However when retailer's budget is small, TCF is detrimental to both retailer and supplier.

Keywords: trade credit, budget constrained retailer, market expansion

SESSION 6-D: SUPPLY CHAIN MANAGEMENT

How to Finance Agricultural-Product Suppliers?

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Nowadays more and more agricultural products are sold through intermediary electronic platforms. It is also common that a farmer lacks financial resources. As one key part in the supply chain, the platform may choose to help the farmer in finance. In this paper, we theoretically examine how the intermediary platform should finance the farmer by establishing a dynamic game. We find that, when the planting cost is relatively low, the platform is better off by providing direct financing; when the cost is relatively high, it is more profitable to encourage the farmer to raise funds from the banking market.

Keywords: bank financing; guarantor financing; direct financing; agricultural product supply chain

SESSION 6-E: GREEN EFFORTS AND LOCATION MANAGEMENT

Vertical or Horizontal Cooperation in a Competitive Supply Chain for Investing Greening Efforts

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We consider a competitive supply chain (SC) with two substitutable products where one manufacturer (M1) invests greening efforts in its product and then resale to a retailer (R1) while the other manufacturer (M2) sells the general product to the other retailer (R2). We focus on three models, i.e. no cooperation between competitive members, cooperation between M1 and R1 (i.e., vertical cooperation), and cooperation between M1 and M2 (i.e., horizontal cooperation). We seek to improve the efficiency and the performance of the supply chain. We investigate and compare the different cooperation models and find optimal pricing strategies for above three models.

Keywords: competitive supply chain, greening efforts, vertical cooperation, horizontal cooperation, pricing strategies

The Evolutionary Game Analysis of Collaboration on Carbon Reduction Behavior by Manufacturer and Retailer in Supply Chain

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We studied the mechanism of evolutionary game of collaboration on carbon reduction behavior by manufacturer and retailer in two-stage supply chain, and discussed the long-term evolutionary trend of whether or not the manufacturer chooses carbon emission reduction strategy and the retailer chooses low-carbon promotion strategy. Firstly, the evolutionary game model of cooperation on carbon emissions reduction was built. Furthermore, we obtained the evolutionary process of cooperation on carbon emissions reduction according to the replicator dynamics equation and give the parameters conditions satisfied the evolutionary stabilization strategy. Finally, we verified the validity of the results by simulation experiments, and provided a theory basis for manufacturer and retailer to carry out long-term emission reductions cooperation.

Keywords: low-carbon, supply chain, carbon emission reduction, low-carbon promotion, evolutionary game

A New Method to Stabilize the Grand Coalitions of Unbalanced Uncapacitated Facility Location Games

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In this paper, we study how to stabilize the grand coalition of an uncapacitated facility location (UFL) game with an empty core. Different from the existing concepts such as core or least core, we come up with a new approach which selectively blocks some arcs in the UFL bipartite graph. By exploiting the primal-dual relationship of the centralized UFL problem, we are able to formulate the problem as a mixed integer programming (MIP). After that, we develop some valid cuts to strengthen the MIP and then solve it. The computational experiments show that our new approach is effective.

Keywords : cooperative game, facility location game, inverse optimization, integer linear programming

SESSION 6-E: GREEN EFFORTS AND LOCATION MANAGEMENT

An Inventory Model with Transshipment and Demand Substitution

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We consider a single period inventory model with two retailers selling substitutable products. When customers encounter stock out at one retailer, they may wait for transshipment from the other retailer or walk away to purchase the product from the other retailer. We model the problem as a two-stage game to examine the inventory and transshipment decisions in this competitive environment, and explore the existence of coordinating transshipment prices that result in the first-best ordering and transshipment decisions in the decentralized system.

Keywords: inventory, transshipment, demand substitution

SESSION 6-F: THE OR/OM MODELS AND THEIR APPLICATIONS

Analysis of Pooling Effect for Multiple Products Using a Single Warranty Reserve

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Manufacturers offer warranties for most of the products. To support the warranty service, the manufacturer will set up a warranty reserve fund for addressing future warranty claims. Suppose that a manufacturer manages warranties for multiple products, it is beneficial to maintain a combined account for different products to pool the risks involved. In this paper, we analyze the pooling effect of warranty reserves, and show that the manufacturer can not only reduce the total amount of the warranty reserves, but also reduce the risk of reserve depletion.

Keywords: multiple products, pooling effect, warranty reserve

Beyond Heavy-traffic Regimes: Universal Bounds and Controls for the Single-server Queue

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Brownian approximations provide tractability in the analysis of queues. Their stationary distributions are used as proxies for those of the original queues and the convergence of suitably scaled primitives and processes provides mathematical support for the use of these Brownian models. From a heuristic viewpoint, however, there is an immediate Brownian analogue of the queueing model that is derived directly from the primitives. For the M/GI/1+GI queue, this direct (limitless approach) works: the Brownian model is universally accurate. It maintains the tractability and appeal of the limit approximations while avoiding many of the assumptions that facilitate them.

Keywords: M/GI/1+GI, universal approximation, stationary distribution, Stein's method

The Cost of Skipping the Line

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If you do not have time to wait in a long line to get your morning caffeine fix or to grab your lunch, now you can skip the line and order online. Thanks to the technology progress, more and more restaurants, e.g., Starbucks and McDonald's, are offering online ordering without customer physical presences in the service line. We study the impacts of this novel business model with both online and in-store customers waiting to be served. We find that although the provider enjoys a revenue increase, both online and in-store customers endure longer delays and the social welfare may suffer.

Keywords: order online, strategic customer; behavioral queue

SESSION 6-F: THE OR/OM MODELS AND THEIR APPLICATIONS

Capacity Design and Allocation in Unbalanced Networks with Flexibility

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Flexibility is generally viewed as a firm's ability to match supply with uncertain demand. A certain level of flexibility can curb the damage caused by uncertain demand, whereas lacking flexibility can result in significant loss. Flexibility is so important that it has been incorporated into many systems and networks. For instance, auto-mobile manufacturers have used flexible production systems to meet uncertain demands effectively, and service providers have used cross-training agents to serve multiple types of customers. While some companies have gained competitive advantages by using flexibility, others are not very successful. In our studied case, the hospital introduced flexibility into bed management but later faced with serious patient overflow problems. If a network is not well designed, then flexibility may not benefit the network or even hurt system performance. How can we design a network which can better utilize flexibility? In this work, we propose a design model with flexibility and use node approximation analysis to estimate the overflow out of a node in the network. The objective is to minimize the total overflow cost in the network by allocating capacity to each node. Then we give an explicit heuristic solution which minimizes the maximal node overflow probability in the network. In addition, we discuss the total capacity design and capacity allocation problem together by considering the overflow cost and node idle cost. We show in our case study how to re-design the capacity so that the patient overflow can be controlled.

SESSION 6-G: HEALTHCARE OPERATIONS MANAGEMENT

Optimal Resource Allocation in Breast Cancer Screening with Different Risk Groups

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Screening mammography is proved to be an effective method for early detection of breast cancer (BC) and thus reduction of BC mortality rate. It is reported to be more cost-effective for women with higher risk factors. This paper studies the optimal allocation of limited budget to a population with different BC risk levels in order to minimize the expected mortality rate. We estimate the risk levels for US women using a dataset from National Cancer Institute. Our computational results show that stratifying the population with risk levels can significantly reduce mortality rate.

Keywords: resource allocation, breast cancer risks, screening

Personalized Medical Decision Making for Type II Diabetes Treatment

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Diabetes mellitus is one of the most prevalent and costly chronic disease worldwide, and it occurs in about 11.3% of the population in Singapore. In clinical practice, general guidelines are available to assist its medication decisions; however, they pose challenges because patients vary on the trade-off between the benefits and the costs of the treatment as well as the progression of the disease. We develop a personalized medication treatment based on the analysis of data from a national cohort. We show that our patient-centred treatment performs better than the classical Markov decision processes (MDPs) approach in multiple criteria. (98<100)
Keywords: personalized treatment, healthcare, target-driven, MDP

Allocation of ICU Beds during Periods of High Demand

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We formulate an MDP model for admission decisions in an ICU where patients' health conditions change over time according to Markovian probabilities. We find that the optimal decision can depend on the mix of patients in the ICU and provide an analytical characterization of the optimal policy. We also identify conditions under which the optimal policy is state-independent.

Keywords: Healthcare management, dynamic control, MDP

SESSION 6-G: HEALTHCARE OPERATIONS MANAGEMENT

Markov Decision Process based Nurse Night Shift Assignment with Burn-Out Considered

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Burnout is a chronic and job-related state causing psychological and physical dysfunction within an individual. A cross-sectional experiment conducted in a tertiary hospital shows that there is a significantly positive relationship between number of night shifts and nurse burnout level. This paper proposes a finite-horizon Markov Decision Process model to determine the optimal number of night shifts for individual nurse with the objective of minimizing the weighted cost of burnout, payroll, and idle. For the nurse with a certain burnout level, the optimal number of night shift is proved to be a threshold-type policy.

Keywords: nurse night shift assignment, burnout, markov decision process

SESSION 6-H: TECHNOLOGY MANAGEMENT

Demand Learning and Agreement Delay in Technology Adoption

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Negotiations associated with technology adoption can take months or years and agreements are often made close to deadlines. Existing theories attribute agreement delay and the deadline effect in bilateral negotiations to either asymmetric information or behavioral constraints. However, high-technology industries are often characterized by deep cooperation, effective communications, rational decisions, and uncertain demand for new technologies. To study the driving forces and consequences of delayed agreements in high-technology industries, we build a bilateral, dynamic bargaining model featuring uncertain demand facing the seller, information symmetry, and a deadline. We discover that incentives to learn about the seller's demand drive delay of agreements. With better information, the seller can possibly sell the manufacturing capacity to buyers who would like to pay more; however, the buyer can also benefit from learning because the seller must make concessions if they find the demand to be weak. Thus, contrary to most existing theories, delay can benefit both negotiators, and even with the deadline effect present, their expected payoffs can be improved by extending the deadline. In addition, we find that the delay tendency increases as more technology adopters appear and the belief of high demand becomes stronger.

Investment Strategies in Technology Adoption: Chase the New or Walk with the Old?

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High-technology manufacturers (HTMs) constantly make sourcing decisions on whether to adopt new suppliers' technologies as well as investment decisions on how to support these new suppliers' technology development. We consider an HTM that can source a critical component from a financially constrained supplier who offers an innovative but immature technology, or from an existing (backup) supplier should the new technology fail. Given the new supplier's financial status, the HTM needs to inject capitals in the form of an equity or a loan. An equity allocates the risk proportionally, while a loan allows the supplier a higher upside. Thus, the investment strategy affects the new supplier's development effort and chance of success, which in turn negatively influences the existing supplier's effort in its technological improvement, presenting the HTM a trade-off in motivating the two suppliers. We find that when the marginal development cost and the new supplier's initial capital level are low, an equity-contract can induce a higher effort from the new supplier and generate a higher expected payoff for the HTM than a loan-contract; otherwise, a loan-contract is preferred. More importantly, the optimal investment strategy may change, depending on whether a backup supplier is available.

Supply-Chain Innovation Spillover and New Product Introduction

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Empirically we find a causal relationship that supply-chain innovation spillovers improve a supplier's new product introductions. Longer supply-chain relationships enhance such a positive effect. However, the supplier should be cautious if its sales are overly dependent on these major buyers, as the narrowed technology scope may weaken the positive effect.

Supply Chain Coordination Using Revenue-Sharing Contract with Perishable Products

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We consider a supply chain selling perishable products to final consumer. The products have fixed lifetime which are stored with periodical reviewed (s,S) policy by retailer. In this paper we consider the coordination using revenue-sharing contract between the supplier and retailer in the supply chain to improve the channel performance and maximize the total profit of the system. is 82.3% and total factor productivity growth improved 17.4% for the period 2007-2014.

Keywords: supply chain, coordination, contracts, perishable inventory

Performance Bounds and Asymptotic Optimality of (r, Q) Policies for Stochastic Distribution Inventory Systems

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This paper establishes performance bounds on the minimum cost of a one-warehouse multi-retailer distribution system, in which each location incurs a fixed-plus-variable cost in inventory replenishment. We have achieved so through the following 4 steps. First, we adopt an echelon-based (r, Q) policy, whose lower bound has been developed previously in the literature. Then, we identify a cost upper bound. The exact evaluation of the system-wide cost for (r, Q) policies in both the warehouse and retailers is however di cult. We there-fore resort to a heuristic policy by which the echelon-based (r, Q) policies are taken from the solutions to several single-stage (r, Q) inventory problems. Next, we develop further upper bounds on the heuristic policies. Finally, using those bounds we show the proposed heuristic (r, Q) policy to be asymptotically optimal in terms of system parameters.

Keywords: multi-echelon, distribution system, stochastic demand, performance evaluation, (r, Q) policy.

Store Brand and Asymmetric Demand Information in a Decentralized Supply Chain

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In a decentralized supply chain with one manufacturer selling a national brand product to a retailer who faces deterministic demand, it is well known that the manufacturer always suffers and the retailer always benefits when the retailer has the option to introduce a store brand. This paper studies the impacts of this option on supply chain members when demand is random and the retailer possesses private information about the demand. We show that the manufacturer always prefers contract menu to uniform wholesale price contract, as the contract menu enables the manufacturer to screen the retailer's private information at cost of paying an information rent to the retailer. With a possible store brand, the retailer's pro t from selling the national brand becomes lower due to the cannibalization effect, which lowers the value of private information and hence the information rent. Therefore, the manufacturer may bene t and the retailer may suffer from the retailer's option to introduce a store brand due to the lower information rent.

Keywords: store brand introduction, information asymmetry, contract menu