THE 13TH POMS-HK INTERNATIONAL CONFERENCE

POM FOR A BETTER WORLD: ACCOUNTABLE, ADAPTIVE, AND AGILE

7-8 JAN 2023

POMS-HK 2023
LMS FB POLYU

Welcome to the 13th POMS-HK International Conference

Welcome Message from the Dean of Faculty of Business

It gives me great pleasure to welcome you all to the 13th POMS-HK International Conference. The Department of Logistics and Maritime Studies of The Hong Kong Polytechnic University is delighted to host this prominent Conference again after previously hosting it in 2009 and 2016. It is also particularly meaningful to be able to meet some of you on the PolyU campus after the unprecedented disruptions caused by the pandemic.

The theme of this year's Conference is "POM for a Better World: Accountable, Adaptive, and Agile". We are well aware that globalisation had until recently been increasing interdependence amongst players along the supply chain. The extended period of COVID has undoubtedly disrupted these interdependent supply and production networks, which formally span the globe. The impact of COVID is irreversible and has forced businesses to rethink how they manage the supply chain that is vital to their survival.

The call to be accountable, adaptable, and agile is certainly the clue to a better future for all of us. We need to reach a collective understanding and, more importantly, a consensus, about what it means to be accountable, adaptive, and agile, so that we can proactively deal with "risks" and stay resilient. These "risks" are not only those that are still hindering the complete recovery of production in the aftermath of COVID, but also those associated with other forces, such as ESG compliance and digital transformation. How businesses choose to deal with such risks may affect how business will be carried out in the future.

The Conference has brought together many experts in the field. The discussions promise to shed light on how academics and practitioners can work hand in hand to embrace the challenges that lie ahead.

I wish the Conference every success and look forward to meeting you in person or online.

Ir Prof. T.C. Edwin Cheng
IASCYS Academician, FHKEng, ScD, PhD
Dean, Faculty of Business
Fung Yiu King – Wing Hang Bank Professor in Business Administration
Chair Professor of Management
The Hong Kong Polytechnic University

Welcome to the 13th POMS-HK International Conference

Welcome Message from the Head of the Department of Logistics and Maritime Studies

I have the great pleasure in welcoming you to The 13th POMS-HK International Conference. It is our honour to host this distinguished event for the third time. The Conference provides a valuable opportunity for scholars not only in Hong Kong but all over the world to get together, sharing their experiences and perspectives on current research developments and events of interest in the field of production and operations management (POM).

The theme of the Conference this year is "POM for a Better World: Accountable, Adaptive, and Agile". Environmental, Social, and Governance (ESG) is an increasingly important topic for business and the theme of the Conference this year provides a timely platform for scholars to share their latest studies in this area particularly. We have faced enormous challenges throughout the years, particularly the COVID-19 pandemic since 2020. Many of us have not been able to get together physically for some years due to travel restrictions in many places. This conference marks an important step toward closer collaboration among scholars across borders in the POM community.

I look forward to meeting you all at this prominent event, and we wish all of you a fruitful event.

Prof. Andy C. L. Yeung
Head, Department of Logistics and Maritime Studies
Chair Professor of Operations Management
The Hong Kong Polytechnic University

Welcome to the 13th POMS-HK International Conference

Welcome Message from Associate Executive Director, Global Initiatives & Outreach, POMS & President, POMS

It is my distinct pleasure to welcome you all to The 13th POMS-HK International Conference, January 7th – 8th, 2023.

The planning team has done an incredible job under the direction of the General Chair, Andy Yeung, Organising Committee Chair Yulan Wang, and Programme Committee Chairs, Miao Song, Kai Pan, and Judy Tong. Special thanks to the leadership team in the Business School at The Hong Kong Polytechnic University for hosting this conference.

The 13th POMS-HK International Conference would not be possible without the intensive efforts of the organising committee and the program committee, along with the session organizers, best paper award chairs, and job fair chair who have worked tirelessly to support all facets of this meeting. My sincere thanks to Sushil Gupta, POMS Executive Director for his welcome address at the conference and Keynote Speakers Jeannette Song, Jay Swaminathan, and Chung Piaw Teo. As always, a special hearty welcome to all the doctoral students who will join this conference from all across the world.

Have a great conference and enjoy the POMS experience!
You all stay safe and well.

Nagesh N. Murthy
Associate Executive Director POMS, Global Initiatives and Outreach
President, POMS
Roger Engemann Professor of Operations and Business Analytics
Lundquist College of Business, University of Oregon

About the 13th POMS-HK International Conference

The POMS Hong Kong Chapter was set up in March 2009, with an objective to encourage the exchange of ideas, experiences, and knowledge among scholars and professionals in Hong Kong in the field of Production and Operations Management and foster the integration between Hong Kong and the international POM community. It runs an annual conference every winter.

The 13th POMS-HK International Conference

Under the theme "POM for a Better World: Accountable, Adaptive, and Agile", this conference intends to provide a platform for exchanging research ideas, industry practice, and managerial insights on the latest innovation in the operations of service and production systems, and its cross-discipline research with other areas such as accounting, finance, behavioural economics, and information systems.

Conference Committees

General Chair

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Organising Committee

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- Lijun Ma, Zelong Yi, Shenzhen University
- Li Luo, Sichuan University
- Onur Boyabatli, Yun Fong Lim, Hai Wang, Yangfang (Helen) Zhou, Singapore Management University
- Karthik Natarajan, Singapore University of Technology and Design
- Bo Feng, Soochow University
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- Rowan Wang, Southern University of Science and Technology
- Ke Fu, Haiqing Song, Sun Yat-sen University
- Shilu Tong, Zizhuo Wang, The Chinese University of Hong Kong, Shenzhen
- Baofeng Huo, Weihua Liu, Tianjin University
- Yongbo Xiao, Liu Yang, Tsinghua University
- Tsan-Ming (Jason) Choi, University of Liverpool
- Qinglong Gou, Quan Zheng, University of Science and Technology of China
- Fang Liu, University of the Chinese Academy of Sciences
- Minghui Xu, Wuhan University
- Gang Li, Xi'an Jiaotong University
- Zhaowei Miao, Weifen Zhuang, Xiamen University
- Mingzheng Wang, Zhejiang University

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- Xiaolin Xu, Nanjing University
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- Wei Jiang, Jun Luo, Shanghai Jiao Tong University
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- Lei Xie, Shanghai University of Finance and Economics
- Ying Xu, Singapore University of Technology and Design
- Weixiang Huang, South China University of Technology
- Weili Xue, Southeast University
- Qiaochu He, Southern University of Science and Technology
- Duo Shi, Jingqi Wang, The Chinese University of Hong Kong, Shenzhen
- Jia Shu, University of Electronic Science and Technology of China
- Yi Yang, Weihua Zhou, Zhejiang University

Best Student Paper Competition Chair:

- **Xiaomeng Guo, The Hong Kong Polytechnic University**
- **Guang Xiao, The Hong Kong Polytechnic University**

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- **Zhou Xu, The Hong Kong Polytechnic University**

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- Miss Rachel Cheong
- Mr Parker Ho
- Miss Chung Lam Ng

Conference Technician

- Mr Tsz-him Chan

About the Organiser

The Hong Kong Polytechnic University

The Hong Kong Polytechnic University (PolyU) is a world leading university with world-class research (ranked the 65th in the QS World University Rankings 2023 and 79th in the Times Higher Education World University Rankings 2023). A wide range of courses, which directly meets industrial, commercial and community needs are offered. In addition to meeting Hong Kong's manpower requirements, PolyU also makes significant contributions towards the territory's success by providing the public and private sectors with its expanding range of consultancy, professional training, and applied research services. Through these activities, the university maintains a strong partnership with the business and industrial sectors. Over the years, more than 448,000 young men and women have graduated from PolyU and its predecessors. The graduates have found their places in various sectors, dedicating their knowledge and expertise to the building and development of Hong Kong, the Nation and the world.

Department of Logistics and Maritime Studies

The Department of Logistics and Maritime Studies (LMS) has a team of high-quality research-based expertise in operations management, supply chain management, management science and maritime studies. We lead the world research rankings. We rank 1st in the KUBS Worldwide Business Research Ranking 2019: Operations Management and Management Science and 35th in the UTD Top 100 World Rankings of Business Schools Based on Research Contribution 2019-2022 (Selected Journals: MS, OR, MSOM, POM, JOM and JOC). Our academic staff are active researchers, having their research papers published in leading top-quality academic journals, such as Management Science, Operations Research, Manufacturing and Service Operations Management, Production and Operations Management, Journal of Operations Management, Transportation Research Part A, B, C, D and E, Transportation Science and Maritime Policy and Management. We are dedicated to training high-quality researchers and professionals in areas such as operations and supply chain management, transport and logistics management, aviation and maritime management and decision making.

Conference Schedule

DAY 1		
Time	**Event**	**Venue**
8:00 - 9:00	Registration	Block Z 2/F
9:00 - 9:15	Welcome Speech **Prof. Edwin Cheng** **Dean of PolyU Business School, The Hong Kong Polytechnic University** **Prof. Sushil Gupta** **Executive Director of Production and Operations Management Society**	Room Z209
9:15 - 10:30	Keynote I by **Prof. Jay Swaminathan**	Room Z209
10:30 - 11:00	Coffee Break and Group Photo Session	Block Z 2/F
11:00 - 12:15	Keynote II by **Prof. Jeannette Song**	Room Z209
12:15 - 14:00	Lunch	Block Z
14:00 - 15:30	Parallel Session (A) Tutorial A by **Prof. Michael Pinedo** Best Student Paper Session I & II	Block Z 2/F, 4/F, 5/F Room Z211 Block Z 2/F
15:30 - 16:00	Coffee Break	Block Z 4/F, 5/F
16:00 - 17:30	Parallel Session (B) Best Student Paper Session III Ph.D. Career Development Forum	Block Z 4/F, 5/F Room Z209 Room Z211
18:30 - 21:00	Gala Dinner	New World Millennium Hong Kong Hotel
DAY 2		
Time	**Event**	**Venue**
8:00 - 9:00	Registration	Block Z 2/F
9:00 - 10:15	Keynote III by **Prof. Chung Piaw Teo**	Room Z209
10:15 - 10:45	Coffee Break	Block Z 2/F
10:45 - 12:15	Parallel Session (C) Tutorial B by **Prof. George Shanthikumar**	Block Z 2/F, 4/F, 5/F Room Z209
12:15 - 14:00	Lunch	Block Z
14:00 - 15:30	Parallel Session (D)	Block Z 4/F, 5/F
15:30 - 16:00	Coffee Break	Block Z 4/F, 5/F
16:00 - 17:30	Parallel Session (E)	Block Z 4/F, 5/F
17:30	End of Conference	

Keynote I - Relevance and Impact of Operations Management Research

Day 1: 7th Jan (Sat) 09:15 – 10:30 Venue: Z209

Prof. Jay Swaminathan
GlaxoSmithKline Distinguished Professor of Operations
Kenan-Flagler Business School
University of North Carolina at Chapel Hill

Abstract:
In this talk, we will explore different styles of operations management research and their relevance and potential for impact. Next, we will discuss approaches to enhance practical relevance while maintaining high levels of rigor in scholarship. We will conclude with examples of future topics of study for our community that have important implications for society at large.

Biography:
Jayashankar (Jay) Swaminathan is the GlaxoSmithKline Distinguished Professor of Operations at the Kenan-Flagler Business School at University of North Carolina at Chapel Hill. An internationally recognized thought leader on productivity and innovation in business operations, he is an inducted Fellow of The Institute for Operations Research and Management Science (INFORMS), Manufacturing and Service Operations Management Society (MSOM) and Production and Operations Management Society (POMS). Dr. Swaminathan has published more than 65 scholarly journal articles and is the author of the edited volume "Indian Economic Superpower: Fiction or Future?" and co-author of the edited volume "Responsible Operations". He currently serves as a Department Editor for Management Science and Production and Operations Management journals. He has received numerous awards for his work, including the National Science Foundation CAREER Award, George Nicholson Prize, Schwabacher Fellowship, Weatherspoon Distinguished Research, Weatherspoon Excellence in Teaching and Roy Holsten Award for Exceptional Service. He has consulted with numerous firms over the last 25 years, including AGCO, Agilent, IBM, Kaiser, Nokia, Public Health Institute, Railinc, Samsung, Siemens, Sara Lee, and UNICEF. He has served in various leadership roles at UNC Kenan-Flagler including Senior Associate Dean for Academic Affairs, Associate Dean for Global Executive MBA Programs, Director of UNC Global Business Center as well as Area Chair of Operations Faculty. Prior

to joining UNC, he was a faculty at the Haas School of Business at UC Berkeley. He received his PhD and Master's degree in industrial administration from GSIA (now Tepper) at Carnegie Mellon University and his Bachelor's degree in computer science and engineering from the Indian Institute of Technology, Delhi.

Keynote II - The Role of Inventory in Accountable, Adaptive, and Agile Supply Chains

Day 1: 7th Jan (Sat) 11:00-12:15 Venue: Z209

Prof. Jeannette Song
R. David Thomas Professor of Business Administration
Professor of Operations Management
Fuqua School of Business
Duke University

Abstract:
The COVID pandemic, global economic uncertainty, and climate change intensify the need for building responsible and resilient supply chains. This talk attempts to shed light on how effective inventory planning contributes to making supply chains accountable, adaptive, and agile. After a general discussion, I will illustrate a few recent modeling works studying adaptive inventory decisions enabled by advanced technologies and discretionary product/process flexibility.

Biography:
Jing-Sheng Jeannette Song is the R. David Thomas Professor of Business Administration and a Professor of Operations Management at the Fuqua School of Business of Duke University. Her expertise is in supply chain management and operations strategy, especially in inventory optimization. Her current research projects include data-driven operational decision making, supply chain digitization and flexibility, global supply chain risk mitigation, and responsible operations. She is an INFORMS Fellow and a Fellow and former President of the Manufacturing and Service Operations Management (MSOM) Society. She is also a Department Editor for Management Science and Service Science, a former Area Editor for Operations Research. She is a recipient of the Distinguished Overseas Young Scholar Award（海外杰出青年）by the Natural Science Foundation of China and was named a Chang Jiang Chaired Professor by the Ministry of Education in China (教育部长江学者讲座教授).

Keynote III - Digital Aviation in the Post Covid Era - Opportunities and Challenges

Day 2: 8th Jan (Sun) 09:15 – 10:30 Venue: Z209

Prof. Chung Piaw Teo
Provost's Chair Professor
Executive Director of the Institute of Operations Research and Analytics
National University of Singapore

Abstract:
The Covid-19 pandemic has brought the global economy, especially the airline industry, to an unprecedented standstill. The volatile external environment has created new challenges for operations and forced airlines worldwide to re-examine their practices and prepare themselves for the journey to recovery. This talk review some of the recent work undertaken by the NUS-SIA Digital Aviation Corp Lab, in collaboration with Singapore Airline, on issues ranging from seat comfort, pilot training, employee wellness, and revenue management.

In particular, for operations in the post covid era, "Sense-Infer-Adapt" has become a crucial capability for airlines to navigate the new environment. We discuss several projects that we have embarked on this topic, from an easy-to-implement changepoint detection algorithm to provide alerts and tune parameters in a commercial forecasting system, to data driven demand calibration and online resource allocation. We will show several applications of this approach in airline pricing and revenue management.

Biography:
Chung Piaw TEO is Provost's Chair Professor and Executive Director of the Institute of Operations Research and Analytics (IORA) in the National University of Singapore. Prior to the current appointments, he was Head of Department, Acting Deputy Dean, Vice-Dean of the Research & Ph.D. Program as well as Chair of the Ph.D. Committee in the NUS Business School.

He was a fellow in the Singapore-MIT Alliance Program, an Eschbach Scholar in Northwestern University (US), Professor in Sungkyunkwan Graduate School of Business

(Korea), and a Distinguished Visiting Professor in YuanZe University (Taiwan).

He was elected INFORMS Fellow in 2019.

He is currently serving as a department editor for MS (Optimization), and a former area editor for OR (Operations and Supply Chains). His main interest is in service and manufacturing operations, supply chain planning, discrete optimization, and machine learning.

He has served on several international committees such as the Chair of the Nicholson Paper Competition (INFORMS, US), member of the LANCHESTER and IMPACT Prize Committee (INFORMS, US), Fudan Prize Committee on Outstanding Contribution to Management (China). He is also on the advisory board of various institutions, from the ESD Pillar in SUTD, ISEM in NUS, and also previously the School of Management in USTC, and the Business School in Hong Kong PolyU.

Tutorial A - Scheduling Heuristics in Practice - Flexible Flow Shops and Flow Shops with Reentry

Day 1: 7th Jan (Sat) 14:00 – 15:30 Venue: Z211

Prof. Michael Pinedo
Julius Schlesinger Professor of Operations Management
Department of Technology, Operations, and Statistics
Stern School of Business
New York University

Dr. Tae-Sun Yu
Pukyong National University, Busan, South Korea

Abstract:
Efficient scheduling of industrial systems typically has a major impact on productivity levels. In this tutorial, we focus on the applications of scheduling heuristics in two different industries, both being of importance, namely steelmaking and microelectronics.

In steel production, the steelmaking-continuous casting (SCC) process is a bottleneck. Its scheduling has become more challenging over the years. We first describe the modeling of the essential features of an SCC process as a flexible flow shop with unrelated parallel machine environments, stage skipping, and maximum waiting time limits in between successive stages. The objective is to minimize the total weighted waiting time, earliness, and tardiness. The problem can be formulated as a mixed integer program and we present an iterated greedy matheuristic that solves its subproblems to find a near-optimal solution. Through numerical experiments, we show the effectiveness of such an algorithm. The microelectronics industry is conceptually very different from the steel.

The microelectronics industry is conceptually very different from the steel making industry. The manufacturing processes in a wafer fab can be modeled as flow shops with re-entry, which are special cases of job shops with recirculation. The re-entries of the orders make the associated scheduling problems conceptually very difficult. We discuss the properties of the optimal schedules for various different objective functions. We conclude this presentation with various other scheduling applications in industry that will deserve more research attention in the future.

Biography:

Michael Pinedo is Julius Schlesinger Professor of Operations Management at New York University's Stern School of Business. He received an Ir. degree in Mechanical Engineering from Delft University of Technology (in the Netherlands) in 1973 and a Ph.D. in Operations Research from the University of California, Los Angeles at Berkeley in 1978. He has taught at Columbia University from 1982 till 1997 and at New York University since 1997. His research focuses on the modeling of service systems, and in the development of planning and scheduling systems, as well as systems for measuring operational risk. Over the last decade his research has focused on operational risk in financial services. He is co-editor of Creating Value in Financial Services: Strategies, Operations, and Technologies (Kluwer), and co-editor of Global Asset Management: Strategies, Risks, Processes, and Technologies (Palgrave/McMillan). He has co-authored the monograph Operations in Financial Services - Processes, Technologies, and Risks (NOW Publishers) together with Yuqian Xu. Professor Pinedo has been actively involved in industrial system development. He supervised the development of systems at Goldman Sachs, Siemens, and at Merck. Professor Pinedo is Department Editor of Production and Operations Management and of Service Science, and Associate Editor of Annals of Operations Research, the International Journal of Production Research, and of the Journal of Operational Risk.

Tutorial B - Co-, Cross- and Transfer Learning in Manufacturing and Service Operations Management

Day 2: 8th Jan (Sun) 10:45 – 12:15 Venue: Z209

Prof. J. George Shanthikumar
Richard E. Dauch Chair in Manufacturing and Operations Management
Krannert School of Management
Purdue University

Abstract:
Decision making with limited data is challenging. In this talk, we discuss the ideas of co- cross- and transfer learning in areas such as predictive maintenance, queueing and inventory control. We will relate the ideas here to the data pooling idea that originated with Charles Stein. In particular we introduce the framework of operational data analytics (ODA) that integrates data to predictive or prescriptive solutions. This framework strikes a delicate balance between the (likely imprecise) statistical structural knowledge and the data. The two pillars of the ODA framework are (i) a data-integration model that identifies the class of operational statistics based on the desired structural properties of the models within the domain of validation, and (ii) a validating model that appropriately utilize the data to validate the choice of the operational statistics. Using the classical newsvendor model as an example, we show that the ODA framework generalizes the existing approaches including predict-then-optimize, regularized empirical optimization, robust optimization, robust satisfying, order statistics and smart-predict-and-optimize. We further demonstrate that the data-integration model and the validating model in ODA must be formulated in a coordinated way based on the preciseness of the knowledge and the availability of the data. We present co-, cross- and transfer learning with ODA for a newsvendor system in two specific scenarios:

(1) When ample data form a related system can be used to supplement the limited data from the focal system, we demonstrate that the ODA solution exhibits apparent advantages over

the popular transfer-learning solutions. In particular, we propose cross learning by adapting the parametric ODA solution for non-parametric decision making. Under this approach, we utilize the ample data from the related system to mimic the stochastic environment of the

focal system, which allows for effective validating. The resulting ODA solution significantly improves the performance of the focal system over the transfer-learning solution and is shown to be asymptotically optimal.

(2) When there are multiple related systems each with limited data, we transform the data from different systems to create a generic stochastic environment for the decision-making problem, which facilitates the implementation of the ODA solution. We show that the derived co-learning solution is asymptotically optimal for each involved system, as well as the aggregate system, and outperforms the existing data-pooling strategies, which focus only on aggregated performance.

These results underscore the importance of domain knowledge and the structural relationships (between the data and the decision) in designing efficient decisions with limited data and co-, cross- and transfer learning.

Biography:

J. George Shanthikumar is the Richard E. Dauch Chair Professor of Manufacturing and Operations Management and a University Distinguished Professor of Management at the Krannert School of Management, Purdue University, West Lafayette, IN and a Professor Emeritus of Industrial Engineering and Operations Research at the University of California, Los Angeles, Berkeley, CA. Before joining Purdue, he was a Chancellor's Professor of Industrial Engineering and Operations Research at the University of California, Los Angeles, Berkeley, CA. He received the B. Sc. degree in Mechanical Engineering from the University of Sri Lanka, Peradeniya, and the M. A. Sc. and Ph. D. degrees in Industrial Engineering from the University of Toronto, Toronto, Canada.

He was the president of POMS for the year 2018, is a Fellow of the Institute for Operations Research and Management Science and Production and Operations Management Societies. He is a departmental editor of Management Science, and Production and Operations Management Society Journal, an associate editor of Naval Research Logistics.

His research interests are in model uncertainty, learning, data-integrated operations management, production systems modeling and analysis, queueing theory, reliability, scheduling, semiconductor yield management, simulation, stochastic processes, and supply chain management. He has written or written jointly over 300 papers on these topics. He is a coauthor (with John A. Buzacott) of the book Stochastic Models of Manufacturing Systems and a coauthor (with Moshe Shaked) of the book Stochastic Orders and Their Applications and the book Stochastic Orders.

Parallel Session Programme

Day 1		
Room	**14:00 - 15:30 Parallel Session (A)**	**16:00 - 17:30 Parallel Session (B)**
Z503	A1 - Optimization for Pricing Decisions	B1 - Data-driven Inventory Management
Z505	A2 - Recent Development of Pricing Theory	B2 - Robust Optimization Theory and Applications
Z506	A3 - Emerging Topics in Operations Management	B3 - Innovations in Choice Modeling and Optimization
Z507	A4 - Risk and Learning	B4 - Recent Advances in Interface Between OM and Finance
Z509	A5 - Robust Optimization and Its Applications on Operations Management	B5 - Emerging Topics in Operations Management
Z510	A6 - Blockchain Applications	B6 - Supply Chain Management
Z411	A7 - Healthcare Operations Management	B7- Learning-enabled Decision Making
Z412	A8 - Corporate Social Responsibility	B8 - Omnichannel Retailing
Z413	A9 - Smart Retailing	B9 - Healthcare Information Technology
Z511	A10 - Simulation Experiments	B10 - Sharing Economy
Z512	A11 - Operational Innovation	B11- Online Platforms
Z513	A12 - Supply Chain Management	B12 - Service Operations
Z211	Tutorial Session A	Ph.D. Career Development Forum
Z209	Best Student Paper Session I	Best Student Paper Session III
Z205	Best Student Paper Session II	B13 - Operational Decision Making under Uncertainty

Parallel Session Programme

Day 2			
Room	**10:45 - 12:15** **Parallel Session (C)**	**14:00 - 15:30** **Parallel Session (D)**	**16:00 - 17:30** **Parallel Session (E)**
Z405	C1- Empirical Research in Operations Risk Management	D1 - Practice-Related Topics in Supply Chain Management	E1- Innovative Business Models and Consumer Behaviors
Z414	C2 - Interface between learning and service operations	D2 - Healthcare Operations and Analytics	E2 - Recent Developments in Operations on Online Platforms and Marketplaces
Z406	C3 - Pricing and Capacity Management in Service Operations	D3 - Air Transportation	E3 - Recent Developments in Operations Management
Z407	C4 - Mechanism Design in Marketing-Operations Interface	D4 - Data-driven Supply Chain Management with Uncertainty	E4 - Learning, Forecasting, and Optimization in Pricing and Promotion
Z409	C5 - Prescriptive Analytics in Socially Responsible Operations	D5 - Operations Management - Marketing Interface	E5 - Maritime Operations Research and Management
Z503	C6 - Behavior and Marketing Strategies	D6 - Platform Operations	E6 - Data-based Investigation of Emerging Operations Topics
Z504	C7 - Online Decision-Making	D7 - Healthcare Operations Management	E7 - Emerging Topics in OM and Analytics
Z505	C8 - Learning for Inventory Management	D8 - Platform Operations	E8 - Smart supply chain application and Innovation
Z506	C9 - Fairness in Operations	D9 - Optimization	E9 - Emerging Transportation Technologies and Management
Z507	C10 - Pricing in Online Platforms	D10 - Economics Modeling in Operations Management	E10 - Emerging mobility solutions
Z410	C11- Inventory Management	D11- Operations Management in Healthcare	E11 - Healthcare Operations and Pandemic
Z411	C12 - Healthcare Policy	D12 - Operation Analytics in the Online Marketplace	E12 - New Frontiers of Operations
Z412	C13 - Manufacturing Operations	D13 - Inventory Management	E13 - New topics in Operations Management

Parallel Session Programme

Z413	C14 - Data-driven Operations Management	D14 - Frontiers in Operations Management	E14 - Information in Operations
Z509	C15 - Sustainable Operations	D15 - Channel Coordination	E15 - The Impacts of Ride-Hailing/Sharing on Individual Decision
Z510	C16 - Healthcare Operations	D16 - Information Design	E16 - Optimal Pricing Strategy
Z511	C17 - Business Analytics	D17 - Innovation and Entrepreneurship	E17 - Emerging Topics in Operations Management
Z512	C18 - Behavioral Operations Management	D18 - Supply Chain Management	E18 - Sustainable Operations
Z513	C19 - Smart Transportation	D19 - Robust Decision Making	E19 - Data-driven Operations Management
Z209	Tutorial Session B	/	/
Z212	C20 - Competition and Cooperation in Transportation	/	/
Z210	C21- Economic Models in Operations Management	/	/

Ph.D. Career Development Forum

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z211

Session Chair: Zhou Xu, The Hong Kong Polytechnic University

Description

This forum invites speakers and guests from academia and industry to share experience and knowledge on various topics about the career development of current PhD students and new PhD graduates in POM.

In this forum, we will first invite three speakers, including Professor Weihua Zhou from Zhejiang University, Professor Dongdong Ge from Shanghai University of Finance and Economics and Cardinal Operations (shanshu.ai), and Dr Fan Zhang (Michael) from Theory Lab of Huawei Hong Kong Research Center, to share their experience and knowledge about the recruitment and career development of PhD graduates in their organizations.

After the three individual talks, we will invite the speakers, together with the other two guests, including Professor Daniel Zhuoyu Long from Chinese University of Hong Kong and Dr Junyan Liu from Theory Lab of Huawei Hong Kong Research Center, to have a panel discussion on the related topics.

It is then followed by a Q&A session.

About Speakers and Guests

Prof. Weihua Zhou

Weihua ZHOU is Qiushi Distinguished Professor of Zhejiang University, Professor of School of Management, and Young Changjiang Scholar of Ministry of Education. He received his bachelor degree in Electronic Engineering and master degree in Applied Mathematics from Zhejiang University and his Ph.D. in Industrial Engineering and Engineering Management from Hong Kong University of Science and Technology. He is currently the director of the International Research Center for Data Analytics and Management of Zhejiang University. His research interests include data analytics, supply chain management and supply chain finance.

Prof. Dongdong Ge

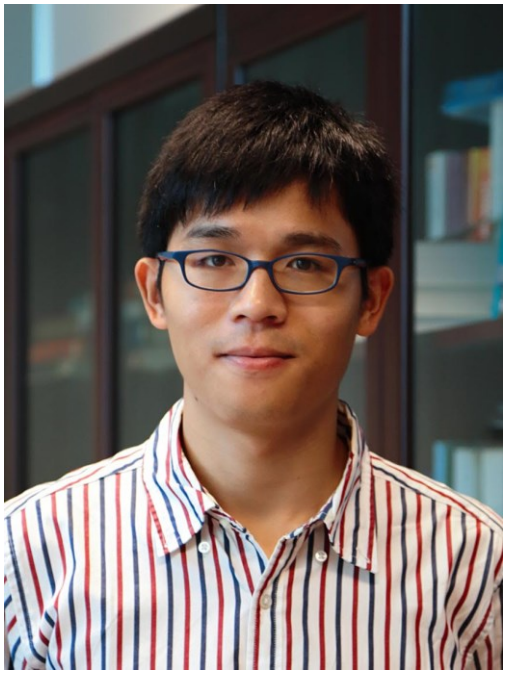
Dongdong Ge is a professor and the dean of Research Institute for interdisciplinary Sciences in Shanghai University of Finance and Economics. He received his Ph.D. degree from MS&E at Stanford University. His main research interests lie in large scale optimization algorithms and applications, and supply chain management in practice. He published in OR and CS journals and conferences such as OR, POMS, MOR, MP, FOCS, SODA, EC, NeurIPS, ICML, etc. He is also the chief scientist and a co-founder of Cardinal Operations(shanshu.ai) and has consulted for companies such as Boeing, IBM, JD, SF-Express, Huawei, Didi, NetEase, etc. He also leads the development of math. prog. solver COPT and LEAVES.

Dr. Fan Zhang (Michael)

Fan Zhang (Michael) is currently with Hong Kong Theory Lab, Huawei Hong Kong Research Center as an optimization expert. He received the BEng (first class Hons) degree from Chu Kochen Honors College, Zhejiang University (ZJU), in 2010, and the Ph.D. degree from the Hong Kong University of Science and Technology (HKUST), in 2015. He joined Huawei Future Network Theory lab as a researcher in 2015 and is an optimization expert in Theory Lab since 2022. His research interest covers a wide range including large-scale optimization techniques, operational research with applications to networking problems, low complexity stochastic optimization, and networked control theory. Michael is now leading a diversified team with people from different backgrounds working on challenging and hardcore optimization problems originated from practical scenarios such as wide area network, optical network, wireless network, and data storage systems. He and his team has gained great experiences in designing customized algorithms for efficiently solving practical large-scale LPs/ILPs with number of variables or constraints to be over 1 million to billion. Some research outputs

directly translate to solving practical problems, leading to increasing revenue or reducing costs, while some contribute to the development of Huawei's generic solver (OptVerse) to enhance its performance.

Prof. Daniel Zhuoyu Long



Daniel Zhuoyu LONG is an associate professor at the Department of Systems Engineering & Engineering Management, The Chinese University of Hong Kong (CUHK). Before joining CUHK, he received his Ph.D. degree from the Department of Analytics and Operations at the National University of Singapore in 2013, his master degree from the Chinese Academy of Science in 2008, and his bachelor degree from Tsinghua University. His research interests revolve around distributionally robust optimization, risk management, and broad applications in supply chain management, revenue management, and project management.

Dr. Junyan Liu

Junyan Liu is an optimization researcher in Hong Kong Theory Lab, Huawei Hong Kong Research Center. She received the B.S. degree in electronics and information engineering from Huazhong University of Science and Technology (HUST) in 2015, and the Ph.D. degree in electronic and computer engineering from Hong Kong University of Science and Technology (HKUST), in 2020. Her current research interests include large-scale optimization techniques with applications in networks problems. She has great experiences in designing customized algorithms for large-scale LPs/ILPs with number of variables or constraints more than 1 million.

Best Student Paper Competition

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z209

Session Chair: Xiaomeng Guo, The Hong Kong Polytechnic University

Title: Implications of Worker Classification in On-Demand Economy

Presenter: Zhoupeng Zhang, University of Toronto
Co-author(s): Ming Hu, Jianfu Wang

Abstract:

How should workers in the on-demand economy be classified? As contractors, employees, or somewhere in between? We study this policy question focusing primarily on the welfare of long-term (LT) workers, who have worked as much as full-time employees but have been treated as contractors. We develop a game-theoretic queueing model with a service platform and two types of workers: LT workers who commit to gig job sex ante according to the long-run earning rate, and ad hoc (AH) workers who participate ex post based on real-time payoffs for doing gigs. We identify two issues associated with uniform classifications: when all workers previously treated as contractors are reclassified as employees according to rulings such as the 2019 Assembly Bill No. 5 (AB5) in California, the profit-maximizing company may undercut(i.e., underpay or underhire) workers and thus LT workers' average welfare can decrease; when all are reclassified as "contractors+," a UK practice and an intermediate status between contractor and employee that provides incomplete employee benefits but allows workers to self-join, workers can over join such that LT workers' utilization rate will remain low and their average welfare will not be effectively enhanced. In light of these issues, we consider a discriminatory scheme that classifies only LT workers as employees while leaving AH workers as contractors. This hybrid mode still suffers from undercutting but curbs overjoining. In addition, it can do less harm to consumers and the platform operator than uniform classifications. As a companion, we also study a discriminatory dispatch policy that prioritizes LT workers over AH workers. We demonstrate the potential of this operational approach to simultaneously counteract both undercutting and overjoining. Finally, we empirically calibrate the model and apply our insights to the ride-hailing market in California.

Title: Optimal Robust Policy for Feature-Based Newsvendor

Presenter: Luhao Zhang, The University of Texas at Austin
Co-author(s): Rui Gao, Jincheng Yang

Abstract:
We study policy optimization for the feature-based newsvendor, which seeks an end-to-end policy that renders an explicit mapping from features to ordering decisions. Most existing works restrict the policies to some parametric class that may suffer from sub-optimality (such as affine class) or lack of interpretability (such as neural networks). Differently, we aim to optimize over all functions of features. In this case, the classical empirical risk minimization yields a policy that is not well-defined on unseen feature values. To avoid such degeneracy, we consider a Wasserstein distributionally robust framework. This leads to an adjustable robust optimization, whose optimal solutions are notoriously difficult to obtain except for a few notable cases. Perhaps surprisingly, we identify a new class of policies that are proven to be exactly optimal and can be computed efficiently. The optimal robust policy is obtained by extending an optimal robust in-sample policy to unobserved feature values in a particular way and can be interpreted as a Lipschitz regularized critical fractile of the empirical conditional demand distribution. We compare our method with several benchmarks using synthetic and real data and demonstrate its superior empirical performance.

Title: The Blockchain Newsvendor: Value of Freshness Transparency and Smart Contracts

Presenter: Chenghuai Li, Duke University
Co-author(s): N. Bora Keskin, Jing Sheng (Jeannette) Song

Abstract:
Motivated by the emerging practice of adopting blockchain technology in the fresh produce supply chain, we investigate how blockchain-enabled transparency on product freshness affects a grocery retailer's inventory decisions, profit, and food waste. We introduce a freshness-dependent consumer demand model in a newsvendor framework and derive closed-form expressions for the retailer's expected profit growth and food waste reduction after adopting blockchain. Based on real-life data, we estimate that each year, blockchain adoption can increase profit by USD 60 million while reducing food waste by 23 million pounds for Walmart's strawberry business in the U.S. alone. These numbers are significant,

considering strawberries make up only about 4%of Walmart's fresh produce sales. Despite the enormous value for the retailer, we show that blockchain adoption may hurt the supplier's expected profit. To incentivize the supplier, we design a family of threshold-type smart contracts contingent on the freshness consensus and examine its win-win propositions. In addition, we find that when the retailer can adjust the retail price based on freshness, the retailer will offer discount for a less fresh product, reducing food waste. When the supplier can change the wholesale price based on freshness, the supplier will also lower the price for a less fresh product, but causing more food waste. Finally, we generalize our findings to the cases of (i) noisy measurements in the Internet of Things (IoT) sensors feeding data into the blockchain, (ii) dual sourcing, and (iii) other practical issues, including the traditional retailer's rejection behavior and the retailer's "culling" process.

Title: Elective Surgery Sequencing and Scheduling under Uncertainty

Presenter: Chen Yang, Hong Kong University of Science and Technology
Co-author(s): Xiaojin Fu, Jin Qi, Han Ye

Abstract:
We consider a surgery sequencing and scheduling problem with uncertain surgical durations. Our goal is to balance the risk of delay and idle time, so the Punctuality Index is proposed. We derive exact solutions based on Benders Decomposition. The framework can also accommodate a robust optimization setting. For practical use, we propose two effective heuristics based on the variance and the forward-backward deviations. With comparison, we demonstrate that our framework is significantly good. The robust setting can effectively lessen the risk of large delay and idle time, and the heuristics are efficient with only little performance sacrificed.

Best Student Paper Competition

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z205

Session Chair: Guang Xiao, The Hong Kong Polytechnic University

Title: Nonprogressive Diffusion on Social Networks: Approximation and Applications

Presenter: Yunduan Lin, University of California, Berkeley
Co-author(s): Heng Zhang, Renyu Zhang, Zuo Jun Max Shen

Abstract:

Nonprogressive diffusion describes the dissemination of behavior on a social network, where the agents are allowed to reverse their decisions as time evolves. It has a wide variety of applications in service adoption, opinion formation, epidemiology, etc. Building upon the rich studies in network diffusion analysis and operations research, we propose a general model to characterize nonprogressive diffusion and develop a fixed-point approximation (FPA) scheme to characterize the limiting adoption on a social network. This approximation scheme admits both a theoretical guarantee and computational efficiency. We show that the maximal deviation of the FPA scheme diminishes as the network size and density increase at a rate of $O(1/\sqrt{N_{min}})$, where N_{min} is the minimum indegree of the agents on a social network. Thus, the FPA scheme is most powerful for dense and large networks that are generally prohibitive by simulation. Taking the widely studied influence maximization and pricing problems on a social network as examples, we further illustrate the broad applications of our FPA scheme. Finally, we conduct comprehensive numerical studies with synthetic and real-world networks. The FPA scheme shows 1,000 times speed up in computation time than simulation. It achieves small approximation error, and out performs conventional algorithms even when the social network is small and/or sparse.

Title: Assortment Optimization with Multi-Item Basket Purchase under the Multivariate MNL Model

Presenter: Chengyi Lyu, University of Colorado Boulder
Co-author(s): Huanan Zhang, Stefanus Jasin, Sajjad Najafi

Abstract:
Problem definition: Assortment selection is one of the most important decisions faced by retailers. Most existing papers in the literature assume that customers select at most one item out of the offered assortment. While this is valid in some cases, it contradicts practical observations in many shopping experiences, both in online and brick-and-mortar retail, where customers may buy a basket of products instead of a single item. In this paper we incorporate customer's multi-item purchase behavior into the assortment optimization problem. We consider both the uncapacitated and capacitated assortment problems under the so-called Multivariate MNL (MVMNL) model, which is one of the most popular multivariate choice models used in the marketing and empirical literature. Methodology/results: We first show that the traditional revenue-ordered assortment may not be optimal. Nonetheless, we show that under some mild conditions, a certain variant of this property holds (in the uncapacitated assortment problem) under the MVMNL model — that is, the optimal assortment consists of revenue-ordered local assortments in each group. Finding the optimal assortment is still computationally expensive as the revenue thresholds for different groups cannot be computed separately. We show that the optimization problem under MVMNL is NP-hard even in the setting where there is no interaction among the product categories. Motivated by this result, we develop FPTAS for several variants of (capacitated and uncapacitated) assortment problems under MVMNL. Managerial implications: Our analysis reveals that disregarding customer's multi-item purchase behavior in assortment decision can indeed have a significant negative impact on profitability, demonstrating its practical importance in retail. We numerically show that our proposed algorithm can improve a retailer's expected total revenues (compared to a benchmark policy that does not properly take into account the impact of customer's multi-item choice behavior in assortment decision) by up to 14%.

Title: Multi-armed Bandit Experimental Design: Online Decision-making and Adaptive Inference

Presenter: Chonghuan Wang, Massachusetts Institute of Technology
Co-author(s): David Simchi-Levi

Abstract:
Multi-armed bandit has been well-known for its efficiency in online decision-making in terms of minimizing the loss of the participants' welfare during experiments (i.e., the regret). In clinical trials and many other scenarios, the statistical power of inferring the treatment effects (i.e., the gaps between the mean outcomes of different arms) is also crucial. Nevertheless, minimizing the regret entails harming the statistical power of estimating the treatment effect, since the observations from some arms can be limited. In this paper, we investigate the trade-off between efficiency and statistical power by casting the multi-armed bandit experimental design into a minimax multi-objective optimization problem. We introduce the concept of Pareto optimality to mathematically characterize the situation in which neither the statistical power nor the efficiency can be improved without degrading the other. We derive a useful sufficient and necessary condition for the Pareto optimal solutions to the minimax multi-objective optimization problem. Additionally, we design an effective Pareto optimal multi-armed bandit experiment that can be tailored to different levels of the trade-off between the two objectives. Finally, we extend the design and analysis to the setting where the outcome of each arm consists of an adversarial baseline reward and a stochastic treatment effect, demonstrating the robustness of our design.

Title: Asymptotic Optimality of Semi-Open-Loop Policies in Markov Decision Processes with Large Lead Times

Presenter: Xingyu Bai, University of Illinois at Urbana-Champaign
Co-author(s): Xin Chen, Alexander Stolyar, Menglong Li

Abstract:
We consider a generic Markov decision process (MDP) with two controls: one control taking effect immediately and the other control whose effect is delayed by a positive lead time. As the lead time grows, one would naturally expect that the effect of the delayed action only weakly depends on the current state, and decoupling the delayed action from the current state could provide good controls. The purpose of this paper is to substantiate this decoupling intuition by establishing asymptotic optimality of semi-open-loop policies, which specify open-loop controls for the delayed action and closed-loop controls for the immediate action. For MDPs defined on general spaces with uniformly bounded cost functions and a fast-mixing property, we construct a periodic semi-open-loop policy for each lead time value and show that these policies are asymptotically optimal as the lead time goes to infinity. For MDPs defined on Euclidean spaces with linear dynamics and convex structures, we impose another set of conditions under which semi-open-loop policies (actually, constant delayed-control policies) are asymptotically optimal. Moreover, we verify that these conditions hold for a broad class of inventory models, in which there are multiple controls with non-identical lead times.

Best Student Paper Competition

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z209

Session Chair: Xiaomeng Guo, The Hong Kong Polytechnic University

Title: Multi-Armed Bandits with Endogenous Learning Curves and Queueing: An Application to Split Liver Transplantation

Presenter: Yanhan (Savannah) Tang, Carnegie Mellon University
Co-author(s): Alan Scheller-Wolf, Sridhar Tayur, Andrew A. Li

Abstract:
Problem definition: Proficiency in many sophisticated tasks is attained through experience-based learning, in other words, learning by doing. For example, transplant surgeons need to practice difficult surgeries to master the skills required, call center staff need to handle customer calls to improve their ability to resolve customer issues, new franchisees learn to operate smoothly over time. This experience-based learning may affect other stakeholders, for example, patients eligible for transplant surgeries. Such a situation illustrates the classical exploration versus exploitation trade-off: A central planner may want to identify and develop surgeons with high aptitudes, while ensuring that patients still have excellent outcomes and equitable access to organs. Methodology and Results: We formulate a multi-armed bandit (MAB) model, in which parametric learning curves are embedded in the reward functions to capture experience-based learning. In addition, our model includes provisions ensuring that the choices of arms are subject to fairness constraints (ensuring equity), incorporates queueing dynamics (to capture waiting time dynamics), and arm dependence (to capture learning across similar surgeries). To solve our MAB problem we propose the L-UCB, FL-UCB, and QFL-UCB algorithms, all variants of the upper confidence bound (UCB) algorithm that attain $O(\log t)$ regret on problems enhanced with experience-based learning, fairness concerns, queueing dynamics, and arm dependence. We demonstrate our model and algorithms on the split liver transplantation (SLT) allocation problem, showing that our algorithms have superior numerical performance compared to standard bandit algorithms in a setting where experience-based learning, fairness, queueing, and arm dependence exist. Managerial implications: From a methodological point of view, our proposed MAB model and algorithms are generic and have broad application prospects. From an application standpoint, our algorithms could be applied to help evaluate potential strategies to increase the proliferation of SLT and other technically-distomesial procedures.

Title: Screening with Limited Information: A Dual Perspective and A Geometric Approach

Presenter: Ruiqin Wang, National University of Singapore
Co-author(s): Zhi Chen, Zhenyu Hu

Abstract:
Consider a seller seeking a selling mechanism to maximize the worst-case revenue obtained from a buyer whose valuation distribution lies in a certain ambiguity set. For a generic convex ambiguity set, we show via the minimax theorem that strong duality holds between the problem of finding the optimal robust mechanism and a minimax pricing problem where the adversary first chooses a worst-case distribution and then the seller decides the best posted price mechanism. This implies that the extra value of optimizing over more sophisticated mechanisms exactly amounts to the value of eliminating distributional ambiguity under a posted price mechanism. The duality result also connects prior literature that separately studies the primal (robust mechanism design) and problems related to the dual (e.g., robust pricing, buyer-optimal pricing and personalized pricing). We further provide a geometric approach to analytically solving the minimax pricing problem (as well as the robust pricing problem) for several important ambiguity sets such as the ones with mean and various dispersion measures, and with the Wasserstein metric. The solutions are then used to construct the optimal robust mechanism and to compare with the solutions to the robust pricing problem. Uniqueness of the worst-case distribution can also be established for some cases.

Best Student Paper Session III

Title: Managing Panic Buying with Bayesian Persuasion

Presenter: Tianqi Song, City University of Hong Kong
Co-author(s): Biying Shou, Pengfei Guo

Abstract:
Information provision by a retailer to its customers plays a vital role in influencing market demand. In this paper, we study how the better-informed retailer can send persuasive signals to influence the customers' panic buying behaviors. We apply the Bayesian persuasion framework in this context and derive the analytical solution by the geometric method. We demonstrate that, for the profit-maximizing retailer, he will use the signals to reduce panic buying when the supply chain disruption risk is high; however, when the risk is low, the retailer may intentionally create panic buying. We also show the optimal policy for the welfare-maximizing social planner.

Title: Quality and Welfare Implications of Product Traceability in Supply Chain

Presenter: Xinyi Zhou, Hong Kong University of Science and Technology
Co-author(s): Lijian Lu, Ruxian Wang

Abstract:
Motivated by the recent trend of increasing transparency and traceability in the food and pharmaceutical industries, we investigate the impacts of traceability on a supply chain in which a buyer (e.g., a procurementagent or retailer) sources a product from multiple competing suppliers. When a product fails in the field, penalty cost including cost of recalls and consumers' ill-will is incurred. We examine the implications of various mechanisms for sharing the penalty cost among supply chain members. With traceability technology, the defective components are traced back to the providers and therefore the corresponding penalty is imposed; otherwise, providers' accountability cannot be identified and therefore the penalty cost must be shared among all suppliers based on group sharing mechanisms. Each supplier can exert a costly effort to improveits product's quality, and a higher quality leads to a lower failure rate and therefore a lower penalty cost. Another benefit of a higher quality is to gain a larger market share in the competing market. In a multi-agent game-theoretic setting, we characterize the equilibrium outcomes for this quality competition game, and reveal the impacts of traceability on product quality and welfare of supply chain members under variousscenarios based on the buyer's monopolistic power. We show that

traceability may either hurt or improve product quality depending on the magnitude of product profitability, the cost of quality improvement, the buyer's monopolistic power in decision making, and the cost of adopting traceability. We also compare the decentralized supply chain with its centralized counterpart, and identify conditions that lead to supply chain coordination.

Parallel Session (A1) - Optimization for Pricing Decisions

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z503

Session Chair: Ying Rong, Shanghai Jiao Tong University

Title: Dynamic Pricing for Two-sided Marketplaces with Offer Expiration

Presenter: Yufeng Cao, Shanghai Jiao Tong University
Co-author(s): Anton J Kleywegt, He Wang

Abstract:
We consider a two-sided marketplace in which a market operator sells services (aka jobs) to clients and buys services from vendors. Jobs are submitted by clients to the marketplace, and vendors view the available jobs with their characteristics and choose jobs based on preferences. The market operator determines the prices for both clients and vendors. We consider an infinite horizon long-run average reward Markov decision process (MDP) model of the market operator's pricing problem. We study a discrete-time fluid approximation of the problem and propose a simple pricing policy whose prices for each job depend on the time remaining until the service deadline. We show that this policy is asymptotically optimal with a loss ratio of order O(1/\theta) on the long-run average reward, where \theta represents the scale of demand and supply.

Title: Dynamic Pricing on Asset Selling Platforms

Presenter: Puping (Phil) Jiang, Shanghai Jiao Tong University
Co-author(s): Rene Caldentey, Lingxiu Dong

Abstract:
In this paper, we propose a holistic dynamic pricing framework of asset acquisition and selling for online asset selling platforms. Our framework assumes individual buyers follow a nested logit choice model. We propose a heuristic that achieves a constant competitive ratio as the problem scales, via solving a low-dimensional problem. Especially, the infrequent-price-update nature of our heuristic fits the platforms' practical needs.

Title: Partition and Prosper: Design and Pricing of Single Bundle

Presenter: Hailong Sun, Shanghai Jiao Tong University
Co-author(s): Xiaobo Li, Chung Piaw Teo

Abstract:
Product bundling is a common marketing strategy for cross-selling in multi-product firms. To make bundling effective in practice, a key challenge is to design and price suitable bundles. In this paper, we consider probably the most basic such problem, i.e., how to select a single (pure) bundle from a product set, and find the bundle and product prices (of the remaining products) to maximize profit. The optimal solution to this problem naturally yields a simple pricing mechanism where customers are offered a single bundle with the rest (SBR) products. By exploiting the structure of the optimal solution, we show that the SBR optimization problem can be solved in polynomial time under independent normal customer valuations. This is surprising as even when individual product prices are predetermined, the problem of designing and pricing a single bundle is already NP-hard under the general setting. We build on these results and use a Bayesian optimization algorithm, combined with conic programming techniques, to solve the general problem under correlated valuations. This leads to an efficient algorithm that works exceedingly well for moderate-size problems. We show further that SBR is a constant approximation to other more general but complex selling mechanisms regarding profit performance. Finally, we extend SBR to allow for separate purchase of component products within the selected bundle, and showcase how these models can be applied to solve the add-on pricing and personalized bundle recommendation problems. Extensive numerical results demonstrate the superior performance of our Bayesian optimization algorithm over simple heuristics.

Title: Information and Bias Effects in Discretionary Pricing: Evidence from an OTC Drug Pricing Field Experiment and Lab Experiment

Presenter: Xinyu Liang, University of Michigan
Co-author(s): Jun Li, Iris Yixin Wang

Abstract:
In theory, discretionary pricing improves the company's performance by allowing managers to incorporate local information into their decisions. However, in practice, managers are vulnerable to behavioral biases and precipitate poor decisions. This paper investigates the effectiveness of discretionary pricing and examines how information and behavioral bias influence managers' pricing decisions by a series of field experiment and lab experiment. Collaborating with a pharmacy retail chain, we first analyze a field experiment that delegates pricing power to local pharmacy managers and reveal the behavioral biases of individual decisions. We then conduct a lab experiment to examine their behavioral drivers.

Parallel Session (A2) - Recent Development of Pricing Theory

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z505

Session Chair: Xiaobo Li, National University of Singapore

Title: Return or Not? Joint Pricing and Refund Optimization for Omni-channel Retailing

Presenter: Yimeng Sun, Nanyang Technological University
Co-author(s): Shouchang Chen, Yun Fong Lim, Zhenzhen Yan

Abstract:
We study a return problem of a retailer selling multiple substitutable products through an online channel and a physical store. Online purchases can be returned either by mail or to the physical store. The retailer decides each product's price and refund value in each channel to maximize his expected profit. We characterize a consumer's sequential decisions on making a purchase and returning the product using a generalized Markovian logit choice (MLC) model, which allows us to formulate a joint pricing and refund optimization problem. If no constraints on the prices and refund values are imposed, this optimization problem is convex and we obtain analytical expressions of its optimal solution. To profit from

introducing return policies for online purchases, the retailer has to ensure that each online product has good quality or one of its return channels creates non-negative social welfare. Due to the cross-channel substitution effect in omni-channel retailing, the online and offline prices are mutually affected and are not necessarily equal. If constraints are imposed on the prices and refund values, the problem may become non-convex and we approximate it using a mixed-integer linear program. Furthermore, the generalized MLC model is flexible and predicts the demand well. Numerical experiments under various parameter settings using synthetic data demonstrate that an estimation-and-optimization framework based on this generalized MLC model yields a profit close to a theoretical benchmark. The generalized MLC model can be estimated based on partially observable data. A case study using data with some unobservable consumer choices from a major fashion retailer in China demonstrates that our approach is effective.

Title: Parameterizing the Rank-List Model with Optimal Pricing Decision

Presenter: Shuo Wang, National University of Singapore
Co-author(s): Xiaobo Li

Abstract:
The rank-list model is a general non-parametric choice model. It assumes each customer has a fixed preference ranking over all products and chooses the product that ranks highest among the offer set. However, consumers' preferences could be affected when products' prices change. Thus, we propose an approach to parameterize the rank-list model and estimate its price sensitivity and noise distribution, based on the ideas of regularized regression and robust optimization. With the price effect captured, we reformulate the multi-product pricing problem as a mixed-integer linear program. Numerical experiments demonstrate its predictive and prescriptive power against some common parametric choice models.

Title: Learning Mixed Multinomial Logits with Provable Guarantees and its Applications in Pricing

Presenter: Zhenzhen Yan, Nanyang Technological University
Co-author(s): Yiqun Hu, David Simchi-Levi

Abstract:
Mixture of multinomial logits (MMNL) generalizes the single logit model, which is commonly used in predicting the probabilities of different outcomes. While extensive algorithms have been developed in the literature to learn MMNL models, theoretical results are limited. Built on the Frank-Wolfe (FW) method, we propose a new algorithm that learns both mixture weights and component-specific logit parameters with provable convergence guarantees for an arbitrary number of mixtures. Our algorithm utilizes historical choice data to generate a set of candidate choice probability vectors, each being close to the ground truth with a high probability. We further provide a sample complexity analysis to show that only a polynomial number of samples is required to secure the performance guarantee of our algorithm. Finally, we conduct simulation studies to evaluate the performance and demonstrate how to apply our algorithm to pricing problems.

Title: Revenue Management Under a Price Alert Mechanism

Presenter: Bo Jiang, Shanghai University of Finance and Economics
Co-author(s): Zizhuo Wang

Abstract:
Many online platforms adopt a price alert mechanism to facilitate customers tracking the price changes. This mechanism allows customers to register their valuation to the system when they find the price is larger than the valuation on their arrival period. Once the price drops below the customers' registered price, a message will be sent to notify them. In this paper, we study the optimal pricing problem under this mechanism. First, when the customer's waiting time is one period, we show that it is optimal for the seller to use a threshold to decide whether to accept or reject a registered price, and the price trajectory under the optimal policy has a stochastic cyclic decreasing structure. When the customer's valuation is a uniform distribution, the analytical form of the optimal policy is further obtained. When the customer's patience level is two periods, we obtain the structure of the optimal policy by showing the asymmetric role each registered price plays in the optimal

policy. Then we consider the case when the customer can stay in the system for an infinite number of periods. We derive an asymptotic optimal policy for this case. We find that adopting the price alert mechanism always increases social welfare; however, it may hurt the customer surplus when the seller has a large discount factor. Finally, we consider the case when the customers can strategically react to the price alert mechanism by timing their purchases and reporting false valuations. Using a Stackelberg's game model, we obtain the seller's optimal threshold type of policy. We show that the price alert mechanism can still be helpful to the seller, although the advantage diminishes when customers are very strategic.

Parallel Session (A3) - Emerging Topics in Operations Management

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z506

Session Chair: Weiming Zhu, The University of Hong Kong

Title: Matchmaking Strategies for Maximizing Player Engagement in Video Games

Presenter: Xiao Lei, The University of Hong Kong
Co-author(s): Mingliu Chen, Adam N. Elmachtoub

Abstract:
We analyze the dynamic matching problem in online video games, aiming to maximize player engagement. Players have different skill levels, which affect the outcomes of matches, and the win-loss record influences their willingness to remain engaged. We fully characterize the optimal matching policy on a stylized model where there are two skill levels, and players churn only when they experience a losing streak. Compared to the industry status, we prove the benefit of optimizing the matchmaking system grows linearly with the number of skill levels. Our framework can also handle the addition of AI bots and pay-to-win system.

Title: People-Centric Regulations on Food Delivery Platforms: Improvements or Impairments

Presenter: Wei Zhang, University of Hong Kong

Abstract:
The recent surge in the number of traffic violations and accidents associated with food delivery workers in China make people believe that platforms are abusing the algorithm and treating workers unfairly. We study two possible government regulations that aim to improve the gig workers' welfare. One is to regulate the platform's service request allocation algorithm, and the other is to require compulsory labor insurance. We show that they can backfire and lead to impairments of worker welfare.

Title: Assortment Optimization and Pricing with Service Rate Consideration

Presenter: Shixin Wang, The Chinese University of Hong Kong
Co-author(s): Zhe Liu, Kalyan Talluri

Abstract:
Quick-service restaurants, such as fast-food franchises and coffeehouse chains, recommend items with spotlight menu that may shorten customers' decision time and hence speed up the service, but with a trade-off of possibly lower profit margin. We study such assortment optimization problems when service rate is affected by the recommendation and plays a role in the revenue rate objective. Formulated as a sequential recommendation problem in a queueing setting under the multinomial logit model, we obtain structural properties of the impact of arrival rate and system capacity on optimal assortment, and find optimality conditions for attractiveness-ordered or revenue-ordered nested policies.

Title: Managing Spatial Equity in Urban Services: Evidence from the Bike-sharing Industry

Presenter: Weiming Zhu, The University of Hong Kong
Co-author(s): Víctor Martínez de Albéniz, Qihang Yang, Jianfeng Lin, Zhaochen Dong, Jinglong Dai

Abstract:
Urban services such as dockless bike sharing and last-mile delivery tend to occupy public space while providing service to the targeted users. In regions where the demand for such services is high, the service level may increase, leading to public areas being used more heavily, resulting in spatial equity concerns both on consumer service and the use of public space. In this paper, using the dockless bike-sharing system as an example, we propose several metrics for spatial equity. We then build a mixed-integer program to determine the optimal bike redistribution policy subject to spatial equity constraints. We conduct a randomized field experiment with Meituan Bike to identify the effectiveness of the equitable redistribution policy.

Parallel Session (A4) - Risk and Learning

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z507

Session Chair: Xuefeng Gao, The Chinese University of Hong Kong

Title: Optimal Pricing for Queueing Systems with Loss-Averse Customers

Presenter: Jian Cao, Beijing University of Posts and Telecommunications
Co-author(s): Junfei Huang, Hongfan (Kevin) Chen, Yongjiang Guo

Abstract:
Loss aversion has two alternative evaluations: stochastic reference point (SRP) and state-dependent reference point (SDRP). We consider a queueing system with uncertain service rates where customers are loss-averse. Then, we investigate the impacts of loss aversion on the revenue-optimal price and socially optimal price in both evaluations. Our main results are as follows. First, for the SRP model, loss aversion could drive both revenue-optimal price and socially optimal price up. Second, for the SDRP model, the revenue-optimal price does not depend on loss aversion. However, loss aversion could motivate the social planner to

charge a higher socially optimal price. Third, the revenue-optimal price and socially optimal price in the SRP model are larger than these prices in the SDRP model, respectively.

Title: Robust Spectral Risk Optimization When Information on Risk Spectrum Is Incomplete

Presenter: Huifu Xu, The Chinese University of Hong Kong
Co-author(s): Wei Wang

Abstract:
Spectral risk measure (SRM) is a weighted average of value at risk (VaR) where the weighting function (also known as risk spectrum or distortion function) characterizes decision maker's risk attitude. In this work, we consider the case where the decision maker's risk spectrum is ambiguous and introduce a robust SRM model based on the worst risk spectrum in a ball of risk spectra centred at a nominal risk spectrum. When the ball consists of step-like risk spectra, we show that the robust SRM can be computed by solving a linear programming problem. For general case, we propose a step-like approximation scheme and derive an error bound for the approximation. As an application, we apply the proposed robust SRM to one-stage stochastic optimization with objective of minimizing the robust SRM and propose an alternating iterative algorithm for solving the resulting minimax optimization problem. Moreover, to examine stability of the robust spectral risk optimization model with respect to perturbation of observed data from the underlying exogenous uncertainty in data driven environments, we investigate statistical robustness of the model and derive sufficient conditions for the required stability.

Title: Risk-Sensitive Reinforcement Learning

Presenter: Wenhao Xu, The Chinese University of Hong Kong
Co-author(s): Xuefeng Gao, Xuedong He

Abstract:
We study risk-sensitive reinforcement learning for finite-horizon episodic Markov decision processes with a broad class of risk measures known as optimized certainty equivalent (OCE). We propose a value iteration algorithm based on the recursive utility and upper confidence bound. We derive an upper bound on the total regret of the proposed algorithm, and establish a worst-case lower bound.

Title: Square-root Regret Bounds for Continuous-time Episodic Markov Decision Processes

Presenter: Xuefeng Gao, The Chinese University of Hong Kong
Co-author(s): Xun Yu Zhou

Abstract:
We study reinforcement learning for continuous-time Markov decision processes (MDPs) in the finite-horizon episodic setting. We present a learning algorithm based on the methods of value iteration and upper confidence bound. We derive an upper bound on the worst-case expected regret for the proposed algorithm, and establish a worst-case lower bound, both bounds are of the order of square-root on the number of episodes. Finally, we conduct simulation experiments to illustrate the performance of our algorithm.

Parallel Session (A5) - Robust Optimization and Its Applications on Operations Management

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z509

Session Chair: Daniel Zhuoyu Long, The Chinese University of Hong Kong

Title: Adjustable Distributionally Robust Optimization with Infinitely Constrained Ambiguity Sets

Presenter: Haolin Ruan, City University of Hong Kong
Co-author(s): Zhi Chen, Chin Pang Ho

Abstract:
We study adjustable distributionally robust optimization problems where their ambiguity sets can potentially encompass an infinite number of expectation constraints. Although such ambiguity sets have great modeling flexibility, the corresponding adjustable problems remain computationally challenging. To overcome this issue, we propose a procedure that consists of solving, via the (extended) linear decision rule approximation, a sequence of tractable subproblems that can be iteratively tightened. Through numerical studies on bed quota allocation and multi-stage inventory control, we show that our approach can yield improved solutions systematically for both two-stage and multi-stage problems.

Title: Decision-Driven Regularization: A Blended Model for Predict-then-Optimize

Presenter: Qinshen Tang, Nanyang Technological University
Co-author(s): Gar Goei Loke, Yangge Xiao

Abstract:
We study the predict-then-optimize approach, which first learns how outcomes result from the features, and then selects optimal decisions based on these outcomes. We construct a regularization for forming the predictions, via the subsequent optimization problem of selecting decisions to minimize cost. We term it decision-driven regularization, which carries both elements of predictive accuracy and decision quality, and is tractable. We additionally show that alternative perspectives for formulating the problem, namely robust optimization and regret minimization, lead to models that are equivalent to or can be naturally approximated to our proposed model. As a consequence, our framework generalizes models such as SPO+ in Elmachtoub and Grigas (2021).

Title: Distributionally Robust Pricing with Asymmetric Information

Presenter: Yihua He, Hong Kong University of Science and Technology
Co-author(s): Hongqiao Chen, Jin Qi, Lianmin Zhang

Abstract:
In this paper, we study a distributionally robust pricing model based on asymmetric information of the customers' valuation distribution by utilizing semivariance information. By maximizing the profit lower bound, we obtain the optimal robust price in a closed form. With a provable higher performance guarantee, our model outperforms the robust model with known mean and variance in all possible scenarios. Numerically, our pricing strategy can obtain around 95% maximal revenue for information goods under some common underlying distributions. Finally, we construct the symmetric robust pricing model under symmetric distributions and elicit its advantages against other models.

Title: Two-Stage Distributionally Robust Optimization with Uncertain Moments

Presenter: Wen Bai, City University of Hong Kong
Co-author(s): Zhi Chen, Grani A. Hanasusanto, Viet Anh Nguyen

Abstract:
We consider an ambiguity set of uncertain mean and covariance and reformulate a two-stage distributionally robust linear program as a finite-dimensional copositive program. In particular, we construct the ambiguity set using the Wasserstein distance and the Kullback–Leibler divergence to specify the uncertain mean and covariance. To use the sample information more effectively, especially for large sample sizes, we add a weight to connect the proposed method with the classical sample average approximation approach. Through numerical studies on a lot-sizing problem, we demonstrate that our method is practically tractable and remains competitive in terms of running time and optimal solutions.

Parallel Session (A6) - Blockchain Applications

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z510

Session Chair: Song Li, International Digital Economy Academy (IDEA)

Title: Accounts Receivable Tokenization in Multitier Supply Networks

Presenter: Jing Hou, Nanjing University
Co-author(s): Burak Kazaz, Fasheng Xu

Abstract:
Accounts receivable can be turned into digital tokens that can either be sold at a discount via factoring or bepassed on to the upstream of the supply chain as a payment instrument. This paper investigates how accountsreceivable (AR) tokenization impacts the multitier supply chain's decisions and profits under different supplynetwork configurations and contractual forms. Our research yields the following main insights. First, ARtokenization always benefits the downstream manufacturer and the reliable tier-2 supplier, but can hurt theprofits of other participants. If a tier-1 supplier allocates the manufacturer's order between the two tier-2suppliers with different reliabilities (i.e., in the Y-shaped supply chain), the sourcing strategy switch broughtby AR tokenization makes the unreliable tier-2 supplier worse off with a zero profit, and the tier-1 suppliercan also be hurt because tier-1's

leverage over the manufacturer is indirectly weakened. If the manufacturerdirectly decides how much to source from the two tier-2 suppliers through two different tier-1 suppliers (i.e.,in the V-shaped supply chain), AR tokenization reduces the unreliable tier-2 supplier's production quantityand even profit when the market potential is relatively large, but the manufacturer never abandons theunreliable branch. Second, when the market potential is relatively small, the manufacturer is more likely toinitiate AR tokenization in the V-shaped supply chain. The result, however, is reversed if the market potentialis relatively high. Third, direct control over the wholesale price may hinder the value of AR tokenization fora supply chain tier. For instance, the tier-1 pricing might allow the manufacturer to extract more value fromAR tokenization in the V-shaped supply chain because of the intensified price competition among tier-1.Lastly, a higher credit risk of the manufacturer can increase the value of AR tokenization, not only for themanufacturer but also for the whole system.

Title: ICOs under Network Effect

Presenter: Zhao Liu, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Xiaoqiang Cai, Fasheng Xu, Lianmin Zhang

Abstract:
Initial Coin Offerings (ICOs) can be used to raise fund. We show how a company implements ICOs and issues tokens backed by its products under network effect. Our research yields three main insights. First, we find that under weak but increasing network effect, the company would increase the fund to be raised by increasing the token price, while under strong network effect, the fund to be raised is independent of network effect. Second, although uncertainty of network effect never decreases the company's profit, it may decrease the raised fund. Third, ICOs decrease volatility of profit with the same expected profit, compared with bank financing.

Title: On the Impact of Institutional Investors in Initial Coin Offerings (ICOs) with Network Externality

Presenter: Siyi Wang, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Xiaoqiang Cai, Lei Guan, Lianmin Zhang

Abstract:
Initial coin offerings (ICOs) are popular among start-ups that issue initial tokens as the sole exchange medium for their planned products. We establish an ICO model with network effects, to study the effect of institutional investors' participation in the pre-ICO stage of offerings. We find that introducing institutional investors significantly increases the equilibrium price of tokens during the public offering stage as well as the price fluctuation of tokens over time. Meanwhile, entrepreneurs will over-issue tokens when the intensity of network externality is relatively high. Interestingly, when institutional investors' required rate of return decreases, the change in the optimal issuance is not monotonic.

Title: Motif-aware Temporal GCN for Fraud Detection in Signed Cryptocurrency Trust Networks

Presenter: Song Li, International Digital Economy Academy (IDEA)
Co-author(s): Chong Mo, Kwok Fai Tso, Yiyan Qi, Songtao Jiang, Mingjie Zhu

Abstract:
Graph convolutional networks (GCNs) is a class of artificial neural networks for processing data that can be represented as graphs, which is increasingly used to model financial networks and has achieved superior results. In this paper, we focus on fraud detection on bitcoin networks. In the literature, most works focus on static networks. Whereas in this work, we consider the evolving nature of the bitcoin network, and use local structure as well as the balance theory to guide the training process. Experimental results on bitcoin-alpha and bitcoin-otc datasets shows that the proposed model outperforms those in the literature.

Parallel Session (A7) - Healthcare Operations Management

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z411

Session Chair: Yufeng Zhang, Singapore University of Technology and Design

Title: Referral and Pricing Decisions of Telemedicine Considering Differential Reimbursement Mechanism

Presenter: Xinling Liu, Tianjin University
Co-author(s): Zhaofang Mao, Yuqiong Jiang

Abstract:
Traditional healthcare system faces problems of long waiting times and unreasonable resource allocation. Telemedicine complementing with traditional healthcare system can relieve the treatment pressure and balance supply and demand. Referral between online and offline appears. Considering the different online and offline insurance reimbursement mechanisms, we develop a stylized queue model to analyze a healthcare system composed of a general hospital and its self-built Internet hospital and find the optimal upward referral strategy and telemedicine pricing strategy. We further explore the impact of different reimbursement policies on system performance. This paper provides suggests for healthcare system optimization and policy formulation.

Title: Treatment Planning of Victims with Heterogeneous Time-sensitivities in Mass Casualty Incidents

Presenter: Yunting Shi, Shanghai Jiao Tong University
Co-author(s): Guohua Wan, Nan Liu

Abstract:
The current emergency response guidelines suggest giving priority of treatment to those victims whoseinitial health conditions are more critical. While this makes intuitive sense, it does not consider potentialdeterioration of less critical victims. Deterioration may lead to longer treatment time and irrecoverablehealth damages, but could be avoided if these victims were to receive care in time. Informed by a uniquetimestamps dataset of surgeries operated in a field hospital set up in response to a large-scale earthquake,we develop scheduling models to aid treatment planning for mass casualty incidents (MCIs). A distinguishing feature of our modeling framework is to simultaneously consider victim health

deterioration andwait-dependent service times in making decisions. We identify conditions under which victims with a lesscritical initial condition have higher or lower priority than their counterparts in an optimal schedule — thepriority order depends on victim deterioration trajectories and the resource (i.e., treatment time) availability. A counterfactual analysis based on our data shows that adopting our model would significantly reduce boththe total number of deteriorated victims and the surgical makespan compared to using the then-implementedtreatment plan; dynamic adjustment of treatment plans (if a second batch of victims arrive) and care co-ordination among surgical teams could further improve operational efficiency and health outcomes. Bydemonstrating the value of adopting data-driven approaches in MCI response, our research holds strong po-tentials to improve emergency response and to inform its policy making.

Title: Clinical Intervention Prediction based on a new ICU Heterogeneous Data Preprocessing Method

Presenter: Taojing Gan, South China University of Technology
Co-author(s): Shouhong Wang, Xuebiao Wei, Hengqing Ye, Wenbin Zhu

Abstract:
ICU nursing tasks are heavy, and patients generally receive many interventions to control their physical condition. It is important to give early warning of some common intervention measures and in this study, we examine the CRRT intervention that is widely in demand in the ICU. For heterogeneous and irregular data, we propose a novel data preprocessing method for machine learning models in predicting the need for intervention. The experiment results show the effectiveness of our method.

Title: Share or Hide Emergency Department Queue-lengths to Reduce Congestion?

Presenter: Yufeng Zhang, Singapore University of Technology and Design
Co-author(s): Shrutivandana Sharma, Costas Courcoubetis

Abstract:
We investigate how different levels of queue-length information influence urgent patients' (UPs') and non-urgent patients' (NUPs') decision and the overall social welfare of Emergency Department (ED). We present an analytical framework based on queueing games and ours is the first work to compare different models of queue-length-information provision in the context of controlling NUP volume at ED. We compare observable, partial and unobservable pre-emptive priority systems. In partial, ED provides an arriving UP and NUP only the queue of UPs and NUPs, respectively. Our results suggest that information sharing is always helpful, but fully observable is not always the best.

Parallel Session (A8) - Corporate Social Responsibility

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z412

Session Chair: Fuzhen Liu, The Hong Kong Polytechnic University

Title: A Conceptual Framework to Analyze Total Quality Management in View of Corporate Social Responsibility

Presenter: Menghua Huang, Tian Gong University
Co-author(s): Yingxue Ren

Abstract:
Product quality is often accused to be insufficient corporate social responsibility, this study is to explorecorporate social responsibility's impact on total quality management and quality performance, by dividing corporate social responsibility into three dimensions, community and environmental responsibility, employee responsibility,and customer responsibility.The empirical analysis is used throughout, the data were collected by questionnaires and 205 valid questionnaires were obtained from 11 manufacturing companies, and then hypotheses and effects were tested using path analysis. The results show that community and environmental responsibility, employee responsibility, and customer responsibility positively and significantly impact total quality management.

Meanwhile, employee responsibility also significantly impacts quality performance. Besides, community and environmental responsibility, employee responsibility, and customer responsibility can indirectly impact quality performance through total quality management, where total quality management plays a mediating role. As a result, this paper considers thatcompanies should focus on the implementation of corporate social responsibility alongside total quality management toimprove their quality performance and competitiveness.

Title: Impacts of Distributive Comparison Behavior on Corporate Social Responsibility in Supply Chains The Role of Small Firms

Presenter: Mingzheng Wang, Zhejiang University
Co-author(s): Xin Fang, Ying Ju Chen

Abstract:
We explore how a firm's concern about profit distribution and the size of downstream firms in a supply chain affect CSR investment strategy. We identify the conditions under which the manufacturer's distributive comparison behavior makes the manufacturer or supplier more likely to invest in CSR. The weak bargaining power of the small manufacturer leads to larger positive or smaller negative impacts of distributive comparison behavior. The low efficiency of the small manufacturer to reduce CSR violations leads to smaller negative impacts. We suggest that governments and NGOs should investigate firms' distributive comparison behavior in supply chains.

Title: Combating Excessive Overtime in Global Supply Chains

Presenter: Chuanya Jiao, University of Science and Technology of China
Co-author(s): Anyan Qi, Jiayu Chen

Abstract:
Workers in developing economies may be forced by suppliers to work excessive overtime, resulting in severe mental and physical issues for the workers and possible significant damage to the brand of multinational enterprises (MNEs) if exposed in public. In this paper, we develop a game-theoretic model of a dyadic supply chain to analyze a manufacturer's strategies to combat these excessive overtime issues of a supplier, including a stick strategy of auditing the supplier's practice (i.e., the auditing strategy) and a carrot supplier-

development strategy of cross-training the supplier's workers to increase their versatility (i.e., the cross-training strategy). When auditing is the only viable strategy, it can effectively mitigate the supplier's violation behavior only when the auditing accuracy is significant. The manufacturer audits the supplier when the auditing cost is smaller than a threshold. In the scenario where both cross-training and auditing are viable, when cross-training is less effective, interestingly, cross-training becomes a complement for auditing, in contrast to the naive common belief that the strategies combating excessive overtime are always substitutes. That is, cross-training increases the manufacturer's auditing incentive. When cross-training is more effective, it is indeed a substitute for auditing. We also find that cross-training may backfire and actually increase the degree of excessive overtime when it is more effective because of the manufacturer's decreased incentive to audit. Finally, cross-training may lead to a win-win situation and Pareto improve the manufacturer's and the supplier's profits.

Title: The Market Value of Responsible Production Practices Adoption: An event Study from Chinese Manufacturers

Presenter: Fuzhen Liu, The Hong Kong Polytechnic University
Co-author(s): Kee Hung Lai

Abstract:
Responsible production has received remarkable attention as an effective way to build corporatereputation and achieve business sustainability. Nevertheless, little is known about the market valueof responsible production practices. Drawing upon the legitimacy and contingency theories, we examine the market valueof responsible production practices adoptedby manufacturersas well as the boundary conditions of this relationship(i.e., resource slack and internal control quality). Based on 182 announcements from publicly listed Chinese manufacturers, we find that the stock market reacts positively to theirannouncements of responsible production practices. In addition, we find that a firm's financial slack strengthens but operational slack weakens the market value brought by the announcements of responsible production practices adoption. Furthermore, the positive market value from announcing responsible production practices adoptionis more prominent for manufacturers with better internal control quality. Our findings provide theoretical implications by revealingthe importance of a firm's internal resources andcapacitiesin affectingresponsible production practices and then influencing market value. More importantly, this study offers practical insights for manufacturers to enhance firm value by adopting responsible production practices under the conditions of more financial slack andbetter internal control quality.

Parallel Session (A9) - Smart Retailing

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z413

Session Chair: Jianyue Wang, Hong Kong University of Science and Technology

Title: Anticipatory Packing

Presenter: Tongwen Wu, City University of Hong Kong
Co-author(s): Zuo Jun Max Shen, Yanzhi Li

Abstract:

Order fulfillment is a crucial task that shapes online retailers' competitiveness and profitability. Order arrivalsto a fulfillment center often fluctuate significantly over time, causing an unbalanced workload and high operational costs.In this paper, we study an emerging practice termedanticipatory packing, which is to prepare some packages in non-peakperiods to be used for fulfilling orders in the subsequent peak periods. Specifically, the preparation involves the operation ofpicking some items and putting them in the same customer bin but may or may not involve actual packaging. Anticipatorypacking promises to better utilize the idle capacity in non-peak periods and reduce the peak-period workload, resulting in alower cost and faster delivery. Improper prepacking operations, nevertheless, can also be costly. For effective anticipatorypacking, we develop a sample-average approximation (SAA) model by using the order data of recent days. We provide acomprehensive APX-hardness analysis for the model and then design an effective approximation algorithm to solve it. Toenhance the practical performance of the algorithm, we have also developed a tighter integer programming formulationand a subgradient descent method to solve the associated Lagrangian dual. We investigate the effectiveness of anticipatorypacking and the SAA model with extensive experiments. On a real data set, we show that anticipatory packing can yield anoperational cost reduction of over 8% and a significant fixed investment cost reduction.

Title: Component Pricing with a Bundle Size Discount

Presenter: Zechao Li, Tsinghua University
Co-author(s): Ningyuan Chen, Xiaobo Li, Chun Wang

Abstract:
Firms selling multiple products usually adopt bundle pricing in their marketing strategy for the purpose of extracting large consumer surplus. In this paper, we propose and analyze a bundling mechanism, referred to as component pricing with a bundle size discount (CPBSD), which sells bundles for the summed prices of the included products (component pricing) minus a discount based on the number of products purchased (bundle size discount). CPBSD is conceptually simple and has been widely used in real-world business settings. Theoretically, we show that CPBSD subsumes several most well-studied bundling mechanisms including component pricing, pure bundling, and bundle size pricing as special cases. We further prove that, under a general condition, CPBSD attains the optimal profit asymptotically for a large number of products among all bundle pricing mechanisms. From a practical perspective, we formulate a mixed-integer linear program for the optimal pricing scheme of CPBSD, and we also develop an approximation algorithm for efficiently solving CPBSD in large-scale problems. Through comprehensive numerical experiments, we show that CPBSD demonstrates superior performance in contrast to other bundling mechanisms. In particular, compared to bundle size pricing whose outstanding empirical performance has been extensively tested in the literature, CPBSD per- forms especially well when products are heterogeneous and the production costs are high. Furthermore, the performance of CPBSD increases significantly when the potential surplus provided by products are negatively correlated with the product valuations. We also show that our approximation algorithm may achieve a performance that is very close to the optimal CPBSD. Given the theoretical guarantee and the computational efficiency, CPBSD presents an appealing selling mechanism for retailers to improve their profitability.

Title: Signaling Cost via Wholesale Price to an Inequity-Averse Retailer

Presenter: Dandan Wu, Chongqing University
Co-author(s): He Huang, Hongyan Xu

Abstract:
Considering that the supplier's wholesale price can serve as a signal of his private cost information, we study the effects of the retailer's different inequity aversion on the pricing strategies and supply chain utility in a standard dyadic supply chain under asymmetric cost information. We show that the supply chain utility may be better, worse or same under asymmetric information when compared with that under symmetric information, which depends on inequity aversion type of the retailer and cost differences of the two types of supplier. Our findings provide some managerial implications for regulating information asymmetry.

Title: Selling Format and Seller Services in Online Retailing

Presenter: Jianyue Wang, Hong Kong University of Science and Technology
Co-author(s): Ki Ling Cheung, Albert Ha

Abstract:
We study the selling format (agency selling versus reselling) and the strategies of seller services (advertising and information sharing) in a supply chain with a supplier and an online retailer. For a game theoretic model with both seller services, we fully characterize its equilibrium and show how each firm's preference of the selling format depends on the model parameters. We also consider two other models with either advertising service only or no seller services. By comparing the models, we show how the offering of more seller services impacts the firms' profits as well as their preference of the selling format.

Parallel Session (A10) - Simulation Experiments

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z511

Session Chair: Yanyuan Wang, The University of Hong Kong

Title: Combating Extreme Weather through Operations Management: Evidence from a Natural Experiment in China

Presenter: Chen Liang, Hong Kong Polytechnic University
Co-author(s): Minghao Zhu, Peter K. C. Lee, T. C. E. Cheng

Abstract:

In recent years, frequent extreme weather events have had serious impacts on firms' production and operations activities. More and more firms are takingextreme weather into consideration in their formulation of strategies and are striving to employa range of measures to mitigate the hardships caused by extreme weather. Prior literature mainly focuses on a single extreme weather event's influence on aggregate-level socioeconomic consequences in the context of developed countries, while some recent firm-level studies are primarily concerned with extreme weather's impact on financial outcomes. With regard to the literature ofoperations management, researchers have long investigated various climate change-related issues like sustainable operations, carbon neutrality, green supply chain management, and corporate environmental initiatives, but very limited attention has specifically concentrated on extreme weather implications. Accordingly, we aim toexplore the impacts of multiple extreme weather events on firms' operational outcomes in terms of labor productivity and market performance. Employing the staggered difference-in-difference approach and analyzing a large-scale panel dataset of Chinese listed firms, we find that there is a significant negative relationship between extreme weather and operational performance. Further analysis shows that firms with high levels of digital technology deployment, operational slack, supplier base diversity, andCSR performance are less significantly affected by extreme weather shocks. Our findings remain consistent across various robustness checks including parallel trend analysis, alternative measures, propensity score matching, and adjustment of estimation window. These findings contribute to the extreme weather and operations strategy literature in several ways and have significant practical implications for firms.

Title: To Err is Human: A Field Experiment in Nudging Doctors Away from Drug-to-Drug Interactions

Presenter: Xiaodan Shao, Nanyang Technological University
Co-author(s): Vivek Choudhary, Arnab Majumdar, Burhanuddin Pithawala

Abstract:
Nearly 1% of hospitalizations happen because of drug-to-drug interactions (DDIs), wherein a patient unknowingly follows the doctor's prescription containing drugs that interact, which then causes severe reactions. Toprevent DDIs, practitioners implement alert-based systems mandating doctors' response to every alert. However, extant studies, which are mostly descriptive(studying what happens when a doctor uses the system), show that most mandatory alerts are either ignored or overridden by doctors. In contrast,extensive researchsuggeststhat non-mandatory interventions,such as providing relevant information (close to a nudge),effectivelyreduce medical errors. In either case, we know little about doctors' learning behavior from these interventions. Building upon the same, in collaboration with a leading health-tech platform in India, a field experiment was conducted with a costless nudge. The platform highlights the drug interactions in real-time, while a doctor is typing a prescription, nudging them to change the DDIs if any. We investigate if such a nudge can reduce the DDI instances in prescriptions and promote the learning behavior of doctors.Specifically, we analyze 2.81million prescriptions administeredby 1,698 doctors, divided into treatment and control groups, resulting in 162,395 doctor-day observations. We find that the number of DDIs prescribed by treatment doctors reduces by ~8.7% compared to that of the control doctors. Importantly, we provide evidence that doctors learn from the DDI nudge and avoid prescribing DDIs. This nudge effect, which is gender agnostic in its impact but varies by doctor type, remains persistent during the study.

Title: The design of panel experiments with spatial and temporal interference

Presenter: Tu Ni, National University of Singapore
Co-author(s): Iavor Bojinov

Abstract:
Panel experiments — where we expose multiple units to some random treatments, measure their responses,and repeat the procedure for some time periods — have rapidly grown popular in marketplace companies, wishing to runrandomized controlled experiments (A/B

testing) in the presence of spatial interference between experimental units andtemporal interference between time periods.When running the experiments, companies group units together across zip codes, cities, or even states to form a singleaggregated unit, in order to alleviate the spatial interference between units, as it ensures that each unit within the aggregatedunit receives the same treatment, but it does not remove the temporal interference over time. Unfortunately, such a drasticaggregation significantly reduces the sample size, leading to much lower power for inference. This highlights a criticaltrade-off when a panel experiment has interference: aggregation limits the degree of interference but reduces the volume ofdata.In this work, we examine this trade-off and present a new, more powerful, randomized design for panel experimentsin the presence of spatial and temporal interference. Our proposed design has two features: the first feature is a notionof cluster-based randomization that allows us to navigate the aforementioned trade-off for aggregation transparently viathe cluster size; the second feature is a notion of balanced randomization of treatment and control that incorporates anassignment mechanism inspired by the classical completely randomized design to obtain further precision gains. Weprove the theoretical performance of our design, develop its inferential techniques and verify its superior performance byconducting an extensive simulation study.

Title: Smooth Nested Simulation: Bridging Cubic and Square Root Convergence Rates in High Dimensions

Presenter: Yanyuan Wang, The University of Hong Kong
Co-author(s): Wenjia Wang, Xiaowei Zhang

Abstract:
Nested simulation concerns estimating functionals of a conditional expectation via simulation. In this paper,we propose a new method based on kernel ridge regression to exploit the smoothness of the conditional expectationas a function of the multidimensional conditioning variable. Asymptotic analysis shows that the proposed method caneffectively alleviate the curse of dimensionality on the convergence rate as the simulation budget increases, provided thatthe conditional expectation is sufficiently smooth. The smoothness bridges the gap between the cubic root convergencerate (that is, the optimal rate for the standard nested simulation) and the square root convergence rate (that is, the canonicalrate for the standard Monte Carlo simulation). We demonstrate the performance of the proposed method via numericalexamples from portfolio risk management and input uncertainty quantification.

Parallel Session (A11) - Operational Innovation

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z512

Session Chair: Caleb Kwon, Harvard University

Title: To Share or Not in a Competitive Innovation Market

Presenter: Meng Chen, Southern University of Science and Technology
Co-author(s): Xiaoshuai Fan

Abstract:
This paper investigates whether a leading firm with an innovation opportunity has an incentive to share it withothers. The profit allocation schemes, innovation effort cost and spillover effect all affect the success rate of innovationand expected profit, causing the firm to make different innovation opportunity disclosure decisions. We examine a leadingfirm's optimal disclosure decisions under two profit allocation schemes: (1) All successful innovators can receive equalbenefits (i.e., "equal-sharing" scheme) and (2) the first successful innovator takes all the innovation profit (i.e., "winner-takes-all" scheme). Under the first scheme, we find that when the innovation effort cost is high, as the spillover effectdecreases, the leading firm's optimal disclosure decision transfers from non-disclosure of the innovation opportunity todisclosure, and then back to non-disclosure. This interesting pattern is driven by a trade-off between the innovation costreduction and expected profit loss due to market competition. Under the second scheme, we find that only when both effortcost and spillover effect are high will the leading firm disclose the innovation opportunity. In addition to maximizing theleading firm's expected profit, we also derive the optimal spillover level by the government to maximize four nonprofitobjectives (i.e., the expected total successful number, innovation success rate, total revenue and total profit), throughenhancing/relaxing the knowledge property protection to inhibit/encourage the spillover effect. We find that when theeffort cost is sufficiently small, the government cannot affect these nonprofit objectives by controlling the spillover effect.

Title: Analysis of New Product Introduction Strategies in the Presence of Price Signals

Presenter: Yalan Zhu, Northwestern Polytechnical University
Co-author(s): Gongqian Liang, Yufei Huang

Abstract:
When a firm introduces successive generations of products under conditions of imperfect knowledge, con-sumers may infer a new product's quality from price. We consider consumers' strategic deliberation over different ver-sions and employ a two-period analytical model focusing on how the presence of price signals affects the firm's decisionon new product introduction strategy. Our analysis yields three main insights. First, in the presence of price signals, eventhough the sales of the earlier version is low, it can serve as a reference for consumers to better understand the qualityimprovement in the later version. Therefore, the firm should be braver to launch multiple versions of the product in themarket. Second, when consumers use prices to infer product quality, the firm actually benefits from consumers' strategic deliberation over different versions. So the firm should encourage consumers to compare different versions. Third, as price signal intensity becomes stronger, the firm's optimal pricing strategy switches from mark-down to mark-up. This indicates that the firm should carefully evaluate how consumers interpret product quality via prices, then make decisions on the pricing strategy.

Title: Improving the Information Processing Capability in Supply Chain Finance: ATtext Mining Architecture

Presenter: Jiaxing Wang, Xi'an Jiaotong-Liverpool University
Co-author(s): Guoquan Liu, Yang Cheng

Abstract:
Small and medium-sized enterprises need greater than ever for supply chain finance support during the recent COVID-19 pandemic and subsequent global lockdowns. Financial service providers (FSPs) have to improve their information processing capability when facing significant surges in demand for supply chain finance services. This study designs a text mining-based architecture to improve FSPs' information processing capability. The study then presents an empirical solution for FSP to reduce risks in supply chain finance activities using the proposed architecture on the new energy buses industry. We demonstrate our work is valid and consistent through cross-correlation tests of multi-source information.

Title: The Effects of Fair Workweek Laws on Store Performance Evidence from Chicago

Presenter: Caleb Kwon, Harvard University

Abstract:
To protect shift-based workers from unstable and unpredictable work schedules, several cities and states in the United States have passed laws that require employers to compensate their employees if they adjust previously scheduled shifts or add new shifts without providing sufficient advance notice. In this paper, we use a difference-in-differences strategy around the passing of Chicago's Fair Workweek Ordinance to show that labor adjustment costs imposed by scheduling regulations can have large negative effects on store performance. Analyzing a sample of more than 7.7 million shifts covering 67, employees across 4,4 retail stores, we estimate persistent and sizeable declines in labor productivity and output among impacted stores in Chicago. Specifically, we estimate productivity declines of 1.3% and reductions in store output (transactions) by 8.3% that persist more than 24 weeks after the effective date of the law. Consistent with the objectives of the Chicago's Fair Workweek Ordinance, impacted stores schedule short-notice shifts with much lower frequency. Using instrumental variables, we relate this reduction in short-notice shifts directly to the decline in store performance.

Parallel Session (A12) - Supply Chain Management

Day 1: 7th Jan (Sat) 14:00-15:30 Venue: Z513

Session Chair: Pratishtha Batra, Indian Institute of Management

Title: Impact of Geopolitical Tension on Market Value of MNCs: The Role of Green Supply Chain Management

Presenter: Yunting Feng, Donghua University
Co-author(s): Kee Hung Lai, Qinghua Zhu

Abstract:
Drawing upon the legitimacy theory, this study examines whether GSCM as an institutionalized practice plays a role to mitigate shock on the trade tension. Using the US-China trade tension between 217 and 219, we conduct an event study to examine market

value of those headquartered in the US operating at host country in China. Results show a decreased value of IBs after the trade tension. Furthermore, GSCM practice alleviates negative market reactions to the trade tension, while such alleviation is less significant for larger MNCs. Managers of MNCs are advised to signal their global GSCM to cushion market shocks.

Title: Reliability and Risk Assessment of Digital Twin System based on Improved Failure Mode and Effects Analysis

Presenter: Zehao Zhang, Tongji University
Co-author(s): Chunyan Duan, Lilong Zhao, Ying Yu

Abstract:
Digital twin system (DTS) is now widely employed in all spheres of industrial production,and the study of its risk and reliability is essential for the stable operation of the real and virtual models to function as they should. Therefore, the reliability and risk assessment of a specific digital twin system based on the smart gas application is the focus of this article. Due to the possibility of interaction between the potential failure modes of the DTS, in this paper, the most commonly used failure mode and effects analysis (FMEA) model for industrial applications is improved to analyze the DTS. We employ the trapezoidal fuzzy theory, the triangle fuzzy analytic hierarchy process (AHP) and the standard deviation approach to reduce the inherent flaws of traditional FMEA such as too much subjectivity and ranking values that do not take into account risk factor weights, and the TODIM (an acronym in Portuguese for interactive and multiple attribute decision making) which modified by entropy value to consider the interrelationship between failure modes. Finally, we analyze with the aid of the Bisecting K-means clustering and the ranking result under the modified model is compared with those other three models, and lastly, the better model is validated to be practical to assess the risk and reliability of DTS.

Title: Research on Reliability and Risk Management of Intelligent Manufacturing System

Presenter: Yuxin Mo, Tongji University
Co-author(s): Chunyan Duan

Abstract:
Research on reliability and risk management of Intelligent Manufacturing System (IMS) is important for intelligent manufacturing factories. After systematic analysis of the modularized intelligent manufacturing system, we collect expert rating data based on double hierarchy hesitant triangular fuzzy linguistic term set and obtain the risk factor weight by optimized combinatorial weighting method based on game theory. Finally, we use the MULTIMOORA method, ranking aggregation method and optimized fuzzy C-means clustering algorithm to establish the IMS reliability and risk management model, exploring new ways to improve the reliability of the intelligent manufacturing system, supporting the transformation of Chinese manufacturing factories.

Title: Capacity and Production Planning in the Presence of Wastage

Presenter: Pratishtha Batra, Indian Institute of Management

Abstract:
The strain on healthcare facilities during the pandemic presented the problem of wastage of medical oxygen during the delivery process. Wastages increase demand when the actual requirements are low, widening the demand-supply gap. While rational use of oxygen is desirable, it is often challenging to identify and control wastages, and attempting to average out requirements may be counterproductive. We build a stochastic, periodic review model to study the impact of random wastage on capacity addition and production decisions. We conduct numerical experiments to illustrate the structure and demonstrate the sensitivity of the optimal policy to different cost and model parameters.

Parallel Session (B1) - Data-driven Inventory Management

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z503

Session Chair: Yi Yang, Zhejiang University

Title: Scenario-based Distributionally Robust Optimization for the Stochastic Inventory Routing Problem

Presenter: Yong-Hong Kuo, The University of Hong Kong
Co-author(s): Zheng Cui, Yong-Hong Kuo, Lianmin Zhang

Abstract:
We consider a class of the inventory routing problem in a discrete and finite time horizon, where the demand for homogeneous products at retail stores is uncertain and varies across different scenarios. The supplier is required to determine the times to visit retailers, the replenishment quantities to each retailer, and the routing of a vehicle so as to minimize the sum of stockout, holding, and transportation costs. We propose a scenario-based distributionally robust optimization framework to tackle this problem. We adopt a warm-start procedure that utilizes the solution to the nominal model in our methodological framework. Then we apply a Tabu search algorithm, integrated with column generation, to solve a set-partitioning-like integer linear programming model so that a better route set can be identified.

Title: The Big Data Newsvendor Problem Under Demand and Yield Uncertainty

Presenter: Tiantian Cao, Zhejiang University
Co-author(s): Yi Yang

Abstract:
We consider a variant of the classical newsvendor problem which considers both demand and yield randomness. We assume that decision-makers have no a priori knowledge on the joint distribution function of demand and yield. The only available information is past demand and yield observations and auxiliary feature information. We adopt data-driven approaches integrated well-grounded machine learning algorithms to determine the optimal order quantity directly from historical data, which are respectively based on empirical risk minimization (ERM), Kernel regression, K-nearest neighbors regression (KNN), and classification and regression tree (CART). These data-driven approaches can not only

sufficiently capture useful information from relevant features, but also take into account the structure of the optimization problem, which can effectively avoid inconsistency solutions in sample average approximation (SAA) method the traditional "prediction then optimization" approach.

Title: Data-Driven Safety Stock Management on a Large-Scale Inventory Network

Presenter: Diyuan Huang, Shanghai University of Finance and Economics
Co-author(s): Chaolin Yang, Yaowu Zhang, Junyao Yu, Youqiong Ai

Abstract:
Optimizing safety stock on a large-scale inventory network is challenging since it may involve a massive number of nodes and many shared materials. Besides, many inventory nodes face "intermittent demand" in practice, the classic approach may fail in that scenario. We propose a data-driven guaranteed service model (DD-GSM) using multi-dimensional data and build an iterative decomposition approach to solve the large-scale model. We build a functional quantile regression model (FQRM) to estimate the data-driven demand bound (DD-bound) function for the GSM based on historical sales and feature data. Our iterative decomposition approach can exploit information about local solutions to iteratively decompose the large-scale network into small sub-networks. This approach combines the fast local solution-finding algorithm, sequential linear programming, with dynamic programming, the optimal algorithm for tree problems.

Title: Learning to Order for Inventory Systems with Lost Sales and Uncertain Supplies

Presenter: Jiashuo Jiang, Hong Kong University of Science and Technology
Co-author(s): Boxiao Chen, Jiawei Zhang, Zhengyuan Zhou

Abstract:
We consider a stochastic lost-sales inventory control system with lead time L over a planning horizon T. Supply is uncertain, and is a function of the order quantity (due to random yield/capacity, etc). We aim to minimize the T-period cost, a problem that is known to be computationally intractable even under known distributions of demand and supply. In this paper, we assume that both the demand and supply distributions are unknown and develop a computationally efficient online learning algorithm. We show that our algorithm

achieves a regret (i.e. the performance gap between the cost of our algorithm and that of an optimal policy over periods) of $O(L+\sqrt{T})$ when $L \geq \log(T)$. We do so by 1) showing our algorithm's cost is higher by at most $O(L+\sqrt{T})$ for any $L \geq 0$ compared to an optimal constant-order policy under complete information (a well-known and widely-used algorithm) and 2) leveraging its known performance guarantee from the existing literature. To the best of our knowledge, a finite-sample ($\sqrt{T}$) (and polynomial in L) regret bound when benchmarked against an optimal policy is not known before in the online inventory control literature.

A key challenge in this learning problem is that both demand and supply data can be censored; hence only truncated values are observable. We circumvent this challenge by showing that the data generated under an order quantity q^2 allows us to simulate the performance of not only q^2 but also q^1 for all $q^1 < q^2$, a key observation to obtain sufficient information even under data censoring. By establishing a high probability coupling argument, we are able to valuate and compare the performance of different order policies at their steady state within a finite time horizon. Since the problem lacks convexity, commonly used learning algorithms such as SGD and bisection cannot be applied, and instead, we develop an active elimination method that adaptively rules out suboptimal solutions.

Parallel Session (B2) - Robust Optimization Theory and Applications

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z505

Session Chair: Qinshen Tang, Nanyang Technological University

Title: Targeted Robustness in Minimizing Extreme Risks with Limited Data

Presenter: Anand Deo, Singapore University of Technology and Design
Co-author(s): Karthyek Murthy, Arjun Ramachanda

Abstract:
We introduce a new approach for robustifying objectives involving risk measures such as CVaR against the error introduced by "plugging-in" a model estimated from data. Differing from the conventional approach of hedging against the worst-possible element from an ambiguity set, the proposed estimator seeks to automatically cancel the bias introduced despite not knowing the nature of the error committed in the estimation step. This debiasing exercise is shown to lead to consistent decisions with exponentially fewer data samples than required by sample-average approximation. These findings add to the growing body of evidence on the effectiveness of targeted form of robustness towards tackling major challenges in "estimate, then-optimize" paradigm while optimizing under uncertainty.

Title: Range Value-at-Risk under Distributional Ambiguity: Tight Bounds with Support Information

Presenter: Ruiqin Wang, National University of Singapore
Co-author(s): Zhi Chen, Zhenyu Hu, Guangwu Liu

Abstract:
Estimating risk measures, such as value-at-risk (VaR) and conditional value-at-risk (CVaR), plays an important role when making decisions with limited information. In this paper, we study the problem of bounding a more general class of risk measures called range value-at-risk (RVaR) over mean-variance and Wasserstein ambiguity sets. While existing results all assume an unbounded support, we characterize tight upper and lower bounds when there is support information. Our numerical results further demonstrate the significant value of support information.

Title: Robust Explainable Prescriptive Analytics

Presenter: Li Chen, National University of Singapore
Co-author(s): Melvyn Sim, Xun Zhang, Minglong Zhou

Abstract:
We propose a robust explainable prescriptive analytics framework for two-stage linear optimization problems under distributional ambiguity by leveraging historical data of the uncertain parameters and the related side information. The framework solves an explainable tree-based affine policy that directly transforms side information into implementable decisions. We propose a bi-affine recourse approximation and develop tractable approximations for robust optimization problems. We show that the approach leads to an explainable and robust policy with comparable out-of-sample performance to a stochastic optimization forest policy on a portfolio optimization problem.

Title: The Analytics of Robust Satisficing

Presenter: Minglong Zhou, Fudan University
Co-author(s): Melvyn Sim, Qinshen Tang, Taozeng Zhu

Abstract:
We propose a new prescriptive analytics model based on robust satisficing that incorporates a prediction model to determine the here-and-now decision that would achieve a target expected reward as well as possible under both risk ambiguity and estimation uncertainty. The reward function of the decision model depends on some observable parameters whose future realizations are uncertain, and their outcomes may be influenced by some observable factors or the decision made. We feature two applications and use real data in their case studies and elucidate the benefits of our robust satisficing model over the predict-then-optimize approach.

Parallel Session (B3) - Innovations in Choice Modeling and Optimization

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z506

Session Chair: Yifan Feng, National University of Singapore

Title: A Unified Analysis for Assortment Planning with Marginal Distributions

Presenter: Xiaobo Li, National University of Singapore
Co-author(s): Ahipasaoglu, Zeyu Sun, Yiliang Yuan

Abstract:
We study assortment problems under the marginal distribution model (MDM), a semiparametric choice model that only requires marginal error information without assuming independence. It is known that the multinomial logit (MNL) model belongs to MDM. In this paper, we further show that some multi-purchase choice models, such as the multiple-discrete-choice (MDC) model, and threshold utility model (TUM), also fall into the framework of MDM, although MDM does not explicitly model multi-purchase behavior. For the assortment problem under MDM, we characterize a general condition for the marginal distributions under which a strictly profit-nested assortment is optimal. Moreover, though the problem is shown to be NP-hard, we prove that the best strictly profit-nested assortment is a 1/2-approximate solution for all MDMs. We further construct a simple case of MDM such that the 1/2-approximate bound is tight. These results either generalize or improve existing results on assortment optimization under MNL, MDC, and TUM.

Title: Sequential Recommendation Under Random: Consideration Set Model

Presenter: Yicheng Liu, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Pin Gao, Chenhao Wang, Zizhuo Wang

Abstract:
We consider a multi-stage assortment optimization problem under the random consideration set choice model. In viewing of the hardness of the problem, we develop several approximation algorithms with certain performance guarantees under different types of constraints. The approximation algorithms are based on the classical result of sub-modular maximization, and an important class of assortments known as sequential revenue-ordered assortment. We also study the joint price and assortment optimization problem of our model and develop corresponding approximation algorithms under mild assumptions. Finally, we justify the fitness of our model through a real-world dataset.

Title: Assortment Optimization under Logit-based Choice Model with Tree Structured Consideration Sets

Presenter: Qingwei Jin, Zhejiang University
Co-author(s): Qianqian Wang, Yu Han

Abstract:
We study assortment optimization problems under multinomial logit choice model with two tree structured consideration set models, i.e., the subtree model and the induced paths model. In each model, there are multiple customer types and each customer type has a different consideration set. A customer of a particular type only purchases product within his consideration set. The tree structure means all products form a tree with each node representing one product and all consideration sets are induced from this tree. In the subtree model, each consideration set consists of products in a subtree and in the induced paths model, each consideration set consists of products on the path from one node to the root. All customers make purchase decisions following the same multinomial logit choice model except that different customer types have different consideration sets. The goal of the assortment optimization is to determine a set of products offered to customers such that the expected revenue is maximized. We consider both unconstrained problem and capacitated problem. We show that these problems are all NP-hard problems and propose a unified framework, which captures the tree structure in both models, to design fully polynomial time approximation schemes (FPTAS) for all these problems.

Title: A Simple Algorithm for Best-item Selection from Choice-based Feedback

Presenter: Junwen Yang, National University of Singapore
Co-author(s): Yifan Feng

Abstract:
We consider a ranking and selection problem akin to Feng et al. (2021): A company sequentially and individually shows display sets to a population of consumers to identify the most preferred item (with high probability) from the consumers' choices. We propose an elimination-based algorithm by leveraging the nested structure implied by the information-theoretic lower bound. The algorithm is based on a sequence of easily calculated stopping times and a selection rule, which respectively prescribes when to rule out suboptimal items and which. Compared with the solution in Feng et al. (2021), our

algorithm is significantly simpler and achieves higher-order asymptotic optimality in sample complexity.

Parallel Session (B4) - Recent Advances in Interface Between OM and Finance

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z507

Session Chair: Liao Wang, The University of Hong Kong

Title: Trade Credit Bargaining

Presenter: Jin Yao, The University of Hong Kong
Co-author(s): Leon Yang Chu, Alex Song Yang

Abstract:
Trade credit is "the single most important short-term external financing" (Petersen and Rajan 1997), however, large financially unconstrained buyers with strong market power receive a lot of trade credit. We propose a new theory that rationalize the usage of trade credit by financially unconstrained firms. Under an alternative-offer bargaining model, we study the impact of trade credit on bilateral supply chain relationships and capacity investment. We show that trade credit can effectively alleviate holdup problem and boost supply chain capacity investment.

Title: Retailer Initiated Inventory-Based Financing

Presenter: Weiming Zhu, The University of Hong Kong
Co-author(s): Hongyu Chen

Abstract:
We study an innovative financing scheme in which a large retailer provides inventory-based financing (IBF) to a small retailer selling through her own offline channel. In anticipation of a peak selling period, the small retailer could repeatedly pledge her on-hand inventory in exchange for a loan amount to stockpile to fulfill stochastic customer demand. Following sales proceeds, the small retailer buys back the pledged inventory to the extent possible and defaults on any leftovers, which will be liquidated by the big retailer via his own platform. We derive the optimal joint inventory ordering and pledging decisions for the

small retailer during the stockpiling phase. We provide empirical evidence that small retailers stockpile through IBF, especially prior to shopping seasons and holidays. We also examine the impact of lead time on the planning horizon and interest rate.

Title: Optimal Contingent Claim under Disappointment Aversion: Theory and Application to Integrated Risk Management

Presenter: Andrea Roncoroni, ESSEC Business School (Paris)
Co-author(s): Paolo Guiotto

Abstract:
Most firms exhibit disappointment aversion (DA) to revenue downside shifts. We devise and solve the optimal design problem of a (possibly path-dependent) financial contingent claim by a DA firm. Our theoretical result is applied to a Kouvelis-Li (2019) integrated risk management problem for the car retail newsvendor model in Wang-Yao-Zhang (2022). We show the extent DA vs alternative preferences affect firm's revenues yielded by optimal IRM and the effect of financial hedging on operational level and performance. Remarkably, DA preferences prevent the firm from experiencing decreasing revenues for tail demand figures as it happens for VaR-constrained targets.

Title: Newsvendor's Supplier Selection Problem with Correlated Supply and Demand Uncertainties

Presenter: Liao Wang, The University of Hong Kong
Co-author(s): Jin Yao, Sean Zhou

Abstract:
It is established in literature (Dada et al. 2007) that for a newsvendor facing multiple (possibly unreliable) suppliers, the selection rule (``Dada's rule'') is that the cheaper suppliers always have higher priorities regardless of their reliability conditions. A crucial assumption is that all the supply and demand uncertainties are independent. In this research, we relax this assumption and study the newsvendor's supplier selection problem with correlated supply and demand uncertainties. We identify conditions under which Dada's rule still holds or does not hold, respectively.
*This research is supported by the General Research Fund of Research Grants Council of HKSAR.

Parallel Session (B5) - Emerging Topics in Operations Management

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z509

Session Chair: Weixin Shang, Lingnan University

Title: Supplier Encroachment in a Product-Service Supply Chain

Presenter: Huajiang Luo, Southwest Jiaotong University
Co-author(s): Qiaochu He, Jingye Huang, Hongwei Wang

Abstract:
We explore the supplier encroachment problem in a product-service supply chain with a manufacturer wholesaling a product to a retailer, who resells the product and provides paid services to consumers. The manufacturer can choose to establish a direct channel to sell the product (product encroachment), or provide the services (service encroachment), or provide both the product and services (dual encroachment) to consumers.

Title: Design of Patient Visit Itineraries in Tandem Systems

Presenter: Shan Wang, Sun Yat-sen University
Co-author(s): Nan Liu, Guohua Wan

Abstract:
Multi-stage service is common in healthcare. One widely adopted approach to manage patient visits in multi-stage service is to provide patients with visit itineraries, which specify individualized appointment time for each service stage. We develop an optimization modeling framework to design such visit itineraries. We found that a well-designed patient visit itinerary which carefully addresses the interdependence among stages can significantly improve patient experience and provider utilization.

Title: Information Sharing in the Online Marketplace when Sellers Incur Nonlinear Costs

Presenter: Tian Li, East China University of Science and Technology
Co-author(s): Hu Huang, Hongtao Zhang

Abstract:
We study information dissemination in an online platform where multiple sellers distribute their partially substitutable products. The platform has superior information about consumer demand and determines whether, and with how many sellers, to share the information. An important feature of our study is that the sellers have a nonlinear cost structure. We investigate the effect of and incentives for information sharing using a unified model that incorporates three types of nonlinear cost structure: constant marginal cost, increasing marginal cost, and decreasing marginal cost. We show that the cost structure alone determines the direction of the impact of information sharing on revenue and cost, while the scope of information dissemination (the number of sellers who receive information) affects only the magnitude of that impact. The online platform has incentives to voluntarily share demand information with sellers if and only if the cost structure exhibits diseconomy, linearity, or moderate economy of scale. When the economy of scale is too large, sharing information with sellers will reduce the total revenue and thus the platform's earned commission. The online platform shares information with fewer sellers if their products are more similar.

Title: Follow the Crowd with Uncertain Service Capacity

Presenter: Weixin Shang, Lingnan University
Co-author(s): Liu Yang, Liming Liu

Abstract:
Customer joining behavior is of major concern for service systems where the service capacity is uncertain. It remains unclear whether customer inference of uncertain service capacity can lead to follow the crowd (FTC) behavior. Management can release capacity information, but how it affects system performance needs to be understood. We use a single-server queue to analyze the joining behavior of customers who infer the actual service capacity based on the queue length upon arrival. We also characterize the impact of capacity information disclosure both analytically and numerically. We find that when other customers'

tendency to join the service increases, a tagged customer can make more accurate inferences of service capacity based on queue length. This inference effect arises together with the congestion effect and can lead to FTC when it outweighs the latter. When multiple equilibria exist, we characterize the conditions under which the inference effect is significant at the aggregate customer level so that the joining equilibrium with a larger joining threshold is Pareto-optimal. Management needs to be careful in setting the information disclosure policy, as the key problem parameters may affect its impact on system throughput and social welfare in opposite directions.

Parallel Session (B6) - Supply Chain Management

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z510

Session Chair: Patrick Qiang, Penn State University

Title: Alliance Formation in a Coproduct Supply Chain

Presenter: Yangyang Peng, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Xiaoqiang Cai, Xiaolin Xu, Lianmin Zhang

Abstract:
Independent parties that wholesale perfectly complementary components may form alliances to better coordinate their ordering decisions when they procure components from upstream supplier(s). Products (e.g., cattles, blood, petroleum etc.) can be processed into several types of products (parts) targeting different segments of customers, which belong to the so-called coproducts. This paper studies how the coproduct alliance formed (CAF) when tradeoff between bargain power and mismatch risk among heterogeneous retailers, while the market uncertainty escalates the mismatch ratio. Theses results are interpreted thought processing cost and market variety. Under the Stackelberg game setting, we consider a coproduct supply chain comprising one supplier acting as the leader and two retailers being the follower and establish a stylized model to study how coproduct alliance should be formed and the existence of the core of the grand coalition. We find that when the processing cost is large and the market uncertainty is relatively small, and when the processing cost is small and the market demand uncertainty is large, centralized procurement is better for downstream retailers. Furthermore, we expand the model to the multi-retailer setting, and the general distribution with the cost-least consideration and conduct the numerical analysis of the conclusion.

Title: Best Friends Forever in the Supply Chain: Supply Relationships, Lean Management, and Performance

Presenter: Noelia Garcia-Buendia, University of Jaen
Co-author(s): José Moyano-Fuentes, Juan Manuel Maqueira-Marín

Abstract:
This study aims to investigate the influence of supply relationships in the degree of implementation of a supply chain strategy such as Lean Supply Chain Management (LSCM) and their impact on operational performance. A structural equation model (SEM) was conducted on a sample of 285 medium and large Spanish focal manufacturing firms to test four hypotheses: 1) the role of supply uncertainty in LSCM implementation, 2) the influence of strategic supplier performance in LSCM implementation, 3) the impact of strategic supplier performance in focal firm operational performance, and 4) the effect of LSCM implementation in focal firm operational performance. Ourfindings support the role of reliable and consistent strategic supplier performance in making progress in LSCM implementation, but they also show that LSCM implementation process might be undermined by supply uncertainty.Lastly, our study shows that greater LSCM implementation and better performance from key suppliers are important drivers for focal firms' operational performance. This researchshedslight on the influence of supply uncertainty on the extensionof leanprinciples along the supply chainand support the relevance of building strategic relationships with key suppliers to enhance performance and achieve competitive advantage.

Title: Enablers of Effective Performance Measurement System in Supply Chain: The Impact on Firm Performance

Presenter: Maqsood Memon, Zayed University

Abstract:
Supply chain management (SCM) has emerged as a strategic tool to gain competitive advantage through cooperative, collaborative and partnership arrangements between the firms. The large number of interdependent activities in supply chain needs effective management of its performance. We argue that an effective performance measurement system (PMS) can help to manage, control and improve supply chain management practices (SCMP). Limited literature is available to investigate the impact of SCM practices on PMS and

also the impact of PMS to improve organization performance. This review paper demonstrates a research framework which shows the relationship among SCM practices, PMS, competitive advantage and organizational performance.

Title: Closed-Loop Supply Chain Network with Interaction of Forward and Reverse Logistics

Presenter: Patrick Qiang, Penn State University

Abstract:

As the concept of sustainable development receives more attention in nowadays business world, the closed-loop supply chain (CLSC) has been one of the most important practices in the area. Due to its complex nature, a lot of research has been done regarding CLSC. However, most of the literature focuses on the dyadic structure of the CLSC which involves single manufacturer, distributor, or retailers and very few studies have been done to analyze the CLSCL with network structure, in which multiple players are involved. Furthermore, past literature on the CLSC mostly deals with the homogeneous product. Inspired by the recent business cases, we develop a coupled CLSC network model dealing with heterogeneous products facing different demand markets. The end-of-life product from the forward supply chain is collected, recycled and the raw material is extracted to be used as an input for the reverse supply chain which produces another type of product. In particular, we are to study the interactions between the two supply chains. Moreover, in each supply chain, raw material suppliers, manufactures, and retailers have to compete and coordinate to satisfy the demand while the forward and reverse supply chains have to work together to make the supply chain "loop" closed. Additionally, a CLSC network equilibrium is defined and studied by using variational inequalities. The properties of the equilibrium solution are also examined. By applying the modified projection method, we analyze a series of numerical examples. Based on the proposed model, the managerial insights are provided to show how the market size of the forward chain impacts the demand and prices of the reverse chain. It is also worth noting that the consumers' environmental awareness is critical to make the coupled CLSC networks viable.

Parallel Session (B7) - Learning-enabled Decision Making

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z411

Session Chair: Park Sinchaisri, University of California, Berkeley

Title: A Novel Ensemble Learning Method for Demand Forecasting in the Retail Industry

Presenter: Jiaxing Wang, Xi'an Jiaotong-Liverpool University
Co-author(s): Guoquan Liu, Junyi Lin

Abstract:
With the significant growth of e-commerce business, the retail industry is experiencing rapid developments, leading to the explosion of the number of stock-keeping units (SKUs). We developed a novel ensemble learning algorithm — the time-series gradient boosting tree (TGBT) — for demand forecasting for the retail industry. By incorporating the cross-section and time-series information in the existing gradient-boosting decision tree algorithm, our new algorithm can forecast tremendous SKUs in one process with high accuracy. The numerical experiment results based on a large e-commerce company's historical transaction records support the comparative merits of the new algorithm with superior accuracy and automation ability.

Title: On A Mallows-type Model For (Ranked) Choices

Presenter: Yuxuan Tang, National University of Singapore
Co-author(s): Yifan Feng

Abstract:
We consider a preference learning setting where every participant chooses an ordered list ofkmost preferreditems among an (individualized) display set of candidates. We identify a distance-based ranking model for the population'spreferences and their (ranked) choice behavior. The ranking model resembles the Mallows model but uses a new distancefunction called Reverse Major Index (RMJ). We find that despite the need to sum over all permutations, the RMJ-basedranking distribution aggregates into (ranked) choice probabilities with a simple closed-form expression. This desirableproperty enables effective methods to infer the model parameters from (ranked) choice data with theoretically provenconsistency. Through comprehensive numerical studies on multiple real data sets, we

also showcase the model's favorablegeneralization power, robustness, and computational efficiency for parameter estimation.We also utilize our model to study how feedback structure (represented by the value ofk) is related to the efficiency ofthe feedback collection process. We formulate a collection of sequential experimental design problems: For everyk, thepreference learner sequentially decides on the display set and asks the participant to nominate his/her top-kranked choicesfrom the display set. The learner's goal is to use the fewest samples to identify the globally top-ranked candidate with highprobability. We characterize the informational efficiency of a givenkusing the (asymptotically optimal) sample complexityexpressed by Chernoff's information measure. We find that "a little 'favor' goes a long way": While the informationefficiency always increases withk, a small value ofk=2 is already near (and sometimes fully) optimal.

Title: Privacy-Preserving Personalized Recommender Systems

Presenter: Xingyu Fu, Hong Kong University of Science and Technology
Co-author(s): Ningyuan Chen, Pin Gao, Yang Li

Abstract:
Although personalized recommender systems are vital for many online platforms, they lead to controversialsocietal issues such as privacy breaches. In response to such concerns, there is a clear regulatory trend incalling for stringent privacy protection mechanisms implanted in such algorithms. In this work, we study theoptimal design of a personalized recommender system with the local differential privacy constraints imposedby some external regulators. The recommender system recommends a product to a consumer based on herpreference ranking of products, potentially learned from her personal data such as cookies. The differentialprivacy impedes inferring the consumer's sensitive information from the recommendation outcome. We showthe optimal recommendation policy is a coarse-grained threshold policy: it randomly selects a product torecommend with a subset having higher recommendation probabilities than the rest, where the subset isdetermined by a threshold on the consumer's preference ranking. We analyze the choice of the thresholdand the randomized recommendation in the asymptotic regime with a large number of products, relevantto most online platforms. Our analysis further suggests that pursuing privacy is not a free lunch: it comesat a substantial economic loss due to the resulting inaccurate recommendation, although it may benefitconsumers monetarily via the induced lower product price associated with the less relevant recommendation.Taken together, our study provides guidance for practitioners regarding the design of privacy-preservingpersonalized recommendation algorithms and discusses the implications of the privacy policy for regulators.

Title: Improving Human Decision-Making with Machine Learning

Presenter: Park Sinchaisri, University of California, Berkeley
Co-author(s): Hamsa Bastani, Osbert Bastani

Abstract:
Workers spend a significant amount of time learning how to make good decisions. Evaluating the efficacy of a given decision, however, can be complicated. Surprisingly, even though learning good decision-making strategies is difficult, they can often be expressed in simple and concise forms. Focusing on sequential decision-making, we design a novel machine learning algorithm that is capable of extracting "best practices" from trace data and conveying its insights to humans in the form of interpretable "tips". Our algorithm selects the tip that best bridges the gap between the actions taken by the human workers and those taken by the optimal policy in a way that accounts for which actions are consequential for achieving higher performance. We evaluate our approach through a series of randomized controlled experiments where participants manage a virtual kitchen. Our experiments show that the tips generated by our algorithm can significantly improve human performance relative to intuitive baselines. In addition, we discuss several empirical insights that can help inform the design of algorithms intended for human-AI interfaces.

Parallel Session (B8) - Omnichannel Retailing

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z412

Session Chair: Ailing Xu, Hong Kong University of Science and Technology

Title: Offline-Channel Planning in Smart Omnichannel Retailing

Presenter: Mengying Xue, University of Science and Technology of China

Abstract:

Observing the retail industry inevitably evolving into omnichannel, we study an offline-channel planning problem that helps an omnichannel retailer make store location and location-dependent assortment decisions in its offline channel to maximize profit across both online and offline channels, given that customers' purchase decisions depend on not only their preferences across products but also, their valuation discrepancies across channels, as well as the hassle costs incurred. The proposed model and the solution approach extend the literature on retailchannel management, omnichannel assortment planning, and the broader field of smart retailing/cities. We derive parameterized models to capture customers' channel choice and product choice behaviors and customize a corresponding parameter estimation approach employing the expectation-maximization method. To solve the proposed optimization model, we develop a tractable mixed integer second-order conic programming reformulation and explore the structural properties of the reformulation to derive strengthening cuts in closed form. We numerically validate the efficacy of the proposed solution approach and demonstrate the parameter estimation approach. We further draw managerial insights from the numerical studies using real data sets. We verify that omnichannel retailers should provide location-dependent offline assortments. In addition, our benchmark studies reveal the necessity and significance of jointly determining offline store locations and assortments, as well as of incorporating the online channel while making offline-channel planning decisions.

Title: Retail Strategy for Vertically Differentiated Experiential Products under Physical Retail Formats

Presenter: Soumyadeep Kundu, Indian Institute of Management Kozhikode
Co-author(s): Ashutosh Sarkar

Abstract:
Manufacturers rely on essentially choosing two retail channels – online and offline/physical. However within these channels, numerous retail formats exist compelling firms to make channel and format choices. We consider a game theoretic approach of two manufacturers selling experiential products offline through a common retailer and their own exclusive stores. We consider the role of in-store value enhancing sales services and analyze how such services affect pricing and service decisions and consequently the manufacturer's retail strategy.

Title: Search Deterrence: Exploding Channel with Product Information and Price Discounts

Presenter: Weiqian Lu, University of Science and Technology of China
Co-author(s): Lindong Liu, Xiaoshuai Fan

Abstract:
In this paper, we introduce the exploding channel (EC), which provides product information and price discounts to consumers, into the classic consumer search model where only normal channel (NC) is studied and investigate how the diversity of channels influence sellers' strategies and consumers' behaviors. We find out sellers' optimal information strategy and discount strategy in the ECs and determine the conditions under which consumers' search behaviors in NCs are fully deterred and partially deterred, respectively. We further explore the effects of EC on sellers' profit, consumer surplus and the total social welfare.

Title: Search in Omnichannel Operations via Information Design

Presenter: Ailing Xu, Hong Kong University of Science and Technology
Co-author(s): Qiao Chu He, Ying Ju Chen

Abstract:
This paper examines how firms manage consumer search and purchase behaviors in omnichannel operationsvia information design to increase sales. We propose a sequential search model with free recall, where consumers areallowed to search either channel or both and choose to purchase or leave at any stage of the search process. In terms ofconsumer search, the two channels are different in two aspects: (1) Search online is more convenient than that in offlinestores and thus incurs a lower cost; (2) Consumers can learn the true match value offline but an imperfect signal online,where the information policy online is designed by firms in Bayesian persuasion manner.Our research shows the role of information design in omnichannel operations, as measured by demand gain. By fine-tuning information structures, we are able to synergize both channels to navigate consumer search and coordinate channelcompetitions. The central idea of information design is to utilize the "complementarity effect" between two channelsand differentiate consumer search patterns in two channels. The optimal signal structure is either a two-interval or three-interval policy online, which is shaped by the "complementarity effect" between two channels and the tension betweenthe "persuasion incentive" and the "attraction incentive". When product values are perfectly correlated, firms are likelyto adopt a pooling strategy to obfuscate extreme (low-end and high-end) match values to convince those consumers topurchase immediately online, while mixing intermediate match values to induce other consumers to search and purchaseoffline. In contrast, if the match values become independent, the monopolist would disclose complete information for lowmatch values online to encourage more consumers to search offline and thus increase the likelihood of a final purchase.Our findings provide insights into the optimal information design for managing consumer search behaviors in omnichannel operations.

Parallel Session (B9) - Healthcare Information Technology

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z413

Session Chair: Suxi Zheng, The University of Hong Kong

Title: Can Predictive Technology Help Improve Acute Care Operations? Investigating the Impact of Virtual Triage Adoption

Presenter: Jiatao Ding, INSEAD

Co-author(s): Michael Freeman, Sameer Hasija

Abstract:

To choose the appropriate resources for their healthcare needs (e.g., primary care (GP) or emergency depart-ment (ED)), patients seeking acute care must self-triage based on their own assessment of their symptoms and sever-ity. However, as patients typically lack sufficient medical knowledge, self-triage decisions can often be inaccurate. Inresponse, healthcare and technology companies have been developing and deploying virtual triage tools designed to helppatients make better and more efficient self-triage decisions. However, the operational implications of such tools have notyet been assessed. This paper therefore develops a queueing game model to investigate the impact of virtual triage in theacute care setting and policies to maximize its efficacy. We find that, due to its decentralized nature, when virtual triageexcessivelyrecommendsemergency (primary) care, it could bring about adecreasein ED (GP) visits. Another importantfinding is that for anyarbitrarypatient self-triage accuracy, the adoption ofinformativevirtual triage can worsen systemperformance, even when the virtual triage recommendation is reasonably accurate. To unlock the potential operationalbenefits of virtual triage, we characterize the optimal virtual triage accuracy subjective to the receiver operating charac-teristic (ROC) curve. We then investigate how the optimal accuracy changes when patient composition and acute carecost parameters change and as the triage capability of the tool improves.

Title: The Value of Information Sharing in a Regional Collaborative Emergency Care System: Evidence from a Regional Chest Pain Center

Presenter: Weifen Zhuang, Xiamen University
Co-author(s): Yao Li, Jian Chen, Hong Chen, Changqing Zhong

Abstract:
Timely access to PCI treatment for STEMI, the most severe type of heart attack, is crucial as time is muscle and particularly challenging as it usually involves interhospital transfer within two-hour time window. The lack of access is mainly due to system barriers involving lack of coordination between EMS, non-PCI, and PCI hospitals. We empirically examine the value of advanced information sharing via mobile technology on a regional collaborative emergency care system with one chest pain center. Our results highlight that electronic information sharing between healthcare providers is an important enabler to facilitate coordination and improve the operational efficiency.

Title: Do Healthcare Professionals Always Improve Productivity from Healthcare Information Exchange? The Role of Rurality of Hospital

Presenter: Yao Zhao, Hong Kong University of Science and Technology
Co-author(s): Dongwon Lee, Hillol Bala

Abstract:
Healthcare information exchange (HIE), the health information sharing between healthcare providers, is expected to improve the efficiency of care providers. However, interviews with healthcare professionals suggest that they spend huge amount of time and effort interacting with the HIE platform. It is thus important to examine the impact of HIE on healthcare professionals' productivity. By utilizing data envelopment analysis (DEA) method and applying differences-in-differences (DID) estimation model, we find that physicians and nurses at hospitals with HIE have a significant productivity increase after the HIE adoption. We further find that this positive effect is significant only for urban hospitals but not for rural hospitals, suggesting that the HIE adoption might expand the efficiency gap between urban and rural hospitals.

Title: Does Knowledge Translate Into Clinical Practice: An Empirical Investigation of Intelligent Diagnosis and Treatment Mobile Clinical Support System

Presenter: Suxi Zheng, The University of Hong Kong
Co-author(s): Haipeng Shen

Abstract:
Although stroke is the leading cause of death in China and imposes escalating costs on the healthcare system, it has been shown that adherence to guidelines to recommended stroke care metrics is suboptimal. The clinical support system is expected to enhance the adherence, thus improving patient outcomes. Using a comprehensive dataset including over 8, patients in China from 215 to 222, we showed that, on average, the mobile clinical support system implementation significantly increased physicians' adherence to treatments and decreased major adverse events for stroke patients. We also found that the impact was sustained even after the mobile clinical support system was discontinued. Heterogeneous effects were found in applying the system, with higher improvement in lower-grade hospitals, hospitals equipped with fewer hospital personnel and hospitals lacking cooperation with emergency service centers.

Parallel Session (B10) - Sharing Economy

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z511

Session Chair: Jingwen Pan, City University of Hong Kong

Title: Friend or Foe? Flat-rate Pricing and Supply Outcomes in the Ride-hailing Market

Presenter: Wei Miao, University College London
Co-author(s): Yanlai Chu, Junhong Chu

Abstract:
We leveraged a policy change in which a leading ride-hailing company introduced an origin-destination-based flat-fare option alongside a metered option to study the causal effects of flat-rate pricing on drivers' supply outcomes. We first documented that drivers significantly improved their efficiency in driving distance and time on flat-fare trips vis-a-vis metered trips, which benefited riders. We then conducted difference-in-differences

analyses to identify how flat-rate pricing causally affected drivers' shift earnings and labor supply. We found that treated drivers earned higher shift income not by extending shift hours (the extensive margin of labor supply) but rather by improving their productivity (the intensive margin of labor supply). Flat fares incentivized drivers to take more efficient routes on both flat-fare trips (a direct effect) and metered trips (a spillover effect), and the saved driving time enabled drivers to complete more trips during the same shift length, which benefited drivers. We ruled out alternative explanations for drivers' higher shift earnings, including flat-fare premium, reduced break time, faster driving, more efficient job searching, or negative cross-driver spillovers. Finally, we discussed implications for ride-hailing platforms and policymakers.

Title: SHARING IN CARING: Analyzing Shared Medical Appointments Through an Operations

Presenter: Sundara Natarajan Panchanatham, INSEAD
Co-author(s): Enver Yucesan

Abstract:
Shared medical appointments (SMA) are doctor-patient visits in which groups of patients are seen by healthcare professionals in a concurrent session. The setup can potentially enhance the patient experience, eliminate redundant work, improve compliance, and reduce costs for certain treatments. From an operations standpoint, providers face several key challenges in the smooth conduction of SMAs, including finding the optimal group size and the optimal capacity allocation. In this work, we mathematically analyze the key operational trade-offs involved in SMAs as a service and provide prescriptions that enable providers to choose the optimal decision variables (capacity/payment/group size) for several system configurations.

Title: Design of Car Rental Programs for Drivers Offered by a Ride Hailing Platform

Presenter: Guiyun Feng, Singapore Management University
Co-author(s): Vishal Agrawal, Yannis Bellos, Deyin Ji

Abstract:
The growth of on-demand service platforms in many cities is limited by the availability of workers rather than customers. In order to secure enough drivers to meet demand, ride hailing platforms such as Lyft, Uber, and Grab have been offering short-term car rental

programs to drivers who are interested to work as platform providers but don't have qualified cars (or who are reluctant to use their own cars). Different designs of car rental programs have been adopted and some of them discriminate between car rental drivers and those driving their own cars in one of the following manners: 1) by imposing restrictions on how rented cars should be used; 2) by imposing a surcharge for the personal use of rented cars; 3) by offering different wage compensation to these two pools of drivers. While the car rental program increases the platform's capacity from the supply side, some car rental drivers have raised fairness concerns stemming from the discriminating practicing mentioned above. Motivated by these observations, in our work, we build up a game-theoretic model to study the operation of different car rental programs in conjunction with a ride hailing platform. We further investigate the implications of different car rental programs to the platform, drivers, and riders. Surprisingly, we find that discriminating between car rental drivers and those driving their own cars can benefit all stakeholders (higher profit, higher drivers' surplus, more riders served) when the value per ride is not too high and car-own agents' driving cost is high enough. The contribution of the work is two-fold: 1) it offers managerial insights in terms of how the car rental program should be designed from the platform's perspective; 2) it provides a better understanding of the social impact of introducing car rental programs to increase the capacity of ride hailing platforms.

Title: The Effect of Sharing Economy on Digital Resilience: Evidence from Airbnb

Presenter: Jingwen Pan, City University of Hong Kong
Co-author(s): Angela Lu

Abstract:
Digital resilience builds sustained ability to address adverse events such as natural disasters, as local communities can leverage digital technologies to mitigate the growing pressure on scarce federal and state resources in disaster assistance. This paper examines the digital resilience effect of the sharing economy, a peer-to-peer model of resource sharing that contributes to community disaster relief. Different from normal top-down strategies, the bottom-up approach derived from sharing economy harnessesthe enormous power of the crowd. Using data from the Airbnb platform, we find that communities with higher Airbnb engagement are more resilient, as shown by lower dependence on outside aid. The resilience effect of the sharing economy operates through its sociability values, which tend to be more economically significant and longer lasting than its economic benefits. The platform involvement via a platform policy launch, the "Open Homes" Program, further enhances hosts' sociability motivation in

communityengagement and increases the digital resilience effects. This research contributes to the literature on the sharing economy in disruptive events and its role in improving local community sociability and resilience. Practical implications for disaster managers and digital platforms are outlined.

Parallel Session (B11) - Online Platforms

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z512

Session Chair: Yushu Zeng, Hong Kong University of Science and Technology

Title: An Integrated Platform for Independent Service Providers: Implications on Demand, Revenue, and Welfare

Presenter: Jing Yang (Sunny) Xi, Tsinghua University
Co-author(s): Wai Kin (Victor) Chan

Abstract:
In a traditional homogenous market, service providers (SPs) operate independently and compete for the same customers. Yet, with advancements in digital technologies, it is now possible to extract additional revenue from and/or increase the social welfare of this market if another firm can integrate the SPs under an online service platform, through which all customers can place their orders interchangeably. We model each SP as an M/M/$ssii$ system with $ssii$ servers and model the platform as a larger M/M/s system (ss=$\sum ssii$). The platform charges a commission on each SP and profit (welfare)-maximizing SPs join the platform if their revenue (submarket welfare) increases or is unchanged after joining. To solve for the equilibrium customer arrival (demand) rate and the balking threshold of each M/M/$ssii$ queue, we propose a numericalapproximation method that gives exact results for $ssii$<3 and fast and accurate estimations for $ssii$<7. We find that if no customers balk (low demand), the market's welfare is increased when all SPs join the platform. Its total revenue is unchanged, however, and the smallest (largest) SP always earns more (less) after joining. I n such a market, a welfare-seeking platform may incentivize all SPs to join by using the commission from smaller SPs to subsidize larger SPs. When some customers balk (high demand), market size, revenue, and welfare all increase under the platform. Interestingly, when the SPs and the platform are both welfare-maximizers, the platform can earn the most amount of revenue as the SPs are more willing to trade away profit for increased customer utility (reduced waiting time) under the platform.

Title: Overseas Shipment Consolidation of Cross-border E-commerce for China's Double 11 Shopping Festival

Presenter: Yuyu Zhu, Sun Yat-sen University
Co-author(s): Gang Chen, Junteng Yang

Abstract:
China's cross-border e-commerce grows dramatically in recent years. As the best-known marketing event, the Double 11 shopping festival consists of three periods, i.e., advance selling period, outbreak period, and insured price period. To enable the efficient order fulfillment, cross-border logistics service providers must arrange the shipping in a timely and cost-saving manner. In this paper, we formulate the cross-border shipping as a finite-term Markov decision process and optimize the overseas shipment consolidation. We also examine the impact of earnest money ratios, advance selling prices, fixed shipping costs on the logistics decisions.

Title: Assortative Matching and Product Line Design on Home Service Matching Platforms

Presenter: Hui Xiong, Huazhong University of Science and Technology
Co-author(s): Ying Ju Chen, Lu Hsiao

Abstract:
Recent years have witnessed the growth of the home service matching platforms. These platforms use commission-based contracts to recruit suppliers, provide multiple products to serve consumers and match suppliers with the products. To improve the profit, the platforms have to optimize their matching strategies, commission-based contracts and product quality decisions. Therefore, we build a model to investigate the matching strategies, the contract design and the quality decisions, in which suppliers with different service efficiency provide products for heterogeneous consumers. The consumers with relatively high (low) willingness to pay for quality belong to the high (low) segment. We find that when the low-segment consumers become very important (i.e., the low-segment consumers take a relatively large proportion and their willingness to pay for quality is high), the platform may induce the high-efficiency suppliers to offer the low-quality product. Moreover, the platform is more likely to adopt this strategy when the matching probability for the low-valuation product is higher. However, when the heterogeneity between two segments is sufficiently

small, the platform intends to induce the high-efficiency suppliers to offer the high-quality product and upward distort the quality level for high segment. In this case, the quality difference between two products increases in lowsegment consumers' willingness to pay for quality.

Title: Information Disclosure and Consumer Search on the Online Platform: Theory and Empirical Evidence

Presenter: Yushu Zeng, Hong Kong University of Science and Technology
Co-author(s): Hu Huang, Ying Ju Chen, Xin Wang

Abstract:
In this paper, we develop a stylized game-theoretical model to study the information disclosurestrategies of a firm that sells experience goods (e.g., web novels) to a unit mass of consumers through anonline platform. The consumer is uncertain about the product's vertical quality and horizontal attributes.The platform can offer vertical quality information before the quality level is realized, and the firm maydisclose the horizontal quality information. The firm is more likely to disclose horizontal attribute informationwhen the search cost is negligible. Besides, the firm with lower vertical quality is more likely to reveal the fitinformation than the high-type firm. If the vertical quality information is unavailable, the low-type (high-type) firm may have the incentive to pool with (separate from) the high-type (low-type) firm. As a result,the firm, regardless of the vertical type, is less likely to disclose his attribute information when the platformdoes not provide vertical quality information than when the platform offers that information. The platformhas no incentive to provide consumers the vertical quality information of the product sold through it whenthe search cost is low. Besides, we empirically show that lower-level authors (with lower vertical quality) ofweb novels tend to choose longer book or article names, which can be well explained by our model.

Parallel Session (B12) - Service Operations

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z513

Session Chair: Michael Wang, University of Windsor

Title: Team Familiarity, Partner Exposure, and Performance: Evidence from Cardiac Interventional Procedure

Presenter: Xiaohan Chen, Xiamen University
Co-author(s): Weifen Zhuang

Abstract:
Interventional procedures for coronary heart disease continue to rise in China. The procedure is a team job. What influences the performance of a procedural team? Familiarity and prior partner exposure are often considered to be two important empirical measures in fluid team studies. Low-fluidity teams increase familiarity but decrease prior partner exposure, while high-fluidity teams do the opposite. To explore the fluidity strategies of teams under a particular composition, we measured the impact of familiarity and partner exposure on procedural performance in teams of different seniority. We found that lower fluidity and higher familiarity in senior teams facilitated improved performance.

Title: Prediction Model of Tumor Response to Different Chemoradiation Doses Based on Attentional Feature Fusion and Convolutional Variational Autoencoder

Presenter: Yulin Pu, Tongji University
Co-author(s): Chunyan Duan

Abstract:
Tumor response prediction to the estimated chemoradiation doses is the key for doctors to implement personalized precise chemoradiation for lung cancer patients. We combine deep learning methods to build accurate chemoradiation response prediction model. Based on dimension reduction of original 3D image data, the image features are fused using the attentional feature fusion method, and then the combined method of convolutional variational autoencoder and regression is used to predict the tumor response after treatment with corresponding chemoradiation doses to help doctors set the treatment dose. The accuracy of the model is tested by adopting the comparison with other methods.

Title: Queue Visibility Decisions in Customer-Intensive Services

Presenter: Junxue Zhang, Hong Kong University of Science and Technology
Co-author(s): Chenguang (Allen) Wu, Ying Ju Chen

Abstract:
Strategic servers may discreetly disclose or hide queue length information to influence customers' joining behaviors. For customer-intensive services, the choice of service rate further complicates this decision by affecting the service quality and consequently customers' service rewards. We develop an integral analysis of a server's queue visibility decisions in the context of speed-quality trade-offs, and show that under a fixed price, the server often discloses the queue length and lowers the service quality when the customer-intensity is high. Under an endogenous price, a high customer-intensity also induces queue disclosure but often accompanied by higher service qualities.

Title: Implementating Enhanced Recovery After Surgery (ERAS) Procedure for Health Quality Improvement in Hospitals

Presenter: Michael Wang, University of Windsor

Abstract:
In this research project, we are examining the introduction of the Enhanced Recovery After Surgery (ERAS) procedure for patients in the Gynecology and Gynecologic Oncology Department within a local hospital. ERAS is a set of evidence-based protocols/guidelines aimed to improve the recovery process for those patients undergone surgery operations. Specifically, ERAS focused on the re-assessment of past standard practices in terms of pre-surgery, during-surgery, and post-surgery by creating a patient-centered and more customized portfolio in order to accelerate the individual patient recovery process. Specifically, we demonstrated how the ERAS protocols can be adopted and merged with the existing procedures.

Parallel Session (B13) - Operational Decision Making under Uncertainty

Day 1: 7th Jan (Sat)16:00 – 17:30 Venue: Z205

Session Chair: Jinzhi Bu, The Hong Kong Polytechnic University

Title: Asymptotic Optimality of Projected Inventory Level Policies for Perishable Inventory Systems with Positive Lead Times

Presenter: Huanyu Yin, The Chinese University of Hong Kong
Co-author(s): Xiting Gong, Jinzhi Bu

Abstract:
We consider periodic-review perishable inventory systems with a fixed product lifetime and positive replenishment lead times. The objective is to minimize the long-run average holding, penalty, and outdating cost. For these notoriously hard systems, we consider a new class of projected inventory level (PIL) policies and establish various asymptotic results for the best PIL policy under different system settings in four parameter regimes. Among others, we prove that it is asymptotically optimal with large unit penalty costs under a large class of demand distributions and general other system settings. An extensive numerical study demonstrates its near-optimal performances.

Title: Approximation Algorithms for Lost-sales Inventory Systems with Remanufacturing

Presenter: Suting Liu, The Chinese University of Hong Kong
Co-author(s): Xiting Gong

Abstract:
We develop the first approximation algorithms for two classes of lost-sales inventory systems with remanufacturing. For pure remanufacturing inventory systems with general replenishment lead times, we develop a modified dual-balancing policy and show that it admits a worst-case performance guarantee (WCPG) of two under a broad class of associated demand processes and mild conditions on system parameters. For hybrid manufacturing/remanufacturing inventory systems with general identical lead times, we develop a dual-balancing policy which admits the same WCPG under similar conditions. Our numerical study demonstrates that both policies generally perform much better than their worst-case performance bounds.

Title: Assortment Optimization Under the Multivariate MNL Model

Presenter: Menglong Li, City University of Hong Kong
Co-author(s): Xin Chen, Jiachun Li, Tiancheng Zhao, Yuan Zhou

Abstract:
We study an assortment optimization problem under a multi-purchase choice model in which customers choose a bundle of up to one product from each of two product categories. For the uncapacitated setting, we prove that this problem is strongly NP-hard. We show that an adjusted-revenue-ordered assortment provides a 1/2-approximation. Furthermore, we develop an approximation framework based on a linear programming relaxation of the problem and obtain a 0.74-approximation algorithm. This approximation ratio almost matches the integrality gap of the linear program, which is proven to be at most 0.75. For the capacitated setting, we prove that there does not exist a constant-factor approximation algorithm assuming the Exponential Time Hypothesis. The same hardness result holds for settings with general bundle prices or more than two categories. Finally, we conduct numerical experiments on randomly generated problem instances. The average approximation ratios of our algorithms are over 99%.

Title: Offline Pricing and Demand Learning with Censored Data

Presenter: Jinzhi Bu, The Hong Kong Polytechnic University
Co-author(s): David Simchi-Levi, Li Wang

Abstract:
We study a single product pricing problem with demand censoring in an offline data-driven setting. Consider a retailer given a finite level of inventory and facing a random demand that linearly depends on the price with unknown parameters and noise distribution. Any unsatisfied demand is lost and unobservable. The retailer's objective is to use censored demand data to make pricing decisions, maximizing her expected revenue within inventory limit. We find the degree of censoring in data affects the identifiability of near-optimal algorithms in data-driven problems and characterize the exact condition for the problem identifiability. We propose a data-driven algorithm that guarantees near-optimality in the identifiable case, and approaches best-achievable optimality gap in the unidentifiable case.

Parallel Session (C1) - Empirical Research in Operations Risk Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z405

Session Chair: Ziang Wang, The Hong Kong Polytechnic University

Title: The Effect of Scope 1 Disclosure on Carbon Emissions

Presenter: Yilin Shi, The Chinese University of Hong Kong
Co-author(s): Christopher Tang, Jing Wu

Abstract:
We study the effect of voluntary disclosure of Scope 1 on carbon emissions. We find that firms who self-disclose Scope 1 emissions have less Scope 1 emissions, but such reduction is at the cost of increasing in upstream Scope 3 emissions and total emissions. This pattern holds for firms in Asia and North America. However, European firms who voluntarily disclose Scope 1 emissions do not increase upstream Scope 3 emissions and total emissions. We also find that mandatory environmental reporting regulations intensifies the negative relationship between self-disclosure and Scope 1 emissions, indicating that firms are not under-reporting Scope 1 emissions.

Title: Can You Have Your Cake and Eat It too? A Tale of Information Security and Operational Efficiency

Presenter: Ruiqi Liu, The Hong Kong Polytechnic University

Abstract:
Although the topic of data breach consequences is attracting increasing attention, the existing literature is limited in its scope and the discourse utilizes few theories. Given this research gap, we draw on the attention-based view (ABV) and theorize that data breach events negatively impact firms' operational efficiency. We also utilize the premises of ABV to guide our theoretical analysis on the potential boundary conditions of data breach impacts. To test our hypotheses, we provide a comprehensive list of tests based on firm-level panel data from 2006 to 2016. We find that data breach events reduce firms' operational efficiency, particularly if firms' managers are risk averse, if their excess resources are insufficient, or if firms are located in an idle market. Our dynamic analysis also suggests that data breach impacts are relatively short-term rather than long-term. Our theorizing and insights have important implications for academics as well as practicing professionals.

Title: Trade Credit and the Transmission of International Capital Flows

Presenter: Jie Peng, The Chinese University of Hong Kong
Co-author(s): Jonathan Lennon Hsu, Jing Wu

Abstract:
A key question in international finance is the impact of economic globalization on firm financing. Using a large cross-sectional data set of cross-border financing (CBF) events, we study the relationship between global financing flows and trade credit activity within production networks. We find that firms which receive CBF tend to demand less trade credit from their suppliers, and extend less trade credit to their customers. These results are strongest for global bond issuances and global syndicated loan markets, and not significant for equity cross-listings. We also find significant differences in the trade credit response to a CBF event depending on whether the firm has a high degree of centrality within its local supply chain. More central firms are more likely to receive CBF in a given year, and increase both trade credit demand and supply following a CBF event when compared to non-central firms. The results suggest that central firms play important roles as liquidity providers within their supply chains, extending CBF flows to other firms in the form of trade credit.

Title: Does Carbon Emission Threat Supply Chain Relationship? International Evidence

Presenter: Ziang Wang, The Hong Kong Polytechnic University
Co-author(s): Yang Duan, Yong Jin, Hao Ying

Abstract:
Under the goal of the carbon neutrality, the global supply chain relationships have been experienced the new threats and challenges that are related to the suppliers and customers' carbon emissions. Drawing on the signaling theory and the transaction cost theory, carbon emissions can be the potential source of the disruption of the supply chain partnership, or supply chain discontinuity risk. In this study, we document a large sample evidence to exploit the positive relationship between the carbon emissions and the supply chain discontinuity risk using a comprehensive international data. Our results are robust to survival analysis, causal identification strategy and additional robustness checks. Further analysis suggests that regulations and (endemic) society environmental development are two plausible channels to enhance the covariance of the carbon emissions and the supply chain

discontinuity risk. Our empirical findings and insights have important implications for academics as well as practicing professionals.

Parallel Session (C2) - Interface between learning and service operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z414

Session Chair: Wei You, The Hong Kong University of Science and Technology

Title: Entice Bidders by Maximum Bid

Presenter: Zheng Xie, Hong Kong University of Science and Technology
Co-author(s): Pin Gao, Xuan Wang, Ying Ju Chen

Abstract:
Restricting maximum bid in auctions is observed in practice (e.g., in the airline industry), but the study of its impact on bidders' behaviors and the auctioneer's profit is limited. We consider a stylized model in which the seller conducts a second-price auction admitting heterogeneous bidders who differ in their valuation and outside options. To improve his profit, the auctioneer sets a price cap to invite bidders with high valuation and high outside option under certain conditions. Furthermore, a socially responsible auctioneer has an increasing tendency to set a price cap. Our result is robust under a more general multi-object auction setting.

Title: Congestion-Aware Matching and Learning for Service Platforms

Presenter: Xu Sun, University of Florida
Co-author(s): Jingtong Zhao

Abstract:
We study dynamic matching in a service platform modeled as a multi-class, multi-server queueing system with Bernoulli rewards with unknown mean dependent on job-server assignments. The goal is to minimize regret, defined as the difference between the cumulative payoff over a time horizon and the maximum possible payoff obtained when the platform has complete knowledge of all system parameters while all job arrivals and service completions occur in a deterministic fashion. We propose and analyze a main algorithm for matching and learning based on the idea underpinning the interior-point method, as well as

a bandit algorithm for estimating rewards of job-server assignments. The main algorithm is shown to have a sub-linear regret while maintaining stability for the queue lengths at various servers. We also supply the main algorithm with a queue-length-based matching scheme. Numerical experiments using both synthetically generated random data and a real-world data set reveal that both our main algorithm and the queue-length-based matching scheme are quite effective.

Title: Optimality Condition and Top-Two Algorithms for Top-k-Arm Identification

Presenter: Wei You, The Hong Kong University of Science and Technology
Co-author(s): Chao Qin, Zihao Wang, Shuoguang Yang, Zeyu Zheng

Abstract:
We study the pure exploration problem of identifying all arms from the set of top-k-arm in a stochastic bandit. By detailed analysis of the KKT conditions of the optimal allocation of sampling effort, we propose a unified framework for designing top-two algorithm, where in each step a leader and a challenger are proposed and sampled from. Existing top-two algorithms require tuning parameters to achieve optimality. Our proposed framework incorporates an automatic tuning step that guarantees optimality. We also provide detailed structural analysis of the optimality conditions and show that frequently used heuristics for top-k-arm identification are either incorrect or non-sufficient.

Title: Sample-Based Online Stochastic Matching with Asymptotic Competitive Ratio Analysis

Presenter: Hao Wang, Nanyang Technological University
Co-author(s): Zihao Li, Zhenzhen Yan

Abstract:
We study an edge-weighted online stochastic matching problem with unknown Poisson arrivals. In this model, we consider a bipartite graph which contains a set of offline and online vertices. Online arrivals are sampled from the online vertex types following independent but not necessarily identical Poisson processes with unknown parameters. Each arrival will be matched to an offline vertex or be rejected immediately and irrevocably upon its arrival. We provide a sample-based algorithm which achieves a competitive ratio of at least (1-CN^{-1/3})0.645, where N is the minimum number of samples for each online type in the total

arrivals and C is a constant. In addition, if we have at least N_0 historical samples of each online type before running the matching algorithm, we further provide a new algorithm with a performance guarantee. Its performance measured by competitive ratio depends on the algorithm's parameters. In particular, the competitive ratio converges to 0.645 when N goes infinity. By tuning the parameters, we can calculate the competitive ratio for each given pair of N and N_0. For example, when N = 1000 and N_0 = 10000, the competitive ratio is 0.509.

Parallel Session (C3) - Pricing and Capacity Management in Service Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z406

Session Chair: Zhichao Feng, The Hong Kong Polytechnic University

Title: Battery as a Service: Flexible Electric Vehicle Battery Leasing

Presenter: Lingling Shi, Naveen Jindal School of Management, University of Texas at Dallas
Co-author(s): Bin Hu

Abstract:
Inspired by the electric vehicle (EV) startup NIO which adopts a swappable battery design and a flexible battery leasing business model, we study flexible EV battery leasing where customers make long-term battery lease decisions with temporary up/downgrade options. Adopting a game-theoretical model, we find that flexible battery leasing can reduce both the total customer cost and the total battery capacity, thus benefiting the customers as well as the environment. These findings confirm flexible battery leasing's potential viability in terms of customer value and environmental impact and inform EV manufacturers in their decisions to adopt flexible battery leasing.

Title: Inventory Risk Allocation in the Presence of Sales Effort

Presenter: Buqing Ma, University of Science and Technology of China
Co-author(s): Ying Ju Chen, Weiliang Zhang

Abstract:
We investigate the manufacturer's and retailer's preferences for the traditional, drop-shipping, and dual channels. First, we illustrate that the traditional channel can be Pareto-optimal when considering the retailer's sales effort. Second, in the dual channel, the sales

effort can increase with the drop-shipping markup. Third, the retailer can order more quantity in response the increasing demand uncertainty. Finally, when considering the shipping cost, a channel without the order quantity (i.e., drop-shipping) is less likely to be Pareto-optimal. However, that with the order quantity (i.e., traditional or dual channel) has a greater chance of being Pareto-optimal.

Title: Optimal Growth of a Platform in Networked Markets

Presenter: Yixin Zhu, The Chinese University of Hong Kong
Co-author(s): Hongfan Chen, Renyu Zhang, Sean Zhou

Abstract:
We consider a platform that charges commission fees to both buyers and sellers. The compatibility between different types of users is captured by a bipartite network. The platform leverages commissions to balance the tradeoff between the growth of population and the short-term revenue with an objective of maximizing its total revenue across T periods. We design an approximation algorithm that yields an asymptotic optimal solution to the revenue maximization problem. When the system becomes balanced, we establish how the optimal commissions depend on the stickiness of users in the trading network.

Title: M/M/s On Demand: Queues with On-Demand and Reserved Servers

Presenter: Zhichao Feng, The Hong Kong Polytechnic University
Co-author(s): Milind Dawande, Ganesh Janakiraman, Anyan Qi

Abstract:
In many real-world applications, there is a growing trend to supplement reserved capacity with on-demand capacity; examples include servers by cloud-computing providers and health-care professionals by post-acute-care services. We analyze a queueing system that employs both “reserved" and “on-demand" servers - the number of reserved servers is decided at the beginning of the time horizon while the number of on-demand servers is decided dynamically. The objective is to minimize the long-run average cost incurred in the hiring of the servers and in the waiting of the jobs. We show that the optimal on-demand capacity control is a threshold-based bang-bang policy: If the number of jobs in the system is below a threshold, then no on-demand servers are employed. Otherwise, the number of on-demand servers is chosen such that no jobs wait.

Parallel Session (C4) - Mechanism Design in Marketing - Operations Interface

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z407

Session Chair: Ting Hou, University of Science and Technology of China

Title: Acceleration of Online Shopping in Hong Kong Amid the Covid-19 Pandemic

Presenter: Jingcun Cao, The University of Hong Kong
Co-author(s): Chenxi Liao, Ying Xie

Abstract:
We investigate how COVID-19 pandemic accelerated the adoption of digital channels. In particular, we are interested in examining whether and to what extent the increased offline pickup locations facilitate the acceleration. Using detailed transcation data from HKTVmall, the leading HK-based e-commerce platform, we find that various pandemic-containing policies and the perceived pandemic severity have significant effects on customer shopping frequency and total spending with the e-tailer for both existing and new customers. However, contrary to our expectation, the increased offline pickup locations did not significantly contribute to customer spendings with the e-tailer. We explore mechanisms that might drive this effect.

Title: Will Self-gifting of Streamers Hurt Unions? Analyzing the Union's Compensation Mechanism for a Live Streaming Supply Chain

Presenter: Yuwen Da, University of Science and Technology of China
Co-author(s): Qinglong Gou, Chao Liang

Abstract:
On a live-streaming platform, streamers can join a union to gain its support and then be paid by it. In practice, union's compensation mechanism usually contains a basic requirement for proceeds, which may induce a specific self-gifting behavior — when streamers' proceeds have not met the requirement, they may donate to themselves to increase their income. An interesting question is how should the union respond to such speculation, stand by or prohibit it? Considering a Stackelberg game between streamers and a union, this paper reveals the impact of self-gifting behavior and the union's response strategy.

Title: Strategic Introduction of the Live Streaming Channel

Presenter: Jie Liu, Huazhong University of Science and Technology

Abstract:
In recent years, many sellers cooperate with third-party live streaming hosts for more sales. Under this cooperation, a live streaming host can influence the demand by exerting marketing effort and obtain a pkoportion of revenue. In this paper, we charac-terize the bargaining process between the seller and the host in a game-theoretic model to investigate the seller's decision on whether to sell products through the live stream-ing host. We find that when the host's marketing effort efficiency is low enough, the seller cooperates with the host if the host's bargaining power is sufficiently small under the pure commission contract. However, if the host is endowed with larger bargain-ing power, the host may strive for a high commission rate. Then, the profit increase from the cooperation can not counterbalance the cost caused by the commissions and thus the seller abandons the live streaming channel. Moreover, we show that when the host's marketing effort efficiency is high, the commission rate decreases with the host's bargaining power. In this case, a concession on the commission rate encourages the seller to charge a lower retail price, which leads to more sales. Furthermore, our findings suggest that live streaming channels can generate more consumer surplus and social welfare.

Title: An Analysis of the Dunning-Kruger Effect in Crowdsourcing Contests

Presenter: Ting Hou, University of Science and Technology of China
Co-author(s): Qinglong Gou, Liang Chao, Wen Zhang

Abstract:
Many firms launch crowdsourcing contests to gather solutions to problems from an open crowd. Participants compete at generating innovative solutions whose quality mainly depends on their ability. Empirical research indicates that the Dunning-Kruger effect is one of the cognitive biases affecting people's estimates of their ability (i.e., people may overestimate or underestimate their ability) in competitive situations. In this paper, we study the impacts and implications of the Dunning-Kruger effect in a crowdsourcing contest setting where participants exhibit the Dunning-Kruger effect. We find that the existence of the Dunning-Kruger effect is not always unfavorable to the firm.

Parallel Session (C5) - Prescriptive Analytics in Socially Responsible Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z409

Session Chair: Guodong Lyu, Hong Kong University of Science and Technology

Title: Machine Learning and Mobile Phone Data Can Improve Targeting of Humanitarian Aid

Presenter: Emily Aiken, University of California, Berkeley
Co-author(s): Suzanne Bellue, Dean Karlan, Chris Udry, Joshua Blumenstock

Abstract:
Targeting is a central challenge in the administration of anti-poverty programs: it remains a difficult task to rapidly identify those with the greatest need given available data. Here we show that data from mobile phone networks can improve the targeting of humanitarian assistance. Our approach uses traditional survey data to train machine-learning algorithms to recognize patterns of poverty in mobile phone data; the trained algorithms can then prioritize aid to the poorest mobile subscribers. We evaluate this approach by studying a flagship emergency cash transfer program in Togo, which used these algorithms to disburse millions of US dollars worth of COVID-19 relief aid. We find that relative to the geographic targeting options considered by the Government of Togo, the machine-learning approach reduces errors of exclusion by 4–21%. These results highlight the potential for new data sources to complement traditional methods for targeting humanitarian assistance, particularly in crisis settings in which traditional data are missing or out of date.

Title: Reducing Recommendation Inequality via Stable Matching with Random Preferences

Presenter: Eryn Juan He, University of Utah
Co-author(s): Tu Ni, Chung-Piaw Teo, Hai Wang

Abstract:
Recommender systems are widely used in two-sided decentralized matching markets to facilitate the search for the optimal match. However, only a small fraction of users were recommended because leading recommendation algorithms often exploit popularity and similarity that reinforce preference homogeneity. In this work, we model the search process as a stable matching problem with random preferences and develop an optimization-based

approach for the recommendation. Finally, we design an efficient algorithm and demonstrate through extensive numerical experiments that our approach is effective in both reducing recommendation inequality and achieving near-optimal performance in recommendation accuracy.

Title: Promise or Peril? When Human Efficacy Meets with AI Efficacy Augmentation

Presenter: Yiyu Huang, Fudan University
Co-author(s): Tian Lu, Xianghua Lu, Hai Wang

Abstract:
Literature has amply emphasized that humans high in self-efficacy tend to resist AI advice despite AI's strong efficacy (capacities). However, for the common situation wherein the already-powerful AI efficacy is further augmented, we conjecture that human response to AI advice is unpredictable. This is due to the conflicting cues between humans' high self-efficacy and their explicit recognition of AI efficacy augmentation obtained from their strong learning ability. We leverage a natural experiment on a food delivery service setting to empirically reveal that AI efficacy augmentation renders humans high in self-efficacy to follow AI advice and achieve overall better performance thereby.

Title: The Echoes of Exposure and Community Effects: Evidence from the Pilot of Locker Alliance Network

Presenter: Libo Sun, School of Management, University of Science and Technology of China; Institute of Operations Research and Analytics, National University of Singapore
Co-author(s): Guodong Lyu, Chung Piaw Teo, Victor Fernandez

Abstract:
To detect the prospect of nationwide locker network, the Singapore government rolled out the pilot of Locker Alliance Network (LAN) in two emblematic towns on Dec. 2018. By recruiting 2210 participants from two towns, we synchronized a three-phase survey to identify stimuli for shifting consumers' parcel pickup preferences from home delivery to the lockers. We design an observational study and a randomized intervention to identify the exposure effect (the LAN lockers being experienced by individual consumers). Afterwards, we propose an instrumental variable approach to estimate the community effect (susceptibility of new consumers to the LAN penetrations at the community level).

Parallel Session (C6) - Behavior and Marketing Strategies

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z503

Session Chair: Zelong Yi, Shenzhen University

Title: Pricing with Loss-Averse Customers and Self-Selected Product Ratings

Presenter: Fengfeng Huang, University of Electronic Science and Technology of China
Co-author(s): Pengfei Guo, Yulan Wang

Abstract:
We consider a firm offering a product with uncertain qualities. Customers' purchasing decision is influenced by the ratings generated by loss-averse customers. Moreover, customers with extreme experiences are more likely to rate. We examine the firm's dynamic pricing strategy that maximizes the total profit. We find that when the realized aggregate rating is lower than a threshold value, the firm will charge a price lower than the myopic price. We also propose a high-low pricing strategy with two prices. Our extensive numerical study shows that the profit gap between our high-low pricing strategy and the optimal one is within 4.0\%.

Title: Selling Format Selection in the Presence of Rebate Provision

Presenter: Yuan Jiang, Huazhong University of Science and Technology
Co-author(s): Xu Guan, Hao Wu

Abstract:
This paper investigates the manufacturers' optimal rebate provision strategies in a supply chain setting, wherein two competing manufacturers sell substitutable products via a common platform. We consider two selling formats: wholesale format and agency format to capture the interaction between two firms. We show that under either selling format, the manufacturers target both rebate-sensitive and rebate-insensitive consumers when the proportion of rebate-sensitive consumers is low, otherwise the manufacturers only target rebate-sensitive consumers to explore the benefit of rebate provision. The firms' preferences over two selling formats are jointly determined by the commission rate and the composition of consumers.

Title: Pricing Policy in the Presence of Strategic Consumers and Social Learning: Contingent or Guarantee?

Presenter: Jinlong Zhao, Northeastern University
Co-author(s): Zhong-Zhong Jiang, Zelong Yi

Abstract:
Consumers are uncertain about product quality before purchasing. However, they can strategically wait to obtain the online reviews from bought peers through E-commerce platform or social software without hassle. This learning online reviews, named social learning, further exacerbates the strategic waiting behavior. Price guarantee strategy, in which consumers can claim for price difference if mark-down, is regarded as an efficient tool to alleviate the strategic behavior. This paper investigates how the firm determines price in the presence of strategic consumers and social learning behavior under different pricing policies, i.e., contingent pricing and price guarantee. Four meaningful results are yielded. First, in the absence of SL, a decreasing price path is preferred by the firm under both the contingent pricing and the price guarantee strategies. But in the presence of SL, a decreasing, static or increasing price path may be preferred by the firm. Second, under both pricing strategies, compared with that in the absence of SL, both the firm and consumers can benefit, even simultaneously, from SL. Third, in the absence of SL, compared with that under the contingent pricing strategy, consumers' surplus is worse off under the price guarantee strategy, which seems can protect consumers' rights and interests. But the opposite may be true in the presence of SL. Fourth, in the absence of SL, compared with that under the contingent pricing strategy, the first-period price (second-period demand) is higher (lower) under the price guarantee strategy, which means that the price guarantee strategy can alleviate the consumers' SW behavior. But in the presence of SL, it depends on the SW, SL and the proportion of consumers claiming for price difference. Overall, these insights indicate that both the SW and SL behaviors should be valued by both the firm and consumers.

Title: What Results in More Views of Derivative Works? Evidence from a Video-Sharing Platform in China

Presenter: Ruoshan Li, Shenzhen University
Co-author(s): Fan Li, Shengli Li

Abstract:
Consumers are uncertain about product quality before purchasing. However, they can strategically wait to obtain the online reviews from bought peers through E-commerce platform or social software without hassle. This learning online reviews, named social learning, further exacerbates the strategic waiting behavior. Price guarantee strategy, in which consumers can claim for price difference if mark-down, is regarded as an efficient tool to alleviate the strategic behavior. This paper investigates how the firm determines price in the presence of strategic consumers and social learning behavior under different pricing policies, i.e., contingent pricing and price guarantee. Four meaningful results are yielded. First, in the absence of SL, a decreasing price path is preferred by the firm under both the contingent pricing and the price guarantee strategies. But in the presence of SL, a decreasing, static or increasing price path may be preferred by the firm. Second, under both pricing strategies, compared with that in the absence of SL, both the firm and consumers can benefit, even simultaneously, from SL. Third, in the absence of SL, compared with that under the contingent pricing strategy, consumers' surplus is worse off under the price guarantee strategy, which seems can protect consumers' rights and interests. But the opposite may be true in the presence of SL. Fourth, in the absence of SL, compared with that under the contingent pricing strategy, the first-period price (second-period demand) is higher (lower) under the price guarantee strategy, which means that the price guarantee strategy can alleviate the consumers' SW behavior. But in the presence of SL, it depends on the SW, SL and the proportion of consumers claiming for price difference. Overall, these insights indicate that both the SW and SL behaviors should be valued by both the firm and consumers.

Parallel Session (C7) - Online Decision-Making

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z504

Session Chair: Zihao Li, Nanyang Technological University

Title: Online Resource Allocation for Reusable Resources

Presenter: Xilin Zhang, National University of Singapore
Co-author(s): Wang Chi Cheung

Abstract:
We study a general model on reusable resource allocation under model uncertainty. A heterogeneous popula-tion of customers arrive at the decision maker's (DM's) platform sequentially. Upon observing a customer's type, the DMselects an allocation decision, which leads to rewards earned and resources occupied. Each resource unit is occupied fora random duration, and the unit is available for another allocation after the usage duration. Our model captures numerousapplications involving admission control and assortment planning. The DM aims to simultaneously maximize multipletypes of rewards, while satisfying the resource constraints and being uncertain about the customers' arrival process.

Wedevelop a near-optimal algorithm that achieves$(1-\varepsilon)$fraction of the optimal expected rewards, where the error parameterεdecays to zero as the resource capacity units and the length of the horizon grow. The algorithm iteratively applies theMultiplicative Weight Update algorithm in a novel manner, which balances the trade-off among the amounts of rewardsearned, resources occupied and usage durations.

Title: Joint Assortment and Display Location Optimization with Uncertain Demand

Presenter: Xiaoyue Zhang, University of Electronic Science and Technology of China
Co-author(s): Wenqiang Dai, Xiaoqiang Cai

Abstract:
We consider a new assortment optimization problem for an online retailer where there are n substitutable products with fixed capacities. Customers arrive sequentially with uncertain heterogeneous types and make purchasing decisions following a multinomial logit choice model. In each period, in addition to deciding which subset of products should be offered to the arriving customer, the decision-maker has to decide the display locations of selected

products to maximize the total revenue. We propose an efficient online algorithm and derive an instance-independent Competitive Ratio of the algorithm. Numerical results show that applying our algorithm results in superior performance.

Title: Online Reusable Resource Allocation with Multi-class Arrivals

Presenter: Tianming Huo, National University of Singapore
Co-author(s): Cheung Wang Chi

Abstract:
In this paper, we study an adversarial online reusable resource allocation problem with multi-class arrivals,where each class is associated with its price per unit time and usage duration. Each unit of resource will be returned afterthe usage duration of the class of customer that the unit has been allocated to. We propose a simple online algorithmwhich achieve the best possible competitive ratio among all online policies when the usage durations of any two classesare divisible. Its competitive ratio is proved using a novel Auxiliary Algorithm that constructs a feasible solution to alinear program that upper bounds the optimum. We show that our policy can be extended to the case of general durationsand the advance booking problem where each usage duration only starts after an arbitrary period. We show that our policyachieves at least half of the optimal when the durations are general, and for advance booking with equal usage durations.

Title: A Distribution-free Algorithm for Fully Online Matching with Stochastic Arrivals and Departures

Presenter: Zihao Li, Nanyang Technological University
Co-author(s): Hao Wang, Zhenzhen Yan

Abstract:
We study a fully online matching problem with stochastic arrivals and departures. In this model, each onlinearrival follows a known identical and independent distribution over a fixed set of agent types. Its sojourn time is unknownin advance and follows type-specific distributions with known expectations. The goal is to maximize the weighted rewardfrom successful matches. To solve this problem, we first propose a linear program (LP)-based algorithm whose compet-itive ratio is lower bounded by 0.155 under mild conditions. We further achieve better ratios in some special cases. Todemonstrate the challenges of the

problem, we further establish several hardness results. In particular, we show that noonline algorithm can achieve a competitive ratio better than23in this model and there is no LP-based algorithm (withrespect to our proposed LP) with a competitive ratio better than13. Finally, we demonstrate the effectiveness and efficiencyof our algorithm numerically.

Parallel Session (C8) - Learning for Inventory Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z505

Session Chair: Xiaolong Li, National University of Singapore

Title: Causal Bandits: Online Decision-Making in Endogenous Settings

Presenter: Jingwen Zhang, University of Washington
Co-author(s): Yifang Chen, Amandeep Singh

Abstract:

The deployment of Multi-Armed Bandits (MAB) has become commonplace in many economic applications.However, regret guarantees for even state-of-the-art linear bandit algorithms (such as Optimism in the Face of UncertaintyLinear bandit (OFUL)) make strong exogeneity assumptions w.r.t. arm covariates. This assumption is very often violatedin many economic contexts and using such algorithms can lead to sub-optimal decisions. Further, in social scienceanalysis, it is also important to understand the asymptotic distribution of estimated parameters. To this end, in this paper,we consider the problem of online learning in linear stochastic contextual bandit problems with endogenous covariates.We propose an algorithm we termε-BanditIV, that uses instrumental variables to correct for this bias, and prove an ˜O(k √ T)* upper bound for the expected regret of the algorithm. Further, we demonstrate the asymptotic consistencyand normality of theε-BanditIVestimator. Finally, we carry out extensive Monte Carlo simulations to demonstrate theperformance of our algorithms compared to other methods. We show thatε-BanditIVsignificantly outperforms otherexisting methods in endogeneous settings. Finally, we use data from real-time bidding (RTB) system to demonstrate howε-BanditIVcan be used to estimate the causal impact of advertising in such settings and compare its performance withother existing methods.

Title: Referral, Learning, and Inventory Decisions

Presenter: Yuanchen Su, University of Minnesota
Co-author(s): Guangwen Kong, Ankur Mani

Abstract:
With the proliferation of digital social networks, businesses increasingly use referral programsto increase market exposure and sales. When customers refer a product to others they naturallydisclose their purchase decisions. Thus the referral process introduces a social learning effect.We study the interaction between social learning and referral program structure and examinetheir impact on a firm's inventory decisions. We find that the presence of customers who lackknowledge of their own preferences introduces demand bias but social learning reduces this biasat the expense of increased demand variance. We characterize the optimal inventory levels fordifferent numbers of referrals allowed by the firm and find that it is governed by the combinationofmarket exposure effectanddemand substitution effect. In a single referral program, thestockout of one product can diminish the demand of the other product. In contrast, a multiplereferral program allows a firm to achieve full market exposure but meanwhile increases thedemand variance. Hence, the optimal referral program has to balance the trade-off betweenmarket exposure and demand variance, and thus allows either one or two referrals per customer.

Title: The Privacy-Preserving Big-Data Newsvendor: Efficiency of Noise Injection and Convolution Smoothing

Presenter: Du Chen, Nanyang Technological University
Co-author(s): Geoffrey A. Chua

Abstract:
Despite the practical superiority of data-driven operations, a firm's operational decisions can betray it by inadvertently disclosing private data. Such privacy leakage can arise in supply chain management when sharing plausibly harmless but arguably informative decisions, such as order quantities. Considering both sampling- and feature-based inventory control problems, we propose several secure-by-design algorithms that meet differential privacy constraints, a mathematically rigorous measure of privacy. Using noise injection and convolution smoothing, our proposed algorithms provably guarantee privacy protection and vanishing generalization regrets simultaneously. They are also

shown to be computationally and statistically efficient, achieving near-optimal minimax risks without increasing computational complexity

Title: The Exploration-exploitation-robustness Tradeoff in a Multiperiod Inventory Control Problem with Learning

Presenter: Xiaolong Li, National University of Singapore
Co-author(s): Michael Jong Kim, Andrew E.B. Lim,

Abstract:
We study the tradeoff between exploration, exploitation and robustness in a finite-horizon multi-period Bayesian inventory problem with both parameter and model uncertainty. The decision maker collects data up to a stopping time of his/her choice ("learning"), following which an inventory decision in the form of an order-up-to policy that is fixed for the remaining periods is made ("earning"). We consider a robust version of this problem where the decision maker optimizes a worst-case expected reward over the duration of the learning phase and the inventory decision, focusing on the tradeoff between learning (exploration), exploitation (earning) and robustness.

Parallel Session (C9) - Fairness in Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z506

Session Chair: Daehun Chung, Yonsei University

Title: Fairness Regulation of Prices in Competitive Markets

Presenter: Zongsen Yang, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Xingyu Fu, Pin Gao, Ying Ju Chen

Abstract:
Problem Definition:The loyalty penalty is a discriminatory pricing strategy in which firms offer loyalconsumers high prices for exploitation and nonloyal consumers low prices for attraction. To curb this irre-sponsible business practice, many regulatory agencies (e.g., CMA and FCA in the UK) have proposed orenacted fairness regulations on prices. In this work, we analyze how such regulation affects firms and con-sumers.Methodology and Results:We develop a stylized model to study duopoly competition in twosymmetric

markets, where consumers in different markets are loyal to different firms. The imposed regula-tion stipulates that the price differential between the two markets set by each firm to not exceed a certainthreshold. Our analysis reveals an interesting interplay between market competition and price fairness reg-ulation: when competition is intense, fairness regulation can mitigate the cut-throat competition betweenfirms, leading to Pareto improvements relative to nonregulation; at the other extreme, when competitionis weak, fairness regulation can strengthen firms' already strong monopoly power, triggering collusion ofhigh prices that are harmful to consumers and society. To enrich the results, several extensions are con-sidered, including fairness regulation on relative price discounts, asymmetric markets, and a two-prongedregulation of both price gap and price cap.Policy and Managerial Implications:Taken together, ourstudy provides comprehensive and meaningful guidance for regulators, consumers, and the industry aboutthe potential economic consequences of price fairness regulation in competitive markets.

Title: On Fairness and Efficiency in Nonprofit Operations: Dynamic Resource Allocations

Presenter: Yuanzheng Ma, Shanghai Jiao Tong University
Co-author(s): Tong Wang, Huan Zheng

Abstract:
We study a sequential resource allocation problem balancing fairness and efficiency for nonprofit opera-tions. (Un)fairness is measured by the expected maximum demand shortfall among all communities, and(in)efficiency is measured by the expected remaining resources after allocation. We characterize the optimalallocation policy as a two-threshold policy, where the optimal allocation quantities are spoon-shaped interms of the current maximum demand shortfall. We further show that the thresholds and optimal allocationquantity for each community are increasing in the resource level, realized demand at the current community,and the weight of the efficiency objective. On the basis of these results, we propose a simple heuristic policyand numerically show that it performs well and generates fair allocations in a stochastic majorization order.Numerical results show that a little weight on fairness in the objective could significantly improve the sys-tem's fairness with only a small efficiency cost. In addition, the optimal initial capacity level is increasing(decreasing) in demand variance if the weight of efficiency is small (large). Our theoretical analysis can beextended to the fill rate-based fairness metric.

Title: Personalized Pricing with Group Fairness Constraint

Presenter: Zexing Xu, University of Illinois Urbana-Champaign
Co-author(s): Xin Chen, Yuan Zhou

Abstract:
In this paper, we consider the problem of single-product personalized pricing for different groups under fairness constraints. Specifically, we define group fairness constraints under different distance metrics in the personalized pricing context. We then establish a stochastic formulation which maximizes the revenue. Under the discrete price setting, we reformulate this problem as a linear program and obtain the optimal pricing policy efficiently. To bridge the gap between the discrete and continuous price setting, theoretically, we prove an $O(1/l)$ gap between the optimal revenue with continuous and discrete price set of size l. Empirically, we demonstrate the benefits of imposing fairness constraints on both synthetic data and real-world data. Our results also provide managerial insights into setting a proper fairness degree as well as an appropriate size of discrete price set.

Title: The Effects of Competition Between Fair Trade Organizations

Presenter: Daehun Chung, Yonsei University
Co-author(s): Seung Jae Park

Abstract:
This study explores the effects of competition on fair trade operations. Specifically, as a benchmark, we first explore a model with one fair trade organization (FTO), i.e., the monopoly FTO. We then consider two competing FTOs, i.e., the duopoly FTOs. These two competing FTOs have the same goal of easing the poverty of farmers, albeit with contrasting strategies to achieve the goal. In this regard, one FTO tries to lower the barriers to fair trade to make it mainstreamed, while the other maintains a higher level of standards, worrying about fairwashing. We show that competition between the two FTOs increases the aggregate demand for fair trade certified products and provides more benefits (or extra payments) to farmers compared to the monopoly FTO case. However, the monopoly FTO can bring more benefits per farmer. Thus, duopoly FTOs (monopoly FTO) bring(s) a greater (lower) aggregate benefit to farmers but help each of them less (more). In addition, we find that the FTOs have trade-offs regarding the proportion of their loyal consumers. We show that as a proportion of loyal consumers to the FTO with a higher (lower) level of standards increases,

the aggregate benefit to farmers increases (decreases), but the benefit per farmer can be less (more). Finally, we consider the potential application of blockchain in fair trade operations, and we show that utilizing blockchain further benefits farmers and alleviates the competition effect because it would facilitate direct consumer–farmer interaction.

Parallel Session (C10) - Pricing in Online Platforms

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z507

Session Chair: Bozhuang Lei, City University of Hong Kong

Title: Platform Commission Reduction and Mobile App Performance

Presenter: Yu Xia, The University of Hong Kong
Co-author(s): Hailiang Chen

Abstract:
Digital platform firms face long-standing disputes with app developers and even lawsuits regarding their commission rules. This study investigates how reducing platform commission affects mobile app performance and developers' behaviors. We leverage a natural experiment based on a commission policy change implemented by Apple and conduct a difference-in-differences (DID) analysis. Surprisingly, we find a negative impact of commission reduction on app performance measured by daily active users and downloads, which is heterogeneous across apps with different ranks and in the game and non-game categories. Further mechanism analysis reveals that developers devote less effort to improving and advancing these apps.

Title: Subscription vs. Spot Pricing in On-Demand Economy

Presenter: Zhoupeng (Jack) Zhang, University of Toronto
Co-author(s): Ming Hu, Taojie Qin

Abstract:
We aim to unveil the prevalence of spot pricing in on-demand economy over subscription, another long-adopted pricing scheme in service settings. We develop a game-theoretic queueing framework to model the matching between consumers and workers on a platform. Unlike subscription, the spot pricing empowers the platform owner to dynamically control

the system congestion and eventually extract more surplus from consumers. Such a control-extraction effect complements the process of incentivizing gig workers and price-segments heterogeneous consumers, further enhancing the platform owner's profit. Interestingly, when both schemes can be applied simultaneously, a hybrid model can yield higher profit than pure spot pricing.

Title: Behavior-Based Pricing in Two-Sided Platforms

Presenter: Bozhuang Lei, City University of Hong Kong
Co-author(s): Xiaohan Zhang, Yimin Yu

Abstract:
Behavior-based pricing (BBP), a traditional retail practice of price discrimination between past and new customers, is also widely adopted by two-sided platforms. We formulate a duopoly two-period model to reveal the novel role of BBP in two-sided platforms. We show that customer-side BBP can improve platforms' profits when the developer side is multi-homing, overturning the implication of traditional BBP on profitability. The driving force is that the cross-side network effects amplify the mitigation of customer-side competition in the first period brought by BBP. However, when the developer side is single-homing, BBP cannot benefit platforms.

Parallel Session (C11) - Inventory Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z410

Session Chair: Sundara Natarajan Panchanatham, INSEAD

Title: Assortment and Inventory Planning Under Dynamic Substitution with MNL Model: An LP Approach and an Asymptotically Optimal Policy

Presenter: Alys Liang, University of Michigan
Co-author(s): Stefanus Jasin, Joline Uichanco

Abstract:
We revisit the uncapacitated single-period joint assortment and inventory problem in the presence of dynamic(stockout-based) substitution behavior (i.e., the so-calleddynamic assortment problem). This is a very impor-tant practical problem; at the same time, it is also

a very dicult analytical problem. The key technicalchallenge here is due to the fact that customer substitution behavior may change depending on productavailability, which requires us to keep track the stockout times of all products. In this paper, we considera general version of this problem under the Multinomial Logit (MNL) choice model. We first consider thesetting with deterministic fluid demand and deterministic choice in which customers are infinitesimal, arriveinto the system at a constant rate, and can simultaneously purchase fractional amounts of different products,which we call the "DD" model for brevity. We show that an optimal solution for this model can be computedby solving a sequence of simple Linear Programs (LPs). We further show that there exists an optimal solu-tion to each LP that satisfies a so-called "quasi gain-ordered" property, which generalizes the well-known"revenue-ordered" property of optimal assortment in thestatic assortment problemunder MNL. Next, weconsider a more realistic setting with random Poisson arrivals and random choice, which we call the "RR"model. We show that the optimal solution for the DD model is asymptotically optimal in the RR modelwhen the expected number of customers is large, which justifies studying the DD model as an approximationof the RR model. Unlike the analysis of similar asymptotic optimality results in the literature, the proofof this result in our setting is non-trivial due to the dynamic substitution behavior. Beyond analyzing theuncapacitated single-period problem, we also consider two extensions: the capacitated single-period problemand a capacitated multi-period problem with stationary demand, both with a general set of storage capacityconstraints. We show that, for each of them, the corresponding DD model can be solved using a modified LP sequence and that its optimal solution is asymptotically optimal in the corresponding RR model.

Title: Feature-Based Inventory Control with Censored Demand

Presenter: Jingying Ding, Shanghai Jiao Tong University
Co-author(s): Woonghee Tim Huh, Ying Rong

Abstract:
We study stochastic periodic-review inventory systems with lost sales, where the decisionmaker has no access to the true demand distribution a priori and can only observe historicalsales data (referred to as censored demand) and feature information about the demand. In aninventory system, excess demand is unobservable due to inventory constraints, and sales dataalone cannot fully recover the true demand. Meanwhile, feature information about the demandis abundant to assist inventory decisions. We incorporate features for inventory systems withcensored demand. We propose two feature-based inventory algorithms called the feature-basedadaptive inventory algorithm and the dynamic

shrinkage algorithm. Both algorithms are based onthe stochastic gradient descent method. We measure the performance of the proposed algorithmsthrough the average expected regret in finite periods: that is, the difference between the cost of ouralgorithms and that of a clairvoyant optimal policy with access to information, which is actingoptimally. We show that the average expected cost incurred under both algorithms convergesto the clairvoyant optimal cost at the rate ofO(logT =T)for the perishable inventory case andO(1=pT)for the nonperishable inventory case. The feature-based adaptive inventory algorithmresults in high volatility in the stochastic gradients, which hampers the initial performance ofregret. The dynamic shrinkage algorithm uses a shrinkage parameter to adjust the gradients,which significantly improves the initial performance. The idea of dynamic shrinkage for thestochastic gradient descent method builds on a fundamental insight known as the bias-variancetrade-off. Our research shows the importance of incorporating the bias-variance in a dynamicenvironment for inventory systems with feature information.

Title: Joint Pricing and Inventory Control for Perishable Product

Presenter: Wenjie Sun, National University of Singapore
Co-author(s): Lucy Gongtao Chen, Zhenyu Hu

Abstract:
This paper studies a joint pricing and inventory control problem in a finite horizon for two vertically differentiated products labelled as new and old products. We split the dynamic programming recursion into two subproblems. In the first subproblem called the inter-stage problem, the firm adjusts the prices for the products in a dynamic fashion over stages and replenishes the new products at the beginning of each stage. In the second subproblem called the intra-stage problem, the firm charges different but fixed prices for both new and old products to exploit consumers' heterogeneous preferences over substitutable products. The key feature of our model is that each stage is divided into multiple periods for each individual consumers' arrival, and the detailed realization of demand at each stage arises from the individual consumers' purchasing behaviors. We analyze the intra-stage optimal prices under various inventory levels. Our results show that when the inventory level of the new product is lower than the maximum intra-stage time horizon and the total inventory level of both new and old products is higher than the maximum intra-stage time horizon, the quality adjusted optimal price of the new product is at least as high as that of the old one. However, when the total inventory level of both new and old products is lower than the maximum intra-stage time horizon, the quality adjusted optimal price of the new product could be lower than that of the old one. In addition, if the inventory level of the new product is lower than the

maximum intra-stage time horizon, the optimal prices of both products become higher than the one when the inventory level of the new product is higher than the maximum intra-stage time horizon. We also conduct extensive numerical study to compare the performance of three pricing strategies: price discrimination, quality adjusted uniform pricing, and uniform pricing. Our results show that price discrimination enjoys the largest advantage over the (quality adjusted) unform pricing in the following situations: i) The quality difference between two products becomes large and the inventory level of the old product is much higher than that of the new one; ii) Under the uniform pricing, only new products can be sold.

Title: One too Many: Inventory Policies for Effective Maintenance of Cord Blood Banks

Presenter: Sundara Natarajan Panchanatham, INSEAD
Co-author(s): Harry Groenevelt, Sameer Hasija

Abstract:
Treating many blood-related diseases requires the transplantation of genetically compatible hematopoietic stem cells extracted from the bone marrow (BM) of live donors or umbilical cord blood (CB) cells of babies. The BM donors are a cost-effective source with strict matching requirements, whereas the CB units are cost-intensive but flexible. With ten million unique genetic types in the U.S., alongside demand and supply uncertainty, it is unclear as to what the optimal inventory policy should be for the CB banks. We take a simulation-based optimization approach to develop cost-effective inventory policies without compromising on matching efficiency.

Parallel Session (C12) - Healthcare Policy

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z411

Session Chair: Xiaodan Shao, Nanyang Technological University

Title: A Comparative Study on the Innovation Efficiency of Macao During Pandemic Covid 19 Using DEA-Malmquist

Presenter: Jin Li, University of Macau
Co-author(s): Zhaotong Lian, Xiaozhi Feng

Abstract:
Based on the innovation input and output panel data before and after Covid-19 from 218 to 22, the DEA-Malmquist method was used to conduct a horizontal quantitative evaluation of eleven cities including Macao S.A.R. The efficiency of technological innovation in the Macao S.A.R. before and after the COVID-19 epidemic was analyzed, and positive and effective suggestions were drawn through the horizontal comparison of control variables. The results show that the Macao S.A.R. government has kept up with the pace of scientific and technological development during the crisis, which has improved the efficiency of technological innovation in Macao under the epidemic.

Title: Regulations for Substitutable Medical Treatments

Presenter: Fan Zhou, University of Michigan
Co-author(s): Shima Nassiri, Ravi Anupindi

Abstract:
Most medical conditions may be treated in one of several ways. Healthcare providers are supposed to help patients understand and choose between the available treatment options. The higher-priced options, typically perceived as more advanced, may only benefit certain types of patients. This creates a problem: healthcare providers may have monetary incentives to recommend expensive treatments to patients who do not need them. The overused treatments are unaffordable for many patients – especially patients in developing countries. Price regulations (e.g., a 2017 price cap on cardiac stent devices by Indias government) may improve healthcare access for these patients. However, such regulations may have unintended consequences. In this paper, we study these consequences and propose alternatives to 1) improve access to care and 2) encourage the appropriate use of

medical treatments. We show that current prevalent policies fail to achieve the above objectives and propose a hybrid policy that combines an overall price cap and an outcome-based subsidy. With a sufficient budget, our policy aligns the provider's actions with those of the social planner to achieve both objectives. When budgets are constrained, there is a trade-off between the two objectives. In general, the regulator optimizes to ensure appropriate use at the expense of expanding access. However, the regulator may permit misuse to widen healthcare access when the budget is severely constrained.

Title: Mortality of Covid 19 Severe Acute Respiratory Syndrome in Sao Paulo using K-means Cluster Analysis

Presenter: Antonio Sergio da Silva, Prevent Senior Private
Co-author(s): Fernanda Kelly Marques de Souza Adriano, Marcos dos Santos

Abstract:
A K-means analysis method was utilized to establish a cluster solution for stratification of hospitals in Sao Paulo/Brazil for Covid 19 severe acute respiratory syndrome mortality. Statistical analysis were conducted using the R environment.

Title: Why Do We Need More Female Doctors? Gender Concordance and Lockdown

Presenter: Xiaodan Shao, Nanyang Technological University
Co-author(s): Vivek Choudhary, Anandasivam Gopal, Arnab Majumdar, Burhanuddin Pithawala

Abstract:
Collaborating with a large health-tech firm and analysing 5.47 million prescriptions, we examine the effect of uncertainty (i.e., lockdowns) on patients' preference for same-gender doctors (i.e., gender concordance). Our results indicate that gender concordance for female doctors decreases by ~11% compared to male doctors post-lockdown. Our investigation reveals that this is driven by the increased demand for female doctors by male patients while the female patients' preference remains unchanged. We provide evidence that changes in consultation time can explain our results. Post-lockdown female doctors increase their face time for male patients, and they maintain it even after un-lockdown.

Parallel Session (C13) - Manufacturing Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z412

Session Chair: Linlin Liu, Harbin Institute of Technology

Title: New Work in Manufacturing: Current and Future Implications to the Paradigm Shift in Global Manufacturing Work

Presenter: Seth Powless, Earlham College
Co-author(s): Ashley Church

Abstract:
This paper investigates the practices of Old Work and New Work while analyzing the past, present, and future of the workplace in digital business ecosystems and manufacturing. The original concept of New Work has been around for decades and is a flexible-work practice several companies around the United States are beginning to adopt in the wake of the pandemic. This paper will discuss how New Work can tackle the modern-day issues such as the staggeringly low employee retention rates and the labor shortage and discuss further how to properly implement the practices of New Work into companies and organizations that are constrained by the limited boundaries of Old Work.

Title: Balancing U-type assembly lines with human-robot collaboration

Presenter: Jiaxin Zhang, Tianjin University
Co-author(s): Zhaofang Mao, Dian Huang, Kan Fang, Yiting Sun

Abstract:
This paper presents the first attempt to study the U-type assembly line balancing problem with human-robot collaboration that is allowed to parallelize tasks. A mixed-integer programming model is formulated to tackle the small-sized problems optimally for this collaborative configuration. Also, we propose the lower bound for the problem. Due to the NP-hard nature of the problem, a simulated annealing algorithm with enhanced search phase (ESA) is implemented to solve the medium- and large-sized problems. Computational study on a set of generated instances shows that the ESA achieves competing performance in comparison with genetic algorithm.

Title: Production Outsourcing Analysis and Partner Selection under Different Power Structures

Presenter: Zheng Luo, University of Electronic Science and Technology of China
Co-author(s): Xu Chen

Abstract:
A complex coopetition relationship is formed in which OEMs and CMs not only compete for the end market, but also involves a cooperative buyer-seller relationship. We develop a benchmark self-producing model, and outsourcing models under three channel power structures within the buyer-seller relationship. The OEM's outsourcing partner selection is analyzed based on the OEM's individual payoff and the total payoffs of the OEM and CM. Under low competition and large cost difference, the OEM's optimal partner is a CM with equal power, and both of them will achieve Pareto improvement beyond that based on the OEM's individual profit.

Title: The Interplay of Supply Chain Complexity, Digitalization, and Governance Structure in Manufacturing Operations

Presenter: Linlin Liu, Harbin Institute of Technology
Co-author(s): Peter K.C. Lee, Andy C.L. Yeung, T.C.E. Cheng, Tienan Wang

Abstract:
Increased globalization, diversified operations, and myriad related factors in the global environment have caused supply chains to become increasingly complex. Since Industry 4. emerging, more firms have been investing in digitalization to stay competitive, making digitalization a critically important topic for both practitioners and researchers of operations management. We empirically examine how the impact of supply chain complexity (SCC) on firms' operational efficiency is moderated by digitalization and governance structure. Measuring digitalization by using data from Factiva and natural language processing in the analysis, we ascertain digitalization's effectiveness in mitigating the negative impact of SCC on firms' operational efficiency.

Parallel Session (C14) - Data-driven Operations Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z413

Session Chair: Foad Mahdavi Pajouh, Stevens Institute of Technology

Title: Phase Transitions in Learning and Earning under Price Protection Guarantee

Presenter: Qing Feng, Cornell University
Co-author(s): Ruihao Zhu, Stefanus Jasin

Abstract:

Motivated by the prevalence of "price protection guarantee", which allows a customer who purchased aproduct in the past to receive a refund from the seller during the so-called price protection period (typicallydefined as a certain time window after the purchase date) in case the seller decides to lower the price, westudy the impact of such policy on the design of online learning algorithm for data-driven dynamic pricingwith initially unknown customer demand. We consider a setting where a firm sells a product over a horizon ofTtime steps. For this setting, we characterize how the value ofM, the length of price protection period, canaffect the optimal regret of the learning process. We show that the optimal regret is ˜Θ(√T+min{M, T2/3})by first establishing a fundamental impossible regime with novel regret lower bound instances. Then, weproposeLEAP, a phased exploration type algorithm forLearning andEArning underPrice Protection tomatch this lower bound up to logarithmic factors or even doubly logarithmic factors (when there are onlytwo prices available to the seller). Our results reveal the surprising phase transitions of the optimal regretwith respect toM. Specifically, whenMis not too large, the optimal regret has no major difference whencompared to that of the classic setting with no price protection guarantee. We also show that there existsan upper limit on how much the optimal regret can deteriorate whenMgrows large. Finally, we conductextensive numerical experiments to show the benefit ofLEAPover other heuristic methods for this problem.

Title: Robust Delivery Strategy of Multi-level Online Advertising Guaranteed Targeted Campaign

Presenter: Xin Sui, University of Electronic Science and Technology of China
Co-author(s): Wenqiang Dai, Ming Liu

Abstract:
We consider a multi-level demand rather than a fixed one, and the demand is determined by the publisher in online display advertising allocation problem. The publisher provides a menu with different demand intervals and prices. Advertisers release targeted segments, and then publisher decides demands before making allocation strategy. Our delivery plan is robust to impression supply uncertainties. Specifically, we model a distributionally robust chance-constrained (DRCC) program. We derive a MILP reformulation under ambiguity set. Besides, we analyze how the adjustable risk impacts the revenue by a second-order cone program (SOCP) reformulation. Numerical experiments demonstrate our approach is effective and robust.

Title: A Network Optimization Approach for Mitigating the Risk of Climate-Change-Induced Flooding

Presenter: Foad Mahdavi Pajouh, Stevens Institute of Technology
Co-author(s): Donald Jenkins, Paul Kirshen, Mahyar Eftekhar

Abstract:
Incomplete climate change knowledge presents decision-makers in coastal cities with challenges to protect their cities from flooding disasters. This study focuses on mitigating the effects of flooding in a coastal area caused by sea level rise and storm surge through land elevations. The problem is modeled as a stochastic program that minimizes overall land elevation and expected flood costs over time and space for sampled probabilistic sea level rise scenarios. Using City of Boston as a case for this study, our proposed methodology resulted in more than 9% cost reduction compared to a ``do nothing'' strategy.

Parallel Session (C15) - Sustainable Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z509

Session Chair: Chen Zhang, Tsinghua University

Title: Cost-Saving Synergy: Energy Stacking in Battery Energy Storage Systems

Presenter: Joonho Bae, University of Michigan
Co-author(s): Roman Kapuscinski, John Silberholz

Abstract:
Despite the great potential benefits of battery energy storage systems to electrical grids, most standaloneuses of BESS are not economical due to batteries' high upfront costs and limited lifespans.Energy stacking,a strategy of providing two or more services with a single BESS, has been of great interest to improveprofitability. However, some key questions, e.g., the underlying mechanism by which stacking works, or whyand how much it may improve profitability, remain unanswered in the literature. Using two popular batteryservices, we analytically show that there often existscost-saving synergy — the cost of performing bothservices at the same time (simultaneous stacking) is smaller than the sum of individual costs if we had per-formed each service alone — which allows forbigger profits. Furthermore, we perform comparative statics onthe optimal mix of the services to systemically characterize grid/market conditions that maximize/minimizethis synergy. We also derive a theoretical upper bound on simultaneous stacking's benefits, showing that itcan approximately double the profit of the best standalone service. Several generalizations of the base modelnot only show that the main lessons continue to hold but also that stacking's benefits may become evenstronger.

Title: Impact of Energy Price on Food Price Inflation in India – A Supply Chain Perspective

Presenter: Pramod Mishra, University of Hyderabad
Co-author(s): Chinmaya Behera, Pratap K. Jena, B. Raja Shekhar, B. Kamaiah

Abstract:
The aim of the study is to examine the impact of energy resources on food inflation in India. While it is seen that the markets are very sensitive to the increased fuel prices, the models depict low level of correlations existing between energy resources and food price inflation.

Further, it is found that the HSD impacts the food-inflation the most, outperforming the coal. In the push-need-based supply chains, the impact of HSD is relatively higher than the push-demand-based supply chains. However, in the long run, there seems to have a little impact of energy variables on the food-inflation, minimizing causality.

Title: Impact of Green Investment Decisions Under Coopetition

Presenter: Ganesh Balasubramanian, Manipal Academy of Higher Education
Co-author(s): Arulanantha Prabhu P M

Abstract:
We study the green investment decisions of an Original Equipment Manufacturer (OEM) and its Contract Manufacturer (CM) considering a coopetition setting. We use a game-theoretic model to capture the impact of the OEM's green initiative decision on the CM's green initiative decision. Our analysis reveals that the market equilibrium results in both the OEM and the CM investing in green technologies. We provide the conditions conducive for the CM's product to be greener than the OEM's product. Further, we show that the CM may enjoy higher pricing power compared to the OEM when the investment in green technology becomes cheaper.

Title: A New Formulation and Benders Decomposition for the Post-Disaster Resilience Optimization of Power System

Presenter: Chen Zhang, Tsinghua University
Co-author(s): Bowen Guan, Yan-Fu Li, Hanxiao Zhang

Abstract:
Extreme weather conditions have a profound impact on the power system. We build a bilinear mixed-integer programming model to study the post-disaster restoration problem with maintenance team dispatching and routing by minimizing the resilience loss during the maintenance process of the power system. Then to solve the nonconvexity, we build a novel equivalent mixed-integer linear formulation based on the multicommodity flow variables. For real-sized problems, we propose a modified Benders decomposition-based solution method enriched with valid inequalities. The effectiveness of the method is tested on a case study of power system in Guangxi province.

Parallel Session (C16) - Healthcare Operations

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z510

Session Chair: Jingxuan Geng, Temple University

Title: The Spillover Effect of Suspending Non-essential Surgery: Evidence from Kidney Transplantation

Presenter: Minmin Zhang, University of Texas at Dallas
Co-author(s): Guihua Wang, Tinglong Dai

Abstract:

The COVID-19 pandemic has posed an epic challenge to the U.S. healthcare industry. Between March and April 2020, multiple state governors issued orders to temporarily suspend non-essential surgical procedures.The suspensions caused the healthcare industry to shed millions of jobs, raising concerns about the availability of essential procedures. In this paper, we estimate the potential spillover effect of suspending non-essentialsurgery on patient access to essential health services, using deceased-donor kidney transplantation as theclinical setting. Through analyzing a dataset of all U.S. kidney transplantation procedures, we observe a steep reduction in the volume of deceased-donor kidney transplantation across nearly all states amid the initial months of the pandemic. However, states that suspended non-essential surgery experienced far steeper reductions than those without. Using a difference-in-differences approach, we estimate a state-level suspension of non-essential surgery led to a 23.6% reduction in the transplant volume. Our study reveals the spillover effect of state-level health policies on patient access to essential services such as deceased-donorkidney transplantation. Our mediation analysis shows 38.7% of the spillover effect can be attributable to the change in healthcare employment, indicating these suspensions caused hospitals to reduce the size oftheir workforces required for all procedures, which ultimately had a negative impact on access to essential procedures. Instead of suspending all non-essential surgery in the event of a future pandemic, policymakers should consider more granular approaches to safeguarding the healthcare workforce critical to supportingessential services.

Title: Split Liver Transplantation: An Analytical Decision Support Model

Presenter: Yanhan (Savannah) Tang, Carnegie Mellon University
Co-author(s): Alan Scheller-Wolf, Sridhar Tayur, Emily R. Perito, John P. Roberts

Abstract:
Split liver transplantation (SLT) can potentially save two lives using one liver. To facilitate increased SLT usage, we formulate a multi-queue fluid model, incorporating size-matching specifics, dynamic health conditions, transplant type, and fairness. We find the optimal organ allocation policy through a novel decomposition technique and evaluate its performance versus other common allocations.

Title: When Less is More: Operations and Incentives of an On-demand Medical Crowdsourcing Platform

Presenter: Jingxuan Geng, Temple University
Co-author(s): Guangwen Kong, Marco Shaojun Qin

Abstract:
Healthcare disparity has been one of the most challenging problems faced by countries worldwide. Online medical crowdsourcing platforms help alleviate this issue by enabling patients to seek medical advice remotely and receive multiple opinions on their consultation in an affordable manner. We study how the pricing and non-pricing operational tools can be used to effectively balance supply and demand on a medical crowdsourcing platform. Specifically, we derive theoretical models and find that the pricing mechanism alone does not always yield optimal alignment between inquiries and answers. However, a platform can address this limitation by capping the number of opinions each inquiry receives (i.e., the control limit mechanism). Together with the optimal price, control limit allows the platform to charge a higher price and avoid the doctors' over-participation. This mechanism also helps avoid one undesirable scenario where low-quality doctors drive out all high-quality doctors. Interestingly, the platform's profits increase with patients' delay sensitivity (i.e., given everything else equal, a patient prefers medical opinions that arrive earlier) because it has a similar effect as the control limit mechanism. We empirically test our predictions using data from a large on-demand medical crowdsourcing platform in China and find consistent results.

Parallel Session (C17) - Business Analytics

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z511

Session Chair: Jiatao Ding, INSEAD

Title: Borda, Condorcet and Copeland Ordinal Methods to Support Multicriteria Decision Making - Applications in R Environment

Presenter: Antonio Sergio da Silva, Prevent Senior Private - Sao Paulo - Brazil
Co-author(s): Victor de Godoy Terror, Marcos dos Santos

Abstract:
This article presents a brief application of the ordinal methods of Borda, Condorcet and Copeland in the R environment, as methods to support multicriteria decision making (MCDM). These methods are illustrated with the application for selecting a computational tool for data analysis.

Title: Decentralized Scheduling in Edge Computing Paradigms: End-to-End Decision Analytics and Price of Anarchy

Presenter: Wenjuan Hou, Southern University of Science and Technology
Co-author(s): Zeyu Zhang, Cong Chen, Qiao-Chu He, Zuo-Jun Max Shen

Abstract:
We design an edge computing system wherein a platform leverages incentive instruments to coordinate request-heterogeneous computing tasks and resource-heterogeneous edge servers. We propose an integrated optimization model in which the platform decides rewards and scheduling policy, and edge servers individually decide on service capacities, while each computing task minimizes its aggregate cost by selfish routing via available edge servers. We focus on systemefficiency evaluation by measuring the Price of Anarchy of the whole system (PoAw), while theefficiency loss due to selfish routing is measured by the Price of Anarchy (PoA). At a strategiclevel, we decompose the PoAw by analyzing the double marginalization between the platform,edge servers and computing tasks, which is significantly magnified by PoA. At an operationallevel, we propose a local-first, local-increasing-costs-and-nonlocal-decreasing-efficiency (LFID) scheduling policy to reduce PoA, with an interesting feature of reversed priorities between localand non-local tasks. In particular, we derive a theoretical PoA bound of32regarding the LFIDpolicy with two edge

servers, outperforming all well-known benchmarks. We also demonstratethe optimality for general communication network topologies. To derive the optimal policyin general, end-to-end (E2E) computational frameworks are proposed, which map input datadirectly to near-optimal solutions. In the first E2E framework, best-response functions areapproximated by neural networks via a Markov Chain Monte Carlo (MCMC) iterative procedureto derive the correlated equilibrium. In the second E2E framework, a built-in prediction moduleis integrated with the neural network architecture to compute the Nash equilibrium directly.Case studies are conducted by combining both simulations and real data, and our results adviseplatform/service providers on scheduling policy design in the edge computing paradigm.

Title: Artificial Intelligence and Domain Brokering: A Deeper Look Into the User Content Generation Behavior

Presenter: Xiaojin Liu, Virginia Commonwealth University
Co-author(s): Pankaj Kumar

Abstract:
Artificial intelligence (AI)-induced content generation can act as a double-edged sword. AI may stimulate content generation via topic suggestions. But AI may also dampen the intrinsic human motivation to lead and be creative. In this study, we examine how human interaction with AI influences domain brokering and content generation behavior.

Title: The Value of Analytics Partnerships for Biopharmaceuticals

Presenter: Jiatao Ding, INSEAD
Co-author(s): Niyazi Taneri, Michael Freeman

Abstract:
Biopharmaceutical firms often form partnerships to gain access to complementary capabilities. There has been a growing number of such partnerships by Biopharmaceuticals in the space of analytics, e.g., machine learning. Through these partnerships, biopharmaceuticals aim to leverage emerging digital technologies to streamline their operations, e.g., improve the selection of drug candidates and speed up the drug development cycle. In an industry with notoriously low success rates and a patent cliff, improvements on these fronts translate to more products with longer periods of on-patent

sales. We study the shareholder value implications of such partnerships and when they add the most value.

Parallel Session (C18) - Behavioral Operations Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z512

Session Chair: Yanqiu Ruan, Singapore University of Technology and Design

Title: Behavior-Aware Queueing: The Finite-Buffer Setting with Many Strategic Servers

Presenter: Yueyang Zhong, The University of Chicago Booth School of Business
Co-author(s): Ragavendran Gopalakrishnan, Amy R. Ward

Abstract:

Problem definition: Service system design is often informed by queueing theory. Traditional queueing theory assumes that servers work at constant speeds. That is reasonable in computer science and manufacturing contexts. However, servers in service systems are people, and, in contrast to machines, systemic incentives created by design decisions influence their work speeds. We study how server work speed is affected by managerial decisions concerning (i) how many servers to staff and how much to pay them, and (ii) whether and when to turn away customers. Methodology /results: We develop a game-theoretic many-server Markovian queueing model with finite or infinite buffers in which the work speeds emerge as the solution to a noncooperative game. The existence of multiple local maxima in the utility function renders an exact analysis of the finite-server system challenging. We develop an asymptotic regime in which the demand becomes large, wherein we show that the utility function becomes concave. We then establish the existence, uniqueness, and monotonicity properties of underloaded, critically loaded, and overloaded equilibria for various regions in the design space. Managerial implications: Our model provides a tool for managers to trade off fixed and variable costs of staffing given a service level target. In order to predictably control system performance (e.g., lost demand, customer wait times, server burnout, etc.), the system manager must either staff enough servers or pay them enough. In particular, when servers are not paid enough, increasing workload beyond a tipping point may result in a sharp drop in system performance due to server "rebellion". Academic/Practical relevance: This paper constitutes key foundational building blocks to advance the analysis of behavior-aware queueing models where both customers and servers are strategic and customers' decisions endogenously induce a finite buffer.

Title: Free Trial Length as a Signal under Consumer Risk Aversion

Presenter: Chaohui Zhang, Chongqing University
Co-author(s): He Huang, Hongyan Xu

Abstract:
This paper investigates a software firm's decisions on free trial length and price in a signaling game when the consumer is risk averse. A trial length not only conveys a firm's private information about product value, but also allows a consumer to examine whether the product is defective or not. Our results show that, in the costly separating equilibrium, a high-type firm, whose product is more likely to realize a high value, sets a higher price, and offers a longer trial period when the consumer is low risk averse but a shorter length otherwise, relative to its low-type counterpart.

Title: Theory of Constraints & Consumer Behavior: A Comparative Analysis Between Developed & Advanced Developing Consumer Cultures.

Presenter: Seth Powless, Penn State University
Co-author(s): Nathaly Montoya, Diprekshya Maharajan

Abstract:
This paper investigates a shift in consumer buying behavior because of the recent global pandemic in developing and developed consumer cultures by integrating Goldratt's Theory of Constraints (TOC) into buying cultures. TOC is the central theoretical framework behind this global catastrophe of product and labor shortages, hyperinflation, and transportation bottlenecks. This research attempts to connect TOC to paradigm shifts in consumer buying culture along with identifying possible solutions to this global phenomenon. The methodology we used to gather data includes a chain-referral sampling model distributed through social media. We used the impact score and Likert scale to analyze the data using Microsoft excel. Our findings concluded that emerging countries adjust more swiftly to constraints and had a lesser proclivity to modify purchasing habits because of a pandemic than developed economies, whose consumers suffer economic distress less frequently.

Title: The Limit of the Marginal Distribution Model in Consumer Choice

Presenter: Yanqiu Ruan, Singapore University of Technology and Design
Co-author(s): Xiaobo Li, Karthyek Murthy, Karthik Natarajan

Abstract:
Given data on choices made by consumers for different assortments, a key challenge is to develop parsimoniousmodels that describe and predict consumer choice behavior. One such choice model is the marginal distribution model,which requires only the specification of the marginal distributions of the random utilities of the alternatives to explainchoice data. In this paper, we develop an exact characterization of the set of choice probabilities that are representableby the marginal distribution model consistently across any collection of assortments. We further show that verifying theconsistency of choice probability data with this model is equivalent to solving a polynomial-size linear program. Based onthe conditions of verifying consistency, we find the best-fit MDM to the choice data that reduces to solving a mixed integerconvex program and develop novel prediction intervals for the choice probabilities of unseen assortments. We extendthese results to the case where alternatives are grouped based on the marginal distribution of their utilities. Imparting grouping domain knowledge in the model can lead to a more accurate best-fit MDM and narrower prediction intervals forthe alternatives in unseen assortments. Our numerical results show that the marginal distribution model provides muchbetter representational power than multinomial logit and much better computational performance than the random utilitymodel.

Parallel Session (C19) - Smart Transportation

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z513

Session Chair: Yuchen Liang, National University of Singapore

Title: An Integrated Risk-Mitigation Mechanism for Hazardous Material Transportation

Presenter: Ginger Ke, Memorial University of Newfoundland
Co-author(s): Saeed Shakeri Nezhad, David M. Tulett

Abstract:
Integrating both proactive and reactive risk-mitigation tools, this research constructs a bi-level network design problem for hazardous materials (hazmat) to regulate the use of roads, so the environmental impact is minimized. By embedding the emergency response time into risk assessment, the locations of hazmat response teams are determined along with toll schemes, road closures, and road constructions. The demand uncertainties, including differences in the number of shipments, origin/destination changes, and amount variations, are also considered by applying a scenario-based approach. The model is first solved optimally by a single-level reformulation, and then by a two-stage heuristic method for larger instances.

Title: Planning Bike Lanes with Data: Ridership, Congestion, and Path Selection

Presenter: Jingwei Zhang, University of California, Los Angeles
Co-author(s): Auyon Siddiq, Sheng Liu

Abstract:
Urban infrastructure is essential to building sustainable cities. In recent years, municipal governments haveinvested heavily in the expansion of bike lane networks to meet growing demand, promote ridership, andreduce emissions. However, re-allocating vehicle capacity in a road network to cycling is often contentiousdue to the risk of amplifying traffic congestion. In this paper, we develop a method for planning bike lanenetworks that accounts for ridership and congestion effects. We first present an estimator for recoveringunknown parameters of a traffic equilibrium model from features of a road network and observed vehicleflows, which we show asymptotically recovers ground-truth parameters as the network grows large. We thenpresent a prescriptive model that recommends paths in a road

network for bike lane construction whileendogenizing cycling demand, driver route choice, and driving travel times. In an empirical study on the Cityof Chicago, we bring together data on the road and bike lane networks, vehicle flows, travel mode choices,bike share trips, driving and cycling routes, and taxi trips to estimate the impact of expanding Chicago's bikelane network. We estimate that adding 25 miles of bike lanes as prescribed by our model can lift ridershipfrom 3.9% to 6.9%, with at most an 8% increase in driving times.

Title: Scheduling Ground Vehicles of the Whole Baggage Handling Service at An Apron

Presenter: Shengkang Tu, Sun Yat-sen University
Co-author(s): Gang Chen, Qiaoting Chen

Abstract:
Baggage handling service significantly influences airline passengers' satisfaction with airports. To effectively schedule the ground handling vehicles, ramp handling operator (RHO) must consider task synchronization, operational synchronization, and movement synchronization. In this paper, we formulate the ground vehicle scheduling as a mixed integer programming model that minimize the baggage handling delays of inbound flights and outbound flights. We also propose a heuristic algorithm to solve the NP-hard problem. The study is a first attempt to address the synchronization in vehicle routing of ground baggage handling.

Title: The Impact of Workload on Operational Performance: Empirical Evidence from Last-Mile Delivery

Presenter: Yuchen Liang, National University of Singapore
Co-author(s): Stanley Lim, Guodong Lyu, Chung Piaw Teo

Abstract:
Leveraging a data set of last-mile deliveries from a parcel operator in Singapore, we examine the impact of employees' workload on delivery performance. We find that workload exhibits a U-shape relationship with delivery failure rate. We examine moderating effects of work variety. Moreover, we identify potential mechanisms through subsample analyses of failure reasons. We study the workload assignment model for different assignment mechanisms and it implies use of long-chain mechanism for workload design.

Parallel Session (C20) - Competition and Cooperation in Transportation

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z212

Session Chair: Anming Zhang, The University of British Columbia

Title: Competitive Intercity air-HSR Services under Travel and Transfer Time Uncertainty

Presenter: Hong K. Lo, The Hong Kong University of Science and Technology
Co-author(s): Takuya Kawakita, Enoch Lee, Yue Huai

Abstract:
High-speed railways (HSR) and airlines compete for intercity travelers. Passenger route choice for the long-haul market is investigated by the random utility theory based on the attributes of travel time, average delay time, fare, and directness of the route. The model considers the average delay due to missing connecting flights arising from travel time variability, custom control time variability, connection time in the airport, and flight frequencies. Furthermore, we analyze operators' competitive strategies to adjust their fares and service frequencies for profit maximization under passenger route and mode choice equilibrium.

Title: Does the Shipping Alliance Affect Freight Rate? Evidence from Global Satellite Ship Data

Presenter: Yulai Wan, Hong Kong Polytechnic University
Co-author(s): Lu Li, Dong Yang

Abstract:
Shipping alliance can facilitate its members to coordinate in price and capacity decisions. Although this helps reducing over-supply of capacity and cut-throat competition during market downturns, the possible freight rate increase due to potential collusion among member shipping lines is another concern. This study aims to empirically investigate the impacts of shipping alliance on container freight rates on nine major shipping corridors for the period from 2015 to 2020. To measure market concentration, data from a satellite-based Automatic Information System are used to identify liner companies' service in each market.

Title: Impact of CR Express and Intermodal Freight Transport Competition on China-Europe Route: Emission and welfare implications

Presenter: Kun Wang, The Hong Kong Polytechnic University
Co-author(s): Yilin Zhang, Anming Zhang, Kun Wang, Shiyuan Zheng, Hangjun Yang, Junjie Hong

Abstract:
China Railway Express (CR Express) has been fast developed, forming the internmodal competition with maritime shipping. This paper examines the emissions and social welfare implications of this intermodal competition. An analytical model is developed to show that the entry of CR Express, while likely improving welfare, will increase emissions unless CR Express is sufficiently emission efficient. Such impacts are enhanced when there are more CR Express operators, or when there are fewer shipping carrier. The analytical model is further calibrated with real market and operational data on the route between China's Yangtze River Delta and Central Europe.

Parallel Session (C21) - Economic Models in Operations Management

Day 2: 8th Jan (Sun) 10:45-12:15 Venue: Z210

Session Chair: Duo Shi, The Chinese University of Hong Kong, Shenzhen

Title: Employees, Contractors, or Hybrid: An Operational Perspective

Presenter: Haotian Song, Zhejiang University
Co-author(s): Ilan Lobel, Sébastien Martin

Abstract:
We consider a platform's problem of how to staff its operations given the possibilities of hiring employees and setting up a contractor marketplace. We aim to understand the operational difference between using contractors and using employees, as well as the potential for using a hybrid staffing solution. We consider an environment where demand is not only stochastic, but also evolving over time, which we capture via a state of the world that determines the demand distribution. The platform controls the number of employee hours it uses for serving demand and the wage paid to contractors per utilized hour. We show that while the employee problem is equivalent to a standard newsvendor, the contractor one corresponds to an unusual version of the newsvendor model where utilization is the control variable. This difference makes the contractor model much more flexible, allowing us to prove that it performs significantly better if the order of magnitude of demand is unknown. Meanwhile, hybrid solutions have complex optimal solutions and offer relatively limited benefits relative to a contractor marketplace.

Title: Markdown Pricing with Taste Projection of Strategic Consumer

Presenter: Shengshuo Xu, University of Science and Technology of China
Co-author(s): Quan Zheng

Abstract:
Consumers are strategic in the timing of their purchases but also often exaggerate the degree to which others' tastes resemble their own, i.e., taste projection (TP). This paper explores the role of TP in markdown pricing with limited capacity. In the absence of TP, markdown pricing is never optimal. However, the presence of TP leads to consumers inferring disparate availability. We show that, under TP, (i) there exists a discriminating markdown pricing, (ii) the profit is non-monotonic in capacity, and (iii) the profit is increasing in the degree of TP.

Title: Financing Small and Medium-Size Enterprises via Retail Platforms

Presenter: Long Ren, University of International Business and Economics
Co-author(s): Lingxiu Dong, Dennis Zhang

Abstract:
We study the multifaceted impact of loan programs initiated by a retail platform to its sellers on these sellers' operational and financing decisions, profits of the sellers and the platform, as well as consumer welfare. The research findings provide useful insights for retail platforms on how to offer financial loans to sellers based on understanding the potential incentive misalignment between the platform and its sellers. From a government perspective, our research also sheds light on the impact of a platform's loan decisions on consumer welfare and how such decisions should be regulated.

Title: Selling Agri-Tech Products: Firm Strategy, Farmer Incentives, and Government Subsidy

Presenter: Xiao Tan, Washington University in St. Louis
Co-author(s): Duo Shi, Fuqiang Zhang

Abstract:
With the development of technology, there are many emerging agri-technology products that can help with improving output. However, new products are expensive and hard to use. We study the impact of agri-tech product adoption, like agricultural drones, on traditional agriculture supply chain. Farmers' purchasing strategies, the firm's pricing decisions, and government subsidy schemes are considered. Apart from selling agri-tech products, the firm may also sell professional services to help farmers. We find the best pricing strategy for the firm is to achieve either complete bundle selling or no bundle selling at all. In addition, four subsidy schemes are considered.

Parallel Session (D1) - Practice-Related Topics in Supply Chain Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z405

Session Chair: Fang Liu, University of the Chinese Academy of Sciences

Title: Managing Online Service Platforms with Information Heterogeneity: Contract Design and Service Provision

Presenter: Linqiu Li, Singapore Management University
Co-author(s): Xin Fang, Yun Fong Lim

Abstract:
This paper investigates the contract design and service provision of online service platforms with quality and information heterogeneity. For ease of understanding and exposition, we focus on an accommodation-sharing platform on which a landlord can rent out his house to a customer. Facing the customer's information heterogeneity about the house quality, the landlord can choose different levels of observable value-added service to increase the customer's willingness to pay for a booking. We investigate whether the service can resolve the issue of information heterogeneity. We also ask an important question: Who should provide the value-added service? The landlord or the platform?

Title: Data-Driven Shelf-Stock Allocation

Presenter: Jia Zhao, University of Chinese Academy of Sciences
Co-author(s): Shuming Wang

Abstract:
We study a shelf-stock allocation problem under demand ambiguity, which decides the placement and stock-levels of commodities on shelves to maximize the expected profit. We develop a data-driven robust model leveraging a decision-dependent Wasserstein metric that incorporates the demand forecasts and captures the vertical-location effect. Given locations, we develop a nested binary search for the shadow price and a closed-form optimal stock, leveraging a supergradient-based KKT condition. Furthermore, the optimal location can be determined by an improved L-shaped decomposition with a derived supergradient. Finally, impacts of ambiguity-aversion on the marginal expected profit, shadow price, and optimal stocking are presented.

Title: The Promise of mHealth for Chronic Disease Management Under Different Payment Systems

Presenter: Arvind Sainathan, NEOMA Business School
Co-author(s): Balaraman Rajan, Saligrama Agnihotri, Leon Cui

Abstract:
Rapid innovations have created opportunities for different modes of healthcare delivery including digital services provided via mobile applications (mHealth). mHealth has the potential to provide efficient, effective, and patient-centered healthcare to manage chronic conditions. However, the economics associated with the adoption and integration of mHealth into the care delivery process is not well understood. In a chronic care setting, we investigate fee-for-service (FFS) and capitation payment systems and explore their performance in a traditional office-visit mode and in a mHealth-adopted mode. We identify conditions under which it is preferable to switch to an mHealth-based practice from an office visit-based practice.

Title: Improving Health Outcomes with Less Cost? Provision of Mobile Clinic in Developing Economies

Presenter: Yuejuan Xi, University of Chinese Academy of Sciences
Co-author(s): Fang Liu, Pengfei Guo, Yulan Wang

Abstract:
Consider a public healthcare system consisting of a hospital, a mobile clinic (MC), and potential patients. The government needs to decide whether and how to provide the MC service by maximizing the social welfare consisting of the system's long-run average healthcare cost and the population's average quality-adjusted life year (QALY). We classify two types of diseases: fast- and slow-progressive. The MC should be provided either every or every other period for the fast-progressive disease. The MC can reduce the healthcare cost when the setup cost is sufficiently low and the relative treatment cost-saving per person with MC provided is positive.

Parallel Session (D2) - Healthcare Operations and Analytics

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z414

Session Chair: Sarah Yini Gao, Singapore Management University

Title: The Impact of Introducing Release Times for Operating Rooms on Surgery Waiting Times

Presenter: Guang Cheng, National University of Singapore
Co-author(s): Mitchell H. Tsai, Joel Goh

Abstract:
A block release policy is expected to improve the efficiency of operating room scheduling. Its impact on surgery waiting times, an important indicator of patient access to surgical services, has not been studied. In this study, we empirically evaluate the relationship between implementing a 7-day release policy and surgery waiting times at an academic medical center. Our results show that a 7-day release policy can reduce surgery waiting times. Although previous studies showed that a release policy cannot improve operating room utilization, our results suggest that it can help patients get more timely surgical services.

Title: Small Area Estimation of Case Growths for Timely Covid-19 Outbreak Detection

Presenter: Zhaowei She, Singapore Management University
Co-author(s): Zilong Wang, Jagpreet Chhatwal, Turgay Ayer

Abstract:
Rapid and accurate detection of local outbreaks is critical to tackling resurgent waves of COVID-19. A fundamental challenge in case growth rate estimation, a key epidemiological parameter, is balancing the accuracy vs. speed tradeoff for small sample sizes of counties. We develop an algorithm, Transfer Learning Generalized Random Forest (TLGRF), that balances this tradeoff. Through transfer learning, TLGRF can accurately estimate case growth rates for counties with small sample sizes based on relevant day and county-level features affecting the disease spread. TLGRF outperforms established growth rate estimation methods and demonstrated that it can greatly improve the timely detection of outbreaks.

Title: Estimating Patient Health Transition From Data Censored by Treatment-effect-based Policies

Presenter: Zhichao Zheng, Singapore Management University
Co-author(s): Qian Luo, Yan He, Hai Wang, Haidong Luo, Ong Cheong Ooi

Abstract:
Treatment-effect-based policies leverage predictive information on patient health transitions and treatment outcomes for medical interventions. This significantly censors observed health transitions and subsequently distorts the estimation of transition probability matrices (TPMs). We propose a structural model to recover the underlying TPMs from censored transition observations. We show that our estimators are consistent and asymptotically normally distributed and maximize the log-likelihood of observing the censored data under some conditions. We implement our model to estimate patient health transitions under mechanical ventilation in intensive care units with censored data and demonstrate its advantage in optimizing extubation decisions.

Title: Inventory-Responsive Donor Management Policy: A Tandem Queueing Network Model

Presenter: Sarah Yini Gao, Singapore Management University
Co-author(s): Taozeng Zhu, Nicholas Teck Boon Yeo, Gar Goei Loke

Abstract:
In the blood donor management problem, the blood bank incentivizes donors to donate, given blood inventory levels. We propose an optimization model to design donor incentivization schemes that account for the blood inventory dynamics and the donor's donation process. By adopting the Pipeline Queue paradigm, we have a tractable convex reformulation. Numerical results show the advantages of the optimal policy compared with benchmark policies in reducing both shortages and wastage.

Parallel Session (D3) - Air Transportation

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z406

Session Chair: Achim Czerny, The Hong Kong Polytechnic University

Title: The Effects of Bankruptcy on Airline Yield and Frequency: The Case of the Duopolistic Domestic Market in Japan

Presenter: Xiaowen Fu, The Hong Kong Polytechnic University
Co-author(s): Kam To Ng, Xiaowen Fu, Jaewoon Lee, Katsuhiro Yamaguchi, Chuanyan Zhu

Abstract:
Using data on the Japanese domestic market from 2008 to 2013, this paper investigates the market dynamics triggered by the 2010 bankruptcy protection of Japan Airlines (JAL). Our analysis suggests that JAL downsized its overall operations, leaving relatively thin routes even though there were fewer competitors and slightly higher yields in those thin markets. The airline nevertheless increased the yields and flight frequencies in the consolidated network more significantly than its rival airlines did. The competition between the duopoly airlines (JAL and All Nippon Airways (ANA)) became less effective. In comparison, low-cost carriers (LCCs) and smaller airlines continued to exert significant competitive pressure on the market despite their small market shares. Overall, our analysis suggests that the Japanese government's support of JAL's restructuring efforts was appropriate. However, there is evidence that the JAL-ANA duopoly became less effective in maintaining market competition.

Title: How Airlines Suffer from Weather Induced Delay? A Synthetic Convictive Weather Prediction Approach in Dynamic Flight Trajectory Deviation

Presenter: Kam K.H. Ng, The Hong Kong Polytechnic University

Abstract:
The Next Generation Air Transportation System (NextGen) developed by NASA has proven that 66% of weather induced delay can be resolved by various operational procedures, including flight re-routing approach, continuous climb and descent operations (CCO/CDO). At system level, we could pre-design a standard weather hazard avoidance procedure with resolution approach. However, the design lacks the consideration of prediction-and-optimisation in the research areas. The latest research focuses on the impact of convective

weather on flight trajectory deviation and advisory aids. Meteorological phenomena like wind shear, thunderstorms, turbulence, typhoons, and cumulonimbus, contribute to air traffic accidents worldwide. Weather delays contribute to 26.6% of total delay minutes in the United States. Hong Kong is in a location with subtropical climate and is also highly affected by weather hazards. These dynamic weather phenomena might cause aircraft to be unstable, which might impede flight safety. Therefore, the proposed research aims to predict the weather hazard behaviours by deep learning approaches, investigate the flight plan deviation strategy in the data-driven modelling, and further optimise the flight trajectory with minimal deviation from original flight plan. The results illustrate how to extract the weather-induced flight trajectory deviation and further formulate dynamic flight trajectory deviation model with least impact on delay time.

Title: Estimating Aircraft Fuel Consumption with Machine Learning

Presenter: Sai-Ho (Nick) Chung, The Hong Kong Polytechnic University
Co-author(s): Waqar Ahmed Khan, Shiqiang Liu

Abstract:
Estimation of fuel consumption for a flight trip is usually done by engineering approaches, which mainly consider physical factors, e.g., aircraft age/condition, engine, planned weight/cruise level, etc. However, the actual performance of a flight usually deviates from the estimation due to other uncontrollable factors, e.g., weather, wind direction, etc. Therefore, we propose a constructive neural network (CNN) for the estimation. The results indicate that the prediction accuracy increased with the consideration of uncontrollable factors. Our findings provide insights for the aviation industry in controlling airlines' excess fuel consumption.

Title: Intertemporal Price Dispersion: Short- and Long-run Effects of Competition

Presenter: Achim I. Czerny, The Hong Kong Polytechnic University
Co-author(s): Hanxiang Zhang, Jos van Ommeren, Hans-Martin Niemeier

Abstract:
We use airlines' posted prices to estimate the effect of competition on intertemporal price dispersion in the short and the long run in Europe. We argue that posted prices have the advantage of referring to a standardized trip. Intertemporal price dispersion is measured

by the difference between prices for flights booked one week before departure and prices booked one month, three months or six months before departure. Event studies are used to establish causality. More efficient two-way fixed effects regressions are used to show that competition mainly benefits late bookers. Long differences are used to show that low-cost carrier competition has a lasting effect on pricing dynamics whereas full-service carrier competition does not.

Parallel Session (D4) - Data-driven Supply Chain Management with Uncertainty

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z407

Session Chair: Xiangyu Gao, The Chinese University of Hong Kong

Title: Hybrid Sampling Based and Gradient Descent Learning Methods with Inventory Management Applications

Presenter: Zhanyue Wang, Nankai University
Co-author(s): Xiangyu Gao, Sean Zhou, Kairen Zhang

Abstract:
In this paper, we consider a class of inventory management applications where the distribution of the underlying demand is unknown and the manager must make an inventory-ordering decision in each period based only on the past demand data. The standard performance measure is regret, which is the cost difference between a learning algorithm and the clairvoyant (full-information) benchmark. When the benchmark is chosen to be the (full-information) optimal policy, we propose a new nonparametric learning algorithm that combines the Sample Average Approximation (SAA) approach.

Title: Supply Disruption in Multi-Tier Supply Chains: Competition and Missing Link

Presenter: Yixin Zhu, The Chinese University of Hong Kong
Co-author(s): Hongfan Chen, Sean Zhou

Abstract:
Disruptive events have occurred increasingly often in global supply chains. We consider supply chain networks with three tiers, each tier consisting of two firms. One of the firms in the network is susceptible to disruption risk. With both complete and incomplete networks,

we analyze and compare the impact of disruption on the performance of both centralized and decentralized supply chains. Furthermore, we examine how such impact differs when the disruption/missing link occurs at different positions of the network.

Title: Online Learning for a Serial Multi-echelon Inventory System

Presenter: Yufei Zhao, The Chinese University of Hong Kong
Co-author(s): Zhanyue Wang, Xiangyu Gao

Abstract:
We consider the classical serial multi-echelon inventory system of Clark and Scarf. Each echelon orders from the next upstream echelon and the most downstream fulfills the stochastic demand from outside. The objective is to minimize the total expected cost. In contrast to the typical setting, the online learning setting assumes that the decision-maker does not know the demand distribution but learns as the data comes in. We apply the sample average approximation (SAA) method to the online learning algorithm. Moreover, we consider regret as the performance measure and show a square root convergence rate.

Title: Online Learning for On-demand Vehicle sharing Networks with Pricing

Presenter: Xiangyu Gao, The Chinese University of Hong Kong
Co-author(s): Saif Benjaafar, Xiaobing Shen, Huanan Zhang

Abstract:
We consider the pricing decisions for on-demand vehicle sharing networks in an online learning setting. We use a search subroutine to approximately locate the price with a desired demand for each trip and estimate the gradient information at this price point. We develop an ellipsoid based online learning algorithm with provable theoretical performance guarantees.

Parallel Session (D5) - Operations Management - Marketing Interface

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z409

Session Chair: Yan Liu, The Hong Kong Polytechnic University

Title: When to Push Ads: Optimal Mobile Ad Campaign Strategy under Markov Customer Dynamics

Presenter: Guokai Li, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Pin Gao, Zizhuo Wang

Abstract:
In this work, we study the optimal ad campaign push policy for the retailer. We first start with the case without any budget on sending the ad campaigns. Our results show that the optimal policy is a threshold policy. We found that the retailer has an incentive to push ad campaigns earlier to customers with intermediate churn rates rather than those with low or high churn rates. Moreover, the retailer tends to push ads earlier to customers with low recapture rates, high rewards, and high purchase rates. Then, in the capacitated case, we derive an easy-to-implement and asymptotically optimal ad push policy.

Title: A Bane or a Boon? Profit-Margin-Guarantee Contract in a Channel with Downstream Competition

Presenter: Hong Zheng, Beijing Institute of Technology
Co-author(s): Lin Tian, Guo Li

Abstract:
This study investigates the strategic impact of Profit-Margin-Guarantee contract (PMG contract) in a channel, in which the manufacturer has signed a PMG contract with one retailer (the signed retailer) but not with the other (the unsigned retailer). Our analyses show that, the manufacturer can adopt a "cost-independent" pricing strategy to strategically trigger or void the PMG contract. For this reason, the manufacturer (signed retailer) is not always hurt (benefit) from the PMG contract. PMG contract may yield a win–win, win–lose, lose–win or lose–lose outcome for the manufacturer and the signed retailer. Moreover, the unsigned retailer may free ride the PMG contract. Nevertheless, PMG contract cannot yield a win–win–win outcome for all firms, whereas a lose–lose–lose outcome may arise under certain conditions.

Title: Communicate Quality via Disclosing or Signaling: the Impact of Social Learning on Information Transparency

Presenter: Feiyang Shen, Southeast University; City University of Hong Kong
Co-author(s): Weili Xue, Yimin Yu, Han Zhu

Abstract:
This research investigates a firm's quality communicating strategy via disclosing or price signaling when consumers are able to learn about product quality from social learning. The analysis focuses on whether a firm should disclose his quality to all consumers or signal his quality to only strategic consumers in the presence of consumer learning across periods. We find that consumer learning can either make information more transparent or ambiguity. Moreover, both the consumer composition and quality uncertainty can affect the quality information transparency.

Title: Sizing Coalition Loyalty Programs

Presenter: Jingmai Wang, The Hong Kong Polytechnic University
Co-author(s): Yan Liu, Yulan Wang, Dan Zhang

Abstract:
We study the impact of the size on coalition loyalty programs' effectiveness and compare them with proprietary reward programs. Several interesting results emerge. First, the average profit for each firm may first increase and then decrease in the size. Second, a properly sized coalition loyalty program can lead to higher profit for firms even when proprietary reward programs are not profitable for individual firms. Third, larger coalitions are always preferred when a coalition loyalty program can freely choose reward expiration terms in addition to prices and reward sizes. However, frequent adjustments of reward expiration terms may not be desirable in practice.

Parallel Session (D6) - Platform Operations

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z503

Session Chair: Gang Li, Xi'an Jiaotong University

Title: Cannibalization or Enhancement: Effects of Consumer-to-Consumer Resale Platform in the Presence of Consumers' Individual Appreciation

Presenter: Chen Pang, Xi'an Jiaotong University & The Hong Kong Polytechnic University
Co-author(s): Gang Li, Li Jiang

Abstract:
Consumers, after riding of their used products, may repurchase new products from the retailer to receive an individual appreciation value due to their dependence on the retailer's products. Our analysis unveils the impacts of C2C resale platform (CRP) on the performances for the market incumbents in the presence of consumers' individual appreciation. As the CRP comes into existence to sustain used-product transactions, the retailer exacerbates intertemporal price discrimination. It produces an enhancement effect and a cannibalization effect on the retailer's revenue. The consumers and the retailer are likely to hold the same preferences over the establishment of CRP.

Title: Data Gatekeeper: Consumer Opt-out on a Content Platform

Presenter: Xuanqi Chen, Xi'an Jiaotong University & The Hong Kong Polytechnic University
Co-author(s): Gang Li, Yulan Wang

Abstract:
Consumers provide data to get penalization services on content platforms (CP), but CPs may share consumer data with the third party without consumer consents (i.e., mandatory data sharing), triggering significant privacy concerns. To alleviate this issue, regulations require that consumers should be given the choice to deny data sharing (i.e., opt-out). We build an analytical model and show that compared with mandatory data sharing, voluntary data sharing can increase or decrease the advertising intensity. Voluntary data sharing thus may backfire and hurt consumers. Interestingly, voluntary data sharing can benefit the CP. Win-win and loss-loss outcomes are both identified.

Title: Quality Regulatory Strategies in Ride-hailing Market

Presenter: Lixing Li, Xi'an Jiaotong University
Co-author(s): Gang Li

Abstract:
In the ride-hailing market, quality differentiation among drivers enables government and platform to adopt quality-related regulations. With an analytical model, we examine the impact of such quality-differentiated nature on the government and the platform quality regulatory strategies in the presence of network externality on both sides, i.e., drivers and riders. Our results demonstrate that government regulation may harm social welfare. Without government regulation, the platform always induces more transactions by pooling different types of drivers together than separating them. When the platform completely separates drivers according to quality, low-quality driver may earn more than high-quality drivers.

Title: Channel Integration with Competitors in the Ride-Hailing Market

Presenter: Chenwei Xu, Xi'an Jiaotong University
Co-author(s): Gang Li

Abstract:
The ride-hailing platform (e.g., DiDi Chuxing) is collaborating with its offline competitors, i.e., cabs, that have search frictions, to provide riders with an integrated channel to hail services of the platform and offline cabs simultaneously. We develop an analytical model to reveal the driving force of co-opetition between ride-hailing platforms and cabs. Hosting the competitor in the integrated channel can be profitable for the platform when drivers are sensitive to rider availability. Although the integrated channel exacerbates discrimination against different types of riders, it helps increase the surplus of two-sided participants, i.e., riders and drivers.

Parallel Session (D7) - Healthcare Operations Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z504

Session Chair: Yong Hong Kuo & Jamal Abdul Nasir, The University of Hong Kong

Title: Target-Oriented Distributionally Robust Optimization and Its Applications to Surgery

Presenter: Vincent Tsz Fai Chow, The Hong Kong Polytechnic University
Co-author(s): Zheng Cui, Daniel Zhuoyu Long

Abstract:
Whereas the value at risk (VaR) evaluates the threshold loss value such that the loss from the risk position exceeding that threshold is at a given probability level, it fails to indicate a performance guarantee at other probability levels. Motivated by this pitfall, we define the risk enveloping measure (REM) such that the bound on general monetary risk measures at all levels of risk aversion are captured. The coherent version of the REM (CREM) is also investigated. We apply the CREM criterion in surgery block allocation problems and report favorable results in computational time and out-of-sample performance.

Title: Priority Scheduling When Job Type Information Is Not Free

Presenter: Junyan Wang, City University of Hong Kong
Co-author(s): Zhankun Sun, Huiyin Ouyang

Abstract:
We study a service system with a single server and jobs of different importance levels, where each level is characterized by the waiting cost per unit time in the system. Each job's importance level is initially unknown except for a prior belief. The server can choose to either serve a job directly or collect information (possibly imperfect) on the job with some fixed cost. We aim to dynamically determine whether such information is worth collecting. We formulate the problem as a gradual-impulsive control problem and derive structural results on the optimal policy.

Title: How Can A Hospital Motivate Coordination between Emergency Department and Inpatient Ward

Presenter: Jie Wang, The University of Hong Kong
Co-author(s): Mengchuan Zou, Yong-Hong Kuo

Abstract:
Emergency department (ED) overcrowding is a typical problem in hospitals across many countries, leading to numerous grievous consequences. One of the major causes of ED overcrowding is access block, which refers delay causes for patients in being admitted to inpatient wards (IW) due to a bed shortage. To overcome this problem, our research considers a patient streaming strategy and develops a coordination mechanism between ED and IW. With system visibility, both status and operations information are shared between the two departments. A MILP optimization model is built, and our proposed methodology is shown to be effective in improving the computational efficiency. Coordination effects are evaluated with simulation. The computational experiments suggest that the coordination mechanism can improve the efficiency of both departments significantly in terms of patients' waiting time, boarding time, and length of stay. Lastly, we extend it to more complex scenarios and find that the coordination mechanism continues to show good performance when service durations are uncertain and streaming accuracy varies. Impacts of various factors are also investigated to derive managerial insights.

Title: A Time-Varying Arrivals and Preemptive Priority Queue-Based Emergency Department Staff Scheduling Problem

Presenter: Jamal Abdul Nasir, The University of Hong Kong
Co-author(s): Yong-Hong Kuo

Abstract:
Excessive waiting time and overcrowding in emergency departments (EDs) have a negative impact on patient health and service quality. In this study, we investigate an ED staff scheduling problem with time-varying arrivals, multi-server preemptive priority queue, and rush hours. To solve this problem, a novel iterative decision support framework is proposed that combines a numerical queue performance evaluation method with a chance constraints-based optimization model to generate staffing and scheduling plans that meet priority patients' target service levels. The results indicate that seven physicians are sufficient to meet the 90-96% target service level for high-priority patients.

Parallel Session (D8) - Platform Operations

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z505

Session Chair: Xin Wang, The Hong Kong University of Science and Technology

Title: Freedom Is Not Free: Coupon Design with Customer Returns

Presenter: Kanglin Chen, Southern University of Science and Technology
Co-author(s): Xiaoshuai Fan, Chen Hu

Abstract:
Fixed cart coupons, which specify a discount with a minimum purchase requirement, are widely offered by sellers to stimulate the purchase of products. However, sophisticated customers might use coupons strategically; they purchase up to the minimum requirement to get the discount and then return unneeded products to sellers. We build a game-theoretic model to study a seller's coupon design when allowing customers to partially return products. We find that the seller's incentive to offer coupons decreases with the proportion of sophisticated customers. Despite its market expansion effect, allowing partial returns might lead to a multi-lose outcome for the seller and customers.

Title: Interplay between Reselling/Agency Selling and Online Intermediaries' Information Sharing with Manufacturers and Resellers

Presenter: Xiaogang Lin, Guangdong University of Technology
Co-author(s): Qiang Lin, Ying Ju Chen

Abstract:
Manufacturers and their resellers generally employ online intermediaries to sell their products. In practice, these manufacturers can adopt reselling or agency selling format while the resellers employ agency selling format. Motivated by practical examples in which intermediaries possess superior demand information and decide whether to share it with their sellers, we develop a game-theoretic model to study the interplay between an intermediary's information-sharing and a manufacturer's format selection. We find that the manufacturer always prefers agency selling under certain information-sharing strategies. Nevertheless, the intermediary may adjust its information-sharing decisions to make the manufacturer switch to reselling format.

Title: Can On-demand Ride-hailing Platforms Coexist with Traditional Taxi Services?

Presenter: Xin Fang, Singapore Management University
Co-author(s): Liling Lu, Guiyun Feng, Sergei Savin

Abstract:
We consider an on-demand ride hailing platform who potentially collaborates with taxi companies to gain access to taxi drivers. We investigate the government regulation to such collaboration and its implications. Taxi drivers and private car drivers differ in service quality. The platform sets ride fee for ride hailing riders and provides wage compensation for participating drivers. The government decides the maximum amount of time that taxi drivers serve the requests on the platform. We find that the collaboration between the platform and taxi companies may not always benefit riders or drivers, and the government regulation is needed for larger welfare.

Title: Mergers between On-Demand Service Platforms: The Impact on Consumer Surplus and Labor Welfare

Presenter: Xin Wang, Hong Kong University of Science and Technology
Co-author(s): Xiaogang Lin, Tao Lu

Abstract:
We study the impact of mergers between on-demand service platforms on consumer surplus and labor welfare. On an on-demand service platform, more agents benefit customers, and more customers generate higher earnings for agents, which is referred to as the cross-side network effect. We build a game-theoretical model to analyze the impact of a merger between two platforms in the presence of the cross-side network effect. While a merger reduces competition, the merged platform can pool customers and agents together and improve matching; moreover, the merger can amplify the cross-side network effect and thus moderate the merged firm's pricing power. When the cross-side network effect becomes strong enough, some of the benefits from pooling may be left to customers and agents. In this case, a merger can make merging firms, customers, and agents all better off, resulting in a win-win-win outcome.

Parallel Session (D9) - Optimization

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z506

Session Chair: Xiaole Chen, Sun Yat-sen University

Title: Algorithms for Long-run CVaR Optimization in Markov Decision Processes

Presenter: Luyao Zhang, Sun Yat-sen University
Co-author(s): Zhihui Yu, Li Xia

Abstract:
This paper investigates the long-run CVaR optimization in Markov decision processes (MDPs). Traditional dynamic programming fails in this problem since CVaR is a non-additive risk measure. We convert the long-run CVaR MDP into a bilevel MDP problem where the inner level is to solve a standard MDP, and the outer level is a single parameter optimization problem. A globally optimal algorithm based on sensitivity analysis and a locally optimal algorithm based on coordinate descent method are developed. We also prove the convergence of these two algorithms. Finally, numerical experiments are conducted to illustrate the effectiveness of our algorithms.

Title: Optimizing Erlangization-based Approximations for Finite Discrete Distributions and Discrete Phase-type Distributions

Presenter: Haoran Wu, Sun Yat-sen University
Co-author(s): Qi-Ming He

Abstract:
In this paper, we first introduced continuous PH-approximations with Erlang distributions of different orders. Then we develop an algorithm to find the continuous PH-approximation with the minimum variance, among all such PH-approximation with the same total number of phases. Thus, the proposed continuous PH-approximations leads to a smaller gap between the variances of the Erlangization based approximations and the original discrete random variables. Stochastic dominance is shown between the original (discrete) distributions and the approximations, which leads to bounds on the quantities of original distributions and/or stochastic models.

Title: Zero-sum semi-Markov Games with State-action-dependent Discount Factors

Presenter: Zhihui Yu, Sun Yat-sen University
Co-author(s): Xianping Guo, Li Xia

Abstract:
This paper deals with two-person zero-sum semi-Markov games under expected discounted criterion with state-action-dependent discount factors. The state and action spaces are both Borel spaces, and the reward rate function is unbounded. We derive a "drift condition" on the semi-Markov kernel and suppose that the discount factors have a positive lower bound, under which the existence of an optimal pair of stationary strategies are proved by using a general Shapley equation. Moreover, in the scenario of finite state and action spaces, a value iteration-type algorithm for approximating an optimal pair of stationary strategies is developed.

Title: Omnichannel Services: The False Premise and Operational Remedies

Presenter: Xiaole Chen, Sun Yat-sen University
Co-author(s): Opher Baron, Yang Li

Abstract:
Omni-channel service, an integration of in-store service with online ordering, has been thriving. This work studies the impacts of the omni-channel capability in the service industry. We adopt a game-theoretical queueing framework to explore customer channel choices and investigate the efficiency of the omni-channel system. Our results unveil the inefficiency of the omni-channel system due to self-interested channel choices. We, thus, suggest several operational strategies that may curtail this inefficiency for a win-win outcome: the provider is able to improve her revenue while customers also enjoy higher social welfare.

Parallel Session (D10) - Economics Modeling in Operations Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z507

Session Chair: Feng Tian, The University of Hong Kong

Title: The Impact of Providing Visibility into the Freshness of Perishable Food

Presenter: Fan Zhou, University of Michigan
Co-author(s): Ekaterina Astashkina, Ravi Anupindi

Abstract:
The freshness of foods significantly influences consumers' quality valuation. Due to natural deterioration, retailers usually hold perishable foods with various freshness levels in their hands. Few contemporary online retailers differentiate their products by displaying freshness. The strategy of "single ambiguous freshness" brings convenience for inventory management however may raise concerns regarding quality stability and food waste. In this paper, we are interested the impact of the visible freshness of perishable foods on sellers' profit, consumers' benefits, and food waste.

Title: Dynamic Contracting in Asset Management under Investor-Partner-Manager Relationship

Presenter: Ruiting Zuo, The Hong Kong University of Science and Technology (Guangzhou)
Co-author(s): Jussi Keppo, Nizar Touzi

Abstract:
We study incentive contracts in asset management business under dynamic actions and relationships between an investor, a partner of an investment company, and a fund manager of the company. The investor cannot perfectly observe the partner and manager's actions, and similarly, the partner cannot perfectly observe the manager's actions. We show how the actions of the participants and the costs of their actions interact. For instance, the optimal effort of the manager falls in the partner's capital allocation cost. We extend the model to a case with an investor, a partner, and multiple managers. In this case, each manager's effort rises in the effectiveness of the managers' cooperation and falls in the other managers' effort cost.

Title: Freedom Is Not Free: Coupon Design with Customer Returns

Presenter: Chen Hu, Xi'an Jiaotong-Liverpool University
Co-author(s): Xiaoshuai Fan, Kanglin Chen

Abstract:
Fixed cart coupons, which specify a discount with a minimum purchase requirement, are widely offered by sellers to stimulate the purchase of products. However, sophisticated customers might use coupons strategically; they purchase up to the minimum requirement to get the discount and then return unneeded products to sellers. We build a game-theoretic model to study a seller's coupon design when allowing customers to partially return products. We find that the seller's incentive to offer coupons decreases with the proportion of sophisticated customers. Despite its market expansion effect, allowing partial returns might lead to a multi-lose outcome for the seller and customers.

Title: Punish Underperformance with Suspension– Optimal Dynamic Contracts in the Presence of Switching Cost

Presenter: Ping Cao, University of Science and Technology of China
Co-author(s): Peng Sun, Feng Tian

Abstract:
We study a dynamic principal-agent setting in which the principal needs to dynamically schedule an agent to work or to be suspended. When the agent is directed to work and exert effort, the arrival rate of a Poisson process is increased, which increases the principal's payoff. Suspension serves as a threat to the agent by delaying future payments. A switching cost occurs whenever the suspension stops and the work starts again. We characterize the optimal contract, which takes three structures and is easy to implement. Especially, when the switching cost is low, the optimal contract demonstrates a generalized control-band structure.

Parallel Session (D11) - Operations Management in Healthcare

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z410

Session Chair: Zhankun Sun, City University of Hong Kong

Title: Evaluating the Patient Access Block during Omicron Surge in Hong Kong

Presenter: Qihao Wu, The University of Hong Kong
Co-author(s): Sunny Ching-long Chan, Teddy Tai-loy Lee, Kevin Wang-leong So, Omar Wai-kiu Tsui, Yong-hong Kuo, Timothy Hudson Rainer, Abraham Ka-chung Wai

Abstract:
The fifth wave of COVID-19 in Hong Kong caused the highest number of confirmed cases and deaths compared with the previous waves. Because of the patient surge, severe cases of hospital access block (also known as boarding) to inpatient wards were reported. The access block situation led to healthcare operations challenges, such as long waiting times and overcrowding. To identify factors associated with access block, we conducted Vector Autoregression analysis to evaluate the effects of hospital capacity on access block. Finally, we concluded the importance of medical occupancy and admitting elderly patients.

Title: Optimum Pricing Policy for Synthetical Telemedicine System Considering Heterogeneous Patients

Presenter: Yunzhi Cao, City University of Hong Kong
Co-author(s): Xiaoyan Zhu, Houmin Yan

Abstract:
Consider a synthetical telemedicine system that provides telemedicine in addition to in-person treatments. For chronic conditions, some treatments must be performed by in-person visits. Others can be performed by either in-person visits or telemedicine. This study explores analytical optimal pricing policies from multiple perspectives, addressing the geographical heterogeneity of patients. Considering government subsidies on telemedicine, three-stage Stackelberg sequential game models between the patients, hospital, and government are established. Furthermore, a distributionally robust optimization model is formulated to achieve the robust pricing policy for the hospital with random telemedicine feasibility coefficient. This study provides managerial insights for the hospital and government.

Title: The Impact of Surgeon Daily Workload and its Implications for Operating Room Scheduling

Presenter: Yiwen Shen, Hong Kong University of Science and Technology
Co-author(s): Carri Chan, Fanyin Zheng, Michael Argenziano, Paul Kurlansky

Abstract:
In healthcare service systems, the workload level can substantially impact service time and quality. We investigate this relationship in the context of cardiac surgery. Using 5,600 cardiac surgeries in a large hospital, we quantify how individual surgeon's daily workload (number of cases performed in a day) affects surgery duration and patient outcomes. To handle the endogeneity issue, we construct novel instrument variables using hospital operational factors. We find surgeon's high daily workload leads to longer OR times and post-surgery length-of-stay. We develop a scheduling model that incorporates the estimated effects and show that it can lead to substantial improvement.

Title: Emergency Department Modeling with Time-Varying Physician Productivity

Presenter: Zhankun Sun, City University of Hong Kong
Co-author(s): Huiyin Ouyang

Abstract:
Motivated by an intriguing observation on the time-varying physician productivity, we study a continuous-time optimal control problem to understand the transient behavior of individual physicians within their shifts in emergency departments (EDs). By applying Pontryagin's maximum principle, we characterize the optimal policy and provide insights into physician capacity, productivity, and throughput. We leverage the insights to model the complex ED system as a time-varying multi-server queue with shift-hour-dependent service rates. Validation using data from two Canadian EDs shows that our model can accurately capture the time-of-day-dependent patient waiting times.

Parallel Session (D12) - Operation Analytics in the Online Marketplace

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z411

Session Chair: Lijian Lu, Hong Kong University of Science and Technology

Title: Oligopolistic Competition in Online Marketplaces: Consignment vs Contribution-based Model

Presenter: Xinyi Zhou, Hong Kong University of Science and Technology
Co-author(s): Lijian Lu, Guillermo Gallego

Abstract:
Two-sided marketplaces have been growing rapidly over the recent years, and are playing increasingly important roles in daily life. This paper considers a two-sided marketplace with many sellers selling products on a common retailing platform. We investigate the impacts of business models between the sellers and the platform on the market equilibrium and profits of firms. We show that the widely adopted platform business model is sub-optimal and leads to inefficiency and instability. We propose a contribution-based framework that the payment for each seller is based on her contribution, and show that the new proposal leads to a stable, efficient, optimal, and `win-win' outcome for the whole marketplace.

Title: Information Sharing and Financing Services on Online Retailing Platforms

Presenter: Xinru Hu, Huazhong University of Science and Technology

Abstract:
This paper considers integrated information-sharing and financing services for a retail platform on which sellers sell products. We develop a game-theoretical model to examine the impacts of financing on the platform's information-sharing strategy when sellers are financially constrained. We characterize the equilibrium finance-operations and the optimal information-sharing strategy for the platform. We examine how the information sharing and financing service should be integrated and the impacts of these services on the efficiency and firms' profit in a supply chain. Our findings could provide useful guidance for platform practitioners to design integrated services on the financing and information provision.

Title: Advertising Content in Online Platforms: Reselling or Agency Selling

Presenter: Ce Zhang, Hong Kong University of Science and Technology

Abstract:
User-generated content (UGC) platforms have been rapidly growing recently, and are drawing more attention from advertisers. This paper considers that many content creators sell their advertising contents, competing in price and quality, via a platform to advertisers. We consider two commonly observed selling formats, the reselling whereby the platform buys contents from creators and sells to advertisers, and the agency selling where creators sell directly to advertisers and platform collects commission per transaction. The equilibriums are characterized under these models and applied to understand the roles of selling format on the product quality and firms' profit.

Title: Livestream Selling with Online Influencers

Presenter: Jing Hou, Nanjing University
Co-author(s): Houcai Shen, Fasheng Xu

Abstract:
Livestream selling is an emerging trend in e-commerce. Influencers broadcast live to demonstrate products, and consumers can have a real time interaction with influencers and purchase products directly from livestreaming. We study a firm's optimal livestream adoption strategies and implementation tactics. We show that cooperating with a less professional influencer or selling products with a lower quality level can be more favorable for the firm. It is also beneficial for the firm to allow the influencer to share more from livestream sales revenue to gain more pricing flexibility, but introducing a slot fee never has the same effect.

Parallel Session (D13) - Inventory Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z412

Session Chair: Xiting Gong, The Chinese University of Hong Kong

Title: Inventory Routing Problem under Uncertainty

Presenter: Zheng Cui, Zhejiang University
Co-author(s): Daniel Zhuoyu Long, Jin Qi, Lianmin Zhang

Abstract:
We study an uncertain inventory routing problem there the supplier acts as a central planner who determines the replenishment quantities and also the delivery times and routes to all retailers. We allow ambiguity in the probability distribution of each retailer's uncertain demand. Adopting a service-level viewpoint, we minimize the risk of uncertain inventory levels violating a pre-specified acceptable range. We quantify that risk using a novel decision criterion, the Service Violation Index, that accounts for how often and how severely the inventory requirement is violated. We provide algorithms to solve the problem exactly and then demonstrate the superiority of our solutions by comparing them with several benchmarks.

Title: Optimal Ordering Policies for Substitutable Products under Dynamic Forecast Evolution

Presenter: Ke Fu, Sun Yat-sen University
Co-author(s): Tao Lu, Ke Mao

Abstract:
We consider that a newsvendor-type firm sells two substitutable products with demand forecast updates in a finite planning horizon. The firm may place multiple orders for both products with increasing ordering costs over time. At the end of the horizon, the firm sells products under stockout substitution in a newsvendor manner. We model the problem as a stochastic dynamic program based on martingale model of forecast evolution. We show that a state-dependent ordering policy is optimal and characterize the structure of the optimal policies.

Title: Dynamic Multi-product Procurement with Joint and Individual Setup Costs

Presenter: Xiangyin Kong, University of Science and Technology of China
Co-author(s): Yimin Yu, Huihui Wang

Abstract:
We investigate optimal replenishment policy for the multi-product system with joint and individual setup costs. By proposing the notion of (-quasi-convexity, we show that an optimal procurement policy for such a system follows the so-called ( ) policy. We provide bounds for the optimal policy and propose three simple heuristic policies. Extensive numerical experiments indicate that the linear interpolation policy outperforms the other two heuristics, whose average performance gap being less than 3.58% and only 0.5% in some cases. Our results can be extended to systems with more complex setup cost functions, such as time-varying, set-based, and quantity-dependent setup costs.

Title: Managing Hybrid Manufacturing/Remanufacturing Inventory Systems with Random Production Capacities

Presenter: Suting Liu, The Chinese University of Hong Kong
Co-author(s): Xiting Gong

Abstract:
We study hybrid manufacturing/remanufacturing inventory systems that produce a single product with random capacities to satisfy random demands over a finite planning horizon. The firm's objective is to minimize the expected total discounted cost over the planning horizon. We partially characterize the firm's optimal policy for the general model and completely characterize it for the models with one deterministic capacity. For the model with unlimited manufacturing capacity, we show that the optimal policy is the same as that of an auxiliary dual-sourcing inventory model under certain conditions. Our numerical study provides further insights into the effects of random capacities.

Parallel Session (D14) - Frontiers in Operations Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z413

Session Chair: Shining Wu, The Hong Kong Polytechnic University

Title: The Impact of Government Carbon Policy on Firm's R&D Investment in Presence of Spillover Effect

Presenter: Jie Liu, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Hailun Zhang

Abstract:
In order to nudge the firms towards low carbon direction, government needs to incentivize firms to invest on carbon technology R&D. We model a competitive market of duopoly firms which produce substituted products and generate carbon emission, as well as a regulator who decides regulation policy. We find that cap&trade policy is better than tax policy under a moderate regulation intensity range, while tax policy leads to higher incentive when regulation is stringent or loose. Our results shed light on the debate about carbon regulation policy from the viewpoint of investment incentive and provide guidance on carbon policy design.

Title: Data Pooling in Multi-Armed Bandits

Presenter: Wandi Xu, Shanghai Jiao Tong University
Co-author(s): Weiwei Fan, Jun Luo

Abstract:
The upper confidence bound (UCB)-type algorithm is always applied to solve the classical multi-armed bandit (MAB) problem. But when the sampling budget is small and the number of arms is relatively large, an arm only has a small number of times that has been pulled. Consequently, the estimated expected reward is of large variance and the performance of UCB is not guaranteed. To tackle this issue, we develop a pooling UCB algorithm using a new data-pooling estimator. We provide the theoretical performance guarantee for our proposed algorithm and demonstrate its empirical success via several MAB problems under different settings.

Title: Two-sided Competition Between On-demand Service Platforms

Presenter: Shihong Xiao, Fudan University
Co-author(s): Shining Wu, Saif Benjaafar

Abstract:
On-demand service platforms compete for both workers and customers, forming a two-sided competition. We study the game between two platforms implied by such a two-sided competition and examine how the characteristics of the embedded workers-customers subgame affect outcomes in equilibrium. We find that the price and wage in equilibrium increase in the labor pool size but decrease in the demand rate. Moreover, the effective wage of workers first increases and then decreases as the labor pool size grows. We discuss how the economies of scale property sheds light on the competitive dynamics between on-demand service platforms in practice.

Title: Who and When to Provide Return Shipping Insurance in Supply Chains?

Presenter: Lingli Wu, Central China Normal University
Co-author(s): Li Jiang, Shiming Deng

Abstract:
To alleviate online shoppers' concern on returns, firms have initiated to provide return shipping insurance (RSI), entitling consumers who have purchased the insurance to shipping unfit products back for free. RSI can be provided by either retailers (termed retailer insurance) or suppliers (termed supplier insurance). Based on a complete analysis of the performance outcomes under all profiles of RSI and refund policies, we examine the roles of RSI in influencing supply chain performances, and investigate who and when to provide RSI from the perspectives of the retailer, the supplier, and supply chain under partial or full refund policy, respectively.

Parallel Session (D15) - Channel Coordination

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z509

Session Chair: Hsiao-Hui Lee, National Chengchi University

Title: Demand Learning in Distribution Channels

Presenter: Chang Dong, Durham University Business School
Co-author(s): Qian Liu

Abstract:
We study supply chain demand learning by incorporating the vertical interaction between the supplier and the retailer in the two-period inventory problem with unknown demand and loss sales. We find that the equilibrium choice between overstocking and understocking varies non-monotonically with the production cost, contrast to the centralized system. Moreover, when the sales information is privately known to the retailer, we find that withholding this information facilitates demand learning and allows the supplier to charge a higher wholesale price in the first period. We also discuss the profit implications whether the retailer discloses or conceals the sales information.

Title: Information Disclosure, Consumer Returns, and Operational Costs in Omnichannel Retailing

Presenter: Jie Liu, Huazhong University of Science and Technology
Co-author(s): Hui Xiong

Abstract:
In the online retailing, consumers are commonly uncertain about the product's quality and fitness. To resolve these uncertainties, many pure e-tailers adopt various omnichannel strategies to provide tactile product information for consumers. We build a model to investigate a pure e-tailer's decision on whether to adopt an omnichannel strategy. Our result indicates that when the cost for each physical store is sufficiently low, the e-tailer always adopts the omnichannel strategy regardless of the product quality. Moreover, the low-quality e-tailer's willingness to adopt the omnichannel strategy is non-monotonic with the fitness probability when the travel cost factor is high. In contrast, if the cost for each physical store is moderate, the e-tailer adopts the omnichannel strategy if and only if the product quality is above a threshold. The quality threshold may increase with the fitness

probability. Higher fitness probability means a lower return rate and fewer benefits brought by the omnichannel strategy. Thus, the threshold of the quality is increased to guarantee a sufficiently large price increase when choosing the omnichannel strategy. Furthermore, when the cost for each physical store is high, the e-tailer with a high-quality product would abandon the omnichannel strategy if the fitness probability is moderate. Finally, we consider the scenarios in which the e-tailer can endogenously determine the number of the physical stores or provide a partial refund policy.

Title: The Restaurateur's Dilemma: Channel Choice in the Presence of Online Food Delivery Platforms

Presenter: Soumyadeep Kundu, Indian Institute of Management Kozhikode
Co-author(s): Ashutosh Sarkar

Abstract:
Platform based food delivery services are now ubiquitous in the restaurant industry with large number of users. For restaurants who have traditionally offered dine-in and restaurant-delivery services, platform delivery services offer more reach and better utilization of their resources. However there a host of issues which deter restaurants from participating. We take a game theoretic approach considering various scenarios wherein the restaurant offers dine-in, restaurant delivery and platform delivery, drawing insights regarding pricing and revenues. We go on to provide appropriate managerial recommendations for both restaurants and platforms to better harness these platforms.

Title: Ship-from-Store: Market Accessibility, Cross-selling Opportunity, and Store Operations

Presenter: Hsiao-Hui Lee, National Chengchi University
Co-author(s): Zhanyu Dong, Xiaoli Liu, Wenzheng Mao

Abstract:
When expanding from brick-and-mortar stores to multichannel operations, "Ship-from-store" (SFS) is a powerful strategy to achieve omnichannel synergy that enables store to quickly fulfill online demands from customers lived nearby using its store inventory. Although SFS help these stores gain access to more customers, it is not necessary for these stores to gain more profits, as adopting SFS may reduce cross-selling opportunities. We

build a stylized model to investigate the impact of such a SFS strategy on customer demand, store operations, and profits, and we empirically our managerial insights using real data from a pharmacy retailing chain in China.

Parallel Session (D16) - Information Design

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z510

Session Chair: Zibin Xu, City University of Hong Kong

Title: Influencing the Influencer with Influencer Encroachment

Presenter: Luying Wang, Tianjin University

Abstract:

We study the effects of influencer encroachment on marketer engagement in word of mouth. Influencer encroaches seller's market by selling substitute product to followers. Influencer also posts seller's product review to followers and allows sponsorship from seller for seller's product promotion. We use Bayesian Persuasion to formulate the effect of influencer's review on consumers' belief updating when influencer is seller's competitor, and therefore a game theory model to formulate the interaction between influencer and seller on influencing management. Our results suggest that influencer encroachment plays an important role in seller's influencing marketing on sponsorship volume and product sales. Improved persuasion efficiency is achieved through the closer position of influencer's product to seller's product and therefore more intensive competition between influencer and seller. Interestingly, seller may prefer to sponsor the influencer whose product is of a higher level of substutability even follower's prior belief is higher. In addition, influencer may produce the product which follower forms a lower level of prior belief on even influencer knows follower's taste on product, because influencer could earn a higher sponsorship from seller to offset the potential loss on sales.

Title: Joint Pricing and Information Design for Transportation Information Systems

Presenter: Yinlian Zeng, Shenzhen Technology University
Co-author(s): Qiaochu He, Xiaoqiang Cai

Abstract:
Travelers may subscribe to transportation information systems if doing so brings benefits to them. Travelers' subscribing behavior to the transportation information system depends on the price of the information service and the value of the information provided. This raises the question: how should the transportation information service provider set the price of the information service and design the information scheme such that the goal (profit maximizing/congestion minimizing) of the information service provider is achieved. In this paper, we investigate the joint pricing and information design problem for such transportation information systems.

Title: Supplier Encroachment Deterrence through Strategic Communications

Presenter: Yonghui Chen, Hong Kong University of Science and Technology
Co-author(s): Guangrui Ma, Ying Ju Chen, Zuo Jun Max Shen

Abstract:
As e-commerce platforms embrace advanced data analytics technologies, more accurate information is expected to be communicated to their suppliers. However, the presence of supplier encroachment leads to a conflict of interests in communication. This paper investigates a retailer's communication strategy under channel encroachment. We show a "V-shaped" relationship between the accuracy of strategic communications and the supplier's direct selling cost. Interestingly, strategic communications reinforce the wholesale price effect of encroachment and complement encroachment to lead to a win-win outcome. Such managerial insights guide the design of data analytics platforms in e-commerce, rationalizing algorithmic bias in supply chain information communication.

Title: Bayesian Persuasion by an Informed Intermediary with Superior Market Knowledge

Presenter: Zibin Xu, City University of Hong Kong
Co-author(s): Xu Wang

Abstract:
Information asymmetry can confound channel conflicts, especially when data analytics helps intermediaries obtain superior market knowledge over both the seller and consumers. In this paper, we examine the role of Bayesian Persuasion between an intermediary maximizing Gross Merchandise Values and a seller maximizing net profits on uncertain demand due to impulsive purchases. Contrary to the conventional wisdom, our results suggest that partial information distortion with superior market knowledge may improve the channel profits relative to full information. This is because Bayesian Persuasion credibly induces a lower price by the seller, thus alleviating the channel conflict and improving overall economic efficiency.

Parallel Session (D17) - Innovation and Entrepreneurship

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z511

Session Chair: Zhengli Wang, The University of Hong Kong

Title: Integrating Industry 4.0 Technologies into Lean and Agile Paradigms: The Role of Technology Uncertainty

Presenter: Diéssica de Oliveira Dias, University of Jaen
Co-author(s): José Moyano Fuentes, Juan M. Maqueira-Marín, Guilherme Tortorella

Abstract:
This paper explores the relationships between technology uncertainty and Industry 4.0 (I4.0) technologies, and between I4.0 technologies and supply chain strategies. Hypothesized relationships are tested with survey data from 256 Spanish manufacturing companies using structural equations modelling. Underpinned by the Resource Orchestration Theory, the results indicate that technology uncertainty has a positive association with I4.0 technology use. In addition, the use of I4.0 technologies is observed to impact positively the implementation of the lean supply chain strategy; however, the use of I4.0 technologies does not have a direct effect on the agile supply chain strategy.

Title: Push and Pull: The Impact of Incubator Performance on Regional SMEs' Competitiveness-Evidence from China

Presenter: Xiaozhi Feng, University of Macau
Co-author(s): Zhaotong Lian, Jin Li, Chi Ming Lee

Abstract:
Recently, business incubators have been regarded as an important tool to help SMEs grow and commercialize their innovative achievements. It can not only reduce firms' infrastructure costs, but also guide enterprises in building business networks. Such effects can be described as direct "pull" on SMEs. However, are the incubators performances also sending market signals to potential entrepreneurs and non-incubator SMEs? If so, can this signal indirectly "push" their competitiveness? What is the difference between the two effects? Therefore, this study investigates the different impact mechanisms of incubator performance on regional SMEs' competitiveness, discussing the strategies of regional incubator construction.

Title: Selecting and Implementing Industry 4.0 Technologies with Interdependence Patterns and Delay Risk: A Risk-Averse Approach and Case Study

Presenter: Xiaohang Liu, Tsinghua University
Co-author(s): Jingran Liang, Zhi Hai Zhang

Abstract:
The global manufacturing industry has experienced a considerable revolution since the deep integration ofIndustry 4.0 technologies and production systems. This has led to renovations and investments in technologies used forplants. During this process, manufacturers face the challenge of selecting related Industry 4.0 technologies and implementing them. When these technologies have interdependencies, i.e., precedence and enhancement between them, deci-sions on selecting and implementing them cannot be made effectively. The situation becomes more complex when theimplementation time encounters uncertain delays. To further understand the impact of dependency and uncertainty, thisstudy models this decision-making process as a stochastic mixed-integer program to maximise the accumulated profits ofinvesting in Industry 4.0 technologies during the entire planning horizon. A conditional value-at-risk (CVaR) based riskmeasure is integrated into the model to control the delay risk. Then, this study proposes an efficient branch and bound(B&B)-based algorithm with dedicated cutting strategies to solve the nonlinear model. A sample average approximationapproach combined with a backward labelling algorithm is embedded in the B&B-based algorithm. The proposed algo-rithm performed well in numerical experiments. In a case study, this study explores the decision behaviour of risk-aversemanufacturers, highlights the potential benefits of considering enhancement effects, and summarises some managerialinsights on the implementation strategies on industry 4.0 technologies.

Title: New Venture Creation - A Drift-Variance Diffusion Control Model

Presenter: Zhengli Wang, The University of Hong Kong
Co-author(s): Stefanos Zenios

Abstract:
We model the creation of a new venture with a novel drift-variance diffusion control framework in which the state of the venture is captured by a diffusion process. When the process reaches an upper boundary, the venture succeeds and the entrepreneur receives a reward. When the process reaches a lower boundary, the venture fails. We derive closed-form expressions under which the optimal policy will be dynamic versus static and we prove that when the policy is dynamic it switches between the two controls at most once. The results reveal a subtle trade-off between the cost of the two controls, their drift and their variances.

Parallel Session (D18) - Supply Chain Management

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z512

Session Chair: Jingwen Xu, The Hong Kong Polytechnic University

Title: How the adoption of Industry 4.0 leads to lean supply chain management? The mediating role of supply chain ambidexterity

Presenter: María Isabel Roldán Bravo, University of Jaen
Co-author(s): José Moyano Fuentes, Juan Manuel Maqueira Marín

Abstract:
The purpose of this paper is twofold. First, it provides and empirically uses a measurement scale for Industry 4. adoption. Second, its goal is to analyze the mediating role of supply chain ambidexterity on the relationship between Industry 4. adoption and lean supply chain management (LSCM). Empirical results are obtained through analysis of survey data from a sample of 29 Spanish focal firms from industrial sectors that occupy an intermediate position in the supply chain. Structural equation modelling was performed to test the proposed hypotheses. Results show that Industry 4. impacts LSCM directly and indirectly through an ambidextrous mindset.

Title: Agricultural Supply Chains in Emerging Markets: Competition and Cooperation under Correlated Yields

Presenter: Jian Li, Northeastern Illinois University
Co-author(s): Maqbool Dada, Panos Kouvelis

Abstract:
We model the development of effective agricultural supply chains (agri-chains) in emerging economies for better utilization of land and intermediate processing resources for harvested export-oriented goods. We study decisions made by farmers, intermediate processors, and government officials in agri-chains. The structure and management of supply chains and government minimum guarantee prices to farmers affect the performance of these chains and are in the domain of our study. We develop analytical results and algorithmic approaches for finding resulting equilibria that depend on the nature of decision-making and on the structure of yield uncertainty.

Title: Sourcing Under Supply Uncertainty: Impact of Tariff and Shipping Cost

Presenter: Jingwen Xu, The Hong Kong Polytechnic University
Co-author(s): Yulan Wang, Guang Xiao, Lei Chen

Abstract:
In this study, we consider a globalized supply chain that consists of a domestic buyer, a reliable overseas supplier with a high tariff rate (e.g., a supplier located outside the free trade area), an unreliable oversea supplier with a low tariff rate (e.g., a supplier located in a free trade area), and a logistics service provider (LSP) that transports products from the oversea suppliers to the domestic buyer. We consider different combinations of trade agreements and tariff calculation schemes: First, based on who shall bear the costs of shipping and tariff, the buyer and the supplier can undertake one of the following three trade agreements: Ex Works (EXW), Delivered at Place (DAP), or Delivered Duty Paid (DDP). Second, depending on the basis of the dutiable value on which the tariff is calculated, two tariff calculation schemes---Cost Insurance Freight (CIF) and Free on Board (FOB)--- are considered.

Parallel Session (D19) - Robust Decision Making

Day 2: 8th Jan (Sun) 14:00-15:30 Venue: Z513

Session Chair: Mingyang Fu, National University of Singapore

Title: Budget-Driven Multi-Period Hub Location: A Robust Time Series Approach

Presenter: Jie Hu, City University of Hong Kong
Co-author(s): Zhi Chen, Shuming Wang

Abstract:
We study the (un)capacitated multi-period hub location problem with uncertain periodic demands. With adistributionally robust approach that considers time series, we build a model that is driven by budgets onperiodic costs. In particular, we construct a nested ambiguity set that incorporates a general multivariatetime series model for uncertain periodic demands, and to ensure stable periodic cost flows, we propose toconstrain each expected periodic cost within a budget while maximizing the robustness level (i.e., the size) ofthe ambiguity set. Statistically, the proposed ambiguity set ensures the model's solution

to enjoy finite-sampleperformance guarantees under certain regularity conditions on the underlying VAR(p) or VARMA(p,q)process of the stochastic demand. Operationally, for the uncapacitated case we show that our budget-drivenmodel essentially optimizes a "Sharpe Ratio"-type criterion over the worst case among all periods, and wediscuss how the cost budgets would affect the optimal robustness level. Computationally, the uncapacitatedmodel can be efficiently solved via a bisection search algorithm that solves (in each iteration) a mixed-integer conic program, while the capacitated model can be well approximated by an extended linear decisionrule approach. Numerical experiments demonstrate the attractiveness and competitiveness of our proposedmodeling and solution approaches.

Title: Integrated Ground and Aerial Restoration for Disaster Management of Telecommunications Networks: A Robust Optimization Model and a Case Study of Zhengzhou fFood

Presenter: Yan Fu Li, Tsinghua University
Co-author(s): Chen Zhang, Chuanzhou Jia

Abstract:
The current restoration approach of telecommunication networks is separated from the uncertain system demand, leading to a mismatch between the supply and demand of communication resources. This research investigates the post-disaster restoration of telecommunication networks considering the demand uncertainty. We propose a two-stage robust model to simultaneously determine the scheduling of aerial emergency drones, ground maintenance personnel, and the redistribution of communication resources. We derive a new model reformulation and solve it with the column and constraint generation algorithm. The application is illustrated by the 221 Zhengzhou flood disaster. Several managerial insights are provided through extensive numerical experiments.

Title: Multi-portfolio Optimization: A Fairness-aware Target-oriented Model

Presenter: Gen Yu, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Xiaoqiang Cai, Daniel Zhuoyu Long, Lianmin Zhang

Abstract:
We consider a multi-portfolio optimization problem where nonlinear market impact costs result in a strong dependency of one account's performance on the trading activities of other accounts. The key advantages of our proposed model include the consideration of clients' targets on investment returns and the incorporation of distributional uncertainty. We propose a new type of performance measure, called the fairness-aware multi-participant satisficing (FMS) criterion, which has the salient feature of addressing the fairness issue with the collective satisficing level as determined by the least satisfied participant. The numerical study shows that our approach outperforms utility-based models in achieving targets and is more robust in out-of-sample performance.

Title: Data-Driven Feature-based Newsvendor: A Distributionally Robust Approach

Presenter: Mingyang Fu, National University of Singapore
Co-author(s): Xiaobo Li, Lianmin Zhang

Abstract:
In this paper, we study the feature-based newsvendor problem in the presence of historical demand and relateddemand covariates. We adopt general kernel methods to estimate the true demand distributions conditioned on the givendemand features. To account for estimation errors, we propose a distributionally robust optimization (DRO) approach withthe ambiguity set containing all distributions close to the estimated conditional demand distribution under a discrepancymeasure based on the cumulative distribution function (CDF). Interestingly, we show that the DRO problem with thisambiguity set admits a closed-form solution for the newsvendor loss. This result implies that the newsvendor problemunder the well-known infinity-Wasserstein ambiguity set admits a closed-form inventory level as a byproduct. In addition,we show that the solution produced by our proposed approach converges to the optimal inventory decision asymptoticallyat a provable convergence rate. The results of numerical experiments with synthetic and real-world data sets show thatour model performs well in terms of its out-of-sample cost and

computational time compared with other state-of-the-artapproaches.

Parallel Session (E1) - Innovative Business Models and Consumer Behaviors

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z405

Session Chair: Yanli Tang, Sun Yat-sen University

Title: Farsighted Stability in Competition Between On-Demand Service Platforms

Presenter: Hongqiao Chen, Nanjing University
Co-author(s): Pengfei Guo, Qingying Li, Yulan Wang

Abstract:
We consider service competition between two platforms, who are assumed to be farsighted, i.e., they consider the chains of reactions following their initial deviation. We show that, in sharp contrast to the ‘‘winner-take-all’’ outcome predicted by the Nash equilibrium (myopic) solution concept, both platforms can survive competition under the farsightedly stable outcomes. We also find that, in contrast to the myopic solution which may leave either customers or workers a positive surplus, farsightedness behavior of platforms fully extracts the surplus from both customers and workers.

Title: The Role of Product and Market Information in an Online Marketplace

Presenter: Shu Hu, Southwest Jiaotong University
Co-author(s): Shiliang Cui, Mike Mingcheng We

Abstract:
In this paper, we study how provision of product information and/or market information affects buyers' and sellers' behavior and the resultant sales in an online marketplace. We first identify the Pareto-dominant equilibrium for the sellers' pricing decisions. Then, we study the impact of market parameters on the sales of the platform in equilibrium, under various information structures. Finally, we analytically characterize the platform's optimal information strategy as a function of the underlying market parameters.

Title: Supply Chain Short-Term Financing for Responsible Production at Small and Medium-Sized Enterprises

Presenter: Xiaole Chen, Sun Yat-sen University
Co-author(s): Vernon Hsu, Guoming Lai, Yang Li

Abstract:
Supply chain sustainability is still in jeopardy even after more than a decade of corporate investment in social responsibility programs. In this paper, we explore the role of financing in establishing an ethical, environmentally-friendly supply chain and its impacts on the profits of the supplier, the buyer, and the chain as a whole. We demonstrate the financial challenges of building social responsibility in supply chains and suggest implementable remedies

Title: Dual Sourcing under Yield and Quality Uncertainty: Supplier Diversification, Capacitated Competition, and Fairness Concerns

Presenter: Yanli Tang, Sun Yat-sen University
Co-author(s): Xin Wang, Yulan Wang

Abstract:
A potential consequence of dual sourcing is ex-post quality heterogeneity among the final products, as the products come from different suppliers. When that heterogeneity exists, a customer may feel unfairness when she pays the same price but gets a lower-quality product than what a peer customer received. In this paper, we characterize how a manufacturer's choice of sourcing strategy and optimal ordering decision, the supplier's wholesale pricing, and the performance of the system are affected by the ex-post product quality heterogeneity and the resulting consumer fairness concern, as well as by the diversification and competition between suppliers with capacity constraints.

Parallel Session (E2) - Recent Developments in Operations on Online Platforms and Marketplaces

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z414

Session Chair: Dongwook Shin, Hong Kong University of Science and Technology

Title: Cross-channel Marketing on E-commerce Marketplaces: Impact and Strategic Budget Allocation

Presenter: Qiyuan Deng, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Kejia Hu, Yun Fong Lim

Abstract:
As the ecosystem of e-commerce marketplaces becomes more competitive, e-sellers become increasingly relying on marketing channels to access customers. The sellers may find it difficult to allocate their marketing budget on these channels given little knowledge about the interrelationship between the channels. Using data from a world-leading seller on a popular marketplace, we not only empirically confirm and quantify the impact of cross-channel marketing on boosting the seller's revenue, but also identify important spillover effects that should be included in the analysis. Incorporating the empirical estimations into an optimization model, we propose a framework to allocate marketing budget for e-sellers.

Title: Online Revenue Sharing and Channel Coordination in Multichannel Operations

Presenter: Jae-Hyuck Park, Hong Kong University of Science and Technology
Co-author(s): Dongwook Shin

Abstract:
We investigate the impact of customer channel migration on the performance of a dual-channel supply chain, where a supplier sells its product through its own offline store and via an online platform. In a two-stage pricing game, the online platform first sets the customer deliver fee, then the supplier sets the retail price for both channels. We find that several conventional contracts cannot fully coordinate the multichannel supply chain either due to a distortion in firms' pricing or the supplier's lack of incentive to share private information. We propose a simple online revenue sharing contract that achieves supply chain coordination.

Title: Optimal Budget Allocation for Online Ad Campaign with Spillover and Carryover Effects

Presenter: Huijun Chen, Hong Kong University of Science and Technology
Co-author(s): Ying Ju Chen, Sunghyuk Park, Dongwook Shin

Abstract:
This paper investigates how the presence of the spillover and carryover effects in the multi-channel ad campaign affects the budget allocation decisions of a marketing agency. The dynamic customer response to the advertisement is modeled by a hidden state Markov process. We first characterize the state in-attentive budget allocation problem, where the decision maker solves a static optimization iteratively. Second, we study the state attentive budget allocation problem and find the optimal budget remains most of the time close to an optimal steady state. Finally, we show that when channels are very different, the gap between them is not negligible.

Title: Social Learning and the Design of Multi-Featured Products

Presenter: Eunjee Kim, KAIST
Co-author(s): Sang Won Kim, Dongwook Shin

Abstract:
This paper studies a monopolist firm's choices of product quality and price. The quality is a priori unknown, but customers infer it from customer-generated reviews. This problem is studied under two systems: a multi-dimensional (MD) review system and a single-dimensional (SD) review system. Our analysis yields two main insights. First, we find that the learning is successful with MD reviews, whereas SD reviews obfuscate the learning. Second, when customers have uniform beliefs over the features, MD reviews improve the quality. Furthermore, with MD reviews, the firm may not only achieve higher profit but also improve consumer surplus.

Parallel Session (E3) - Recent Developments in Operations Management

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z406

Session Chair: Dohyun Ahn, The Chinese University of Hong Kong

Title: Preservation of Supermodularity in Parametric Optimization: Necessary and Sufficient Conditions on Constraint Structures

Presenter: Daniel Zhuoyu Long, The Chinese University of Hong Kong
Co-author(s): Xin Chen, Jin Qi

Abstract:
This work presents a systematic study of the preservation of supermodularity under parametric optimization, allowing us to derive complementarity among parameters and monotonic structural properties for optimal policies in many operational models. We introduce the new concepts of mostly sublattice and additive mostly sublattice, which generalize the commonly imposed sublattice condition significantly, and use them to establish the necessary and sufficient conditions for the feasible set so that supermodularity can be preserved under various assumptions about the objective functions. Furthermore, we identify some classes of polyhedral sets that satisfy these concepts. Finally, we illustrate the use of our results in assemble-to-order systems.

Title: Service Operations for Justice-On-Time: A Data-Driven Queueing Approach

Presenter: Jeunghyun Kim, Korea University
Co-author(s): Nitin Bakshi, Ramandeep Randhawa

Abstract:
Limited resources in the judicial system can lead to costly delays, stunted economic development, and even failure to deliver justice. Using the Supreme Court of India as an exemplar for such resource-constrained settings, we apply ideas from service operations to study delay. Specifically, court dynamics constitute a case-management queue, whereby each case may experience multiple service encounters spread across time, but all are necessarily with the same server. Our goal is to estimate performance metrics such as the expected case-disposition time (delay) and expected number of cases awaiting adjudication (pendency), and use these to discuss policy interventions.

Title: Tail-based Sequential Simulation Budget Allocation

Presenter: Dohyun Ahn, The Chinese University of Hong Kong
Co-author(s): Taeho Kim

Abstract:
We study the problem of sequentially allocating a simulation budget to stochastic alternatives using tail-based criteria. Specifically, we aim to identify an alternative that is least likely to cause extreme outcomes. Such a problem arises in autonomous vehicle testing and the selection of queueing system designs. The main challenge is that samples associated with extreme outcomes are rarely observed, preventing us from learning the tail behaviors of alternatives. We circumvent this issue by developing an efficient parameter estimation method based on tail probability asymptotics and provide an optimal allocation rule that maximizes the probability of selecting the least risky alternative.

Title: Structural Estimation of Intertemporal Externalities on ICU Admission Decisions

Presenter: Yiwen Shen, Hong Kong University of Science and Technology
Co-author(s): Carri Chan, Fanyin Zheng, Gabriel Escobar

Abstract:
Service systems' behavior can be affected by multiple factors. In the case of intensive care units (ICUs), it has been observed that a significant proportion of the variation in ICU admission rates is due to system, and solely patient, factors. We employ two years of data from patients admitted to 21 ICUs from the ED. We find that substantial heterogeneity in admission rates is present, and that it cannot be explained either by patient factors or occupancy levels alone. We use a structural model to estimate the extent that intertemporal externalities could account for some of this variation. Using counterfactual simulations, we find that correctly understanding the intertemporal externalities is crucial for hospitals to make efficient operational decisions.

Parallel Session (E4) - Learning, Forecasting, and Optimization in Pricing and Promotion

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z407

Session Chair: Xing Hu, University of Hong Kong

Title: Content Promotion for Online Content Platforms with the Diffusion Effect

Presenter: Yunduan Lin, University of California, Berkeley
Co-author(s): Mengxin Wang, Zuo-Jun Max Shen, Heng Zhang, Renyu Zhang

Abstract:
Content promotion policies are playing an important role in improving content consumption for online content platforms. However, a frequently used promotion policy generally neglects employing the diffusion effect within users. We study the candidate generation and promotion optimization problem for online content through incorporating the diffusion effect. We also investigate ways to use the adoption data to estimate the diffusion effect. We not only highlight the differences of diffusion between online content and physical goods but also provide actionable insights for platforms to improve the effectiveness of content promotion policy by leveraging our diffusion model.

Title: Dynamic Pricing and Learning with Discounting

Presenter: Zhichao Feng, The Hong Kong Polytechnic University
Co-author(s): Milind Dawande, Ganesh Janakiraman, Anyan Qi

Abstract:
In many practical settings, learning algorithms can take a substantial amount of time to converge, thereby raising the need to understand the role of discounting in learning. We illustrate the impact of discounting on the performance of learning algorithms by examining two representative dynamic-pricing and learning problems studied in Broder and Rusmevichientong (2012) and Keskin and Zeevi (2014). In both settings, a seller sells a product with an unknown demand distribution over T periods. Given a discount factor ρ, the retailer's objective is to determine a pricing policy to maximize the expected discounted revenue. Our main results are asymptotically optimal policies in terms of both T and ρ.

Title: Improving Accuracy Without Losing Interpretability: A Machine Learning Approach for Time Series Forecasting

Presenter: Yiqi Sun, Tsinghua University
Co-author(s): Zuo-Jun Max Shen

Abstract:
This research explores the possibility of improving accuracy without losing interpretability in time series forecasting. In response, we first quantitatively define interpretability for data-driven forecasts and propose the W-R algorithm accordingly. Specifically, the W-R algorithm succeeds to the principle from time series decomposition but replaces the additive combination function with a weighted variant, where the parameters are automatically output by machine learning. We mathematically analyze the theoretical basis of the algorithm, finding that it may simultaneously improve overall accuracy and the estimates of components. Finally, we validate the performance through extensive numerical experiments on private and public datasets.

Title: Ride-sharing Platform's Carpool Modes

Presenter: Xing Hu, University of Hong Kong
Co-author(s): Qin Zhou, Zhixi Wan

Abstract:
Leading ride-sharing platforms have used different pricing modes for their carpool services. In this paper we build ecnonomics models to compare those pricing modes in terms of their impact on carpool demand, completed orders, and platform profit. Our study examines the important role of market thickness in efficient carpool matching. The results provide insights into how a platform choosing its carpool pricing mode.

Parallel Session (E5) - Maritime Operations Research and Management

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z409

Session Chair: Qinghe Sun & Dong Yang, National University of Singapore & The Hong Kong Polytechnic University

Title: The Role of Priority Scheme on Container Shipping Firm's Congestion Internalization and Port Congestion

Presenter: Xiwen Bai & Dong Yang, Tsinghua University & The Hong Kong Polytechnic University
Co-author(s): Yao Hou, Dong Yang, Yulai Wan

Abstract:
This study examines the congestion internalization at seaports and how the berth priority affects seaport congestion. Specifically, we first build up a theoretic model to understand how priority provision can affect congestion internalization by explicitly modeling the internalized proportion of marginal external cost of congestion (MEC) by shipping lines with and without priority, as well as the change of total internalized proportion of MEC with respect to the share of priority ships over total number of ships. Second, we empirically test the theoretical model and examine the internalization channels utilizing high-frequency micro-level vessel movement data.

Title: Promoting Transport Adaptation: Propaganda or Subsidy?

Presenter: Kun Wang, The Hong Kong Polytechnic University
Co-author(s): Shiyuan Zheng, Xiaowen Fu

Abstract:
It is important for transport facilities to adapt to climate change-related disasters, especially for those along coastal lines. The government can promote adaptation through propaganda or direct financial subsidy. With propaganda approach, the government collects more disaster information and sends to facility operator with an ex-ante designed signaling mechanism. It is to reshape the facility operator's posterior belief on disaster uncertainty (i.e., Bayesian persuasion). Or the government can directly provide the financial subsidy on adaptation investment cost. We build economic model to derive the social optimal policy instruments under these two approaches, and compare their performance.

Title: Ship Operation and Allowance Management Plan Optimization in Liner Shipping under Maritime Emission Trading System

Presenter: Jingwen Qi, The Hong Kong Polytechnic University
Co-author(s): Shuaian Wang, Jianfeng Zheng

Abstract:
This paper focuses on the impact of maritime emission trading system (METS) on liner shipping companies. A stochastic model was developed to optimize the ship operation and allowance management plan in liner shipping under METS. Ship deployment, sailing speed optimization and carbon allowance management were integrated into our model. Important characteristics of METS were also captured. Based on the problem structure, the model was then converted into a deterministic linear one. Various numerical experiments were conducted to validate the model and solution method proposed in this paper. The results show the necessity for our study and indicate constructive managerial insights.

Title: On the Toxic Trade-offs in Ship-recycling

Presenter: Qinghe Sun, The Hong Kong Polytechnic University
Co-author(s): Mabel C.Chou

Abstract:
In 2021, nearly 100% of the world's retired vessels in gross tonnage were broken down manually on beaches instead of those ship recycling yards with the required facilities to ensure environmental protection. As a result, apart from causing detrimental environmental impact such as ocean pollution, carbon emission, and habitat degradation, ship recycling business is also plagued with child labour and workplace death/injuries problems. Many regulations were proposed to encourage more responsible ship recycling choices, but none seemed to work. We develop an equilibrium framework for analyzing and explaining the trade-offs in the end-of-life (EOL) recycling decision and the reason behind the dominance of such irresponsible ship recycling choices. We find that, in the presence of unethical ship recycling yards, the percentage of irresponsible shipowners in the EOL market is much higher than that among all potential shipowners. Meanwhile, responsible shipowners benefit financially from unethical ship recycling operations through the higher second-hand vessel price in the secondary market. We offer insights into why the regulations that forbid unethical ship recycling were ineffective and why many stakeholders in the shipping community seemingly shut their eyes to the deaths and pollution caused by the beaching practice in the ship recycling business.

Parallel Session (E6) - Data-based Investigation of Emerging Operations Topics

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z503

Session Chair: Xin Fang, Singapore Management University

Title: The Impact of Social Comparison on Newsvendor Decisions: An Experimental Investigation

Presenter: Liang (Leon) Xu, Singapore Management University
Co-author(s): Valery Pavlov

Abstract:
Humans concerns not only their own performance but also their relative performance against others. This study examines how individual newsvendor will be influenced when social comparison presents. We conduct experiments in which we manipulate social comparison by providing decision-makers with different information about their peers: orders only, profit rank (without providing the exact profit information), and the exact profits. The data show that providing the rank information influences the players' inventory decisions the most and, importantly, improves their performance compared to the individual newsvendor. Our results provide insights on how to leverage social comparison to improve inventory decisions.

Title: Reverse Cross Subsidization in Healthcare Capitation Programs: Evidence from Medicare Advantage

Presenter: Zhaowei She, Singapore Management University
Co-author(s): Turgay Ayer, Bilal Gokpinar, Danny Hughes

Abstract:
Capitation payment models have been increasingly adopted by payers in healthcare markets during the past decade. However, early study shows that Medicare Advantage (MA), the largest capitation program in the U.S., tends to under-provide healthcare services to the old and the sick but over-provide to the relatively younger and healthier patients. This paper empirically shows that MA unintentionally incentivizes providers to reallocate parts of the capitation payments from the old and the sick to cross subsidize the young and the healthy. By exploiting a policy shock, we identify this reverse cross subsidization incentive through a difference-in-difference (DID) design.

Title: Mergers and Product Repositioning: Theory and Empirical Evidence

Presenter: Xin Wang, Hong Kong University of Science and Technology
Co-author(s): Soo Haeng Cho, Yushu Zeng, Zijun Shi

Abstract:
Mergers often induce firms to modify both product quality and variety. The impact of such changes has received scant attention in merger literature, which mostly focuses on price. We develop a game-theoretical model to investigate the changes of quality, variety, and price after a merger and their impacts on firms and consumers. We find that the quality positions of the two pre-merger firms significantly affect a merger's impact on consumers. When the pre-merger firms' product quality levels are relatively high, a merger can benefit consumers, given that the cost savings generated from the merger are sufficiently large. When the pre-merger firms' product quality levels are relatively low, a merger cannot benefit consumers. To verify our findings, we find empirical evidence by employing a structural estimation to analyze observational data from the airline industry. The empirical findings are consistent with our theoretical results, which further confirm that a merger must be evaluated in an integrated way by examining its impact on product quality and variety as well as price.

Title: Managing The Personalized Order-Holding Problem in Online Retailing

Presenter: Yun Fong Lim, Singapore Management University
Co-author(s): Shouchang Chen, Zhenzhen Yan

Abstract:
A significant percentage of online consumers place consecutive orders within a short duration. To reduce the order-arrangement cost, an online retailer may consolidate consecutive orders from the same consumer. We investigate how long the retailer should hold the consumer's orders before sending them to a third-party logistics provider (3PL) for processing. In this problem, we optimize the holding time to balance the order-arrangement cost and the potential delay in delivery. We show that the optimal order-holding decisions follow a threshold-type policy: Hold any pending orders if the holding time is within a threshold, or send them to the 3PL otherwise.

Parallel Session (E7) - Emerging Topics in OM and Analytics

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z504

Session Chair: Zhi Chen, National University of Singapore

Title: Bargaining or Stackelberg? The Impact of Supply Chain Structure

Presenter: Yifan He, Nanyang Technological University
Co-author(s): Lucy Gongtao Chen, Qinshen Tang

Abstract:
In a bilateral monopoly supply chain consisting of a supplier and a retailer, the chain has higher system profit under bargaining than that under Stackelberg game. Will this result still hold under competition? We consider five different supply chain structures with various types of competition. We find that 1) Neither pure supplier competition nor retailer competition leads to higher system profits under Stackelberg than that under bargaining; 2) Chain-to-chain competition, however, could make the system under Stackelberg game better off when the competition is fierce and thus conventional wisdom on cooperation within supply chains should be applied with caution.

Title: From Black to Grey: Improving Access to Antimalarial Drugs in the Presence of Counterfeits

Presenter: Jiatao Ding, INSEAD
Co-author(s): Saša Zorc, Michael Freeman

Abstract:
In malaria-endemic countries, the high demand for and low accessibility of legitimate antimalarial drugs have fostered the prevalence of counterfeits. We study how donors should allocate limited budgets, i.e., subsidize the purchases and/or sales of the private-sector distribution channel of antimalarial drugs, in markets where counterfeits are present, and what further interventions should or should not be taken to address the problems of counterfeits. We show that the prevailing purchase subsidy only may be suboptimal due to the presence of counterfeits. In particular, the donor may need to refrain from any subsidy as a higher subsidy could lead to a greater market share of counterfeits, worse drug access and worse public health. Moreover, we evaluate three strategies that have been employed to combat counterfeits: adoption of traceability technology, improvement of consumers'

ability to infer drug quality, and elimination of counterfeits. We characterize the conditions under which these interventions should or should not be taken. Lastly, we preform numerical analysis where the models are calibrated to malaria data in Mozambique. Our results lead to several policy implications for improving access to antimalarial drugs in the presence of counterfeits.

Title: When Platform Competes with Third-Party Sellers in Its Own Networked Market: A Revenue Management Perspective

Presenter: Hongfan Chen, Chinese University of Hong Kong
Co-author(s): Hai Wang

Abstract:
We consider a platform marketplace with both third-party and platform-owned sellers. The platform charges commissions to third-party sellers and buyers for their transactions in the marketplace. Meanwhile, it also directly determines the transaction prices for platform-owned sellers in their sales to buyers. Sellers and buyers are divided into different types with their compatibility captured by a bipartite network. Different types of sellers and buyers are heterogeneous in their cost and utility functions. Given the platform's choices of prices and commissions, third-party sellers/buyers maximize their own payoffs from supplying/demanding products, and market-clearing conditions are satisfied in the networked market. Facing the complexity with non-convex equilibrium constraints in the network, we develop a method of determining the platform's price-commission vector for profit maximization purposes. Based on the characterization of the platform's profit-optimal equilibrium, we investigate three other aspects of the revenue management problem. First, under fairness consideration between the platform and its market participants, we develop an efficient approximation algorithm to obtain a price-commission vector such that an allocation of surplus with a fairness level between the platform and its market participants is guaranteed in the equilibrium trades. Next, we shed light on how the platform should determine the optimal mixture of third-party sellers and platform-owned ones in the networked market. Lastly, we establish how the platform's profit-optimal price-commission decision depends on the network structure and demonstrate the impact of network structure on the platform's optimal profit.

Title: Constructing Quantiles via Forecast Errors: Theory and Empirical Evidence

Presenter: Long Zhao, National University of Singapore
Co-author(s): Zhi Chen

Abstract:
Probabilistic forecasts (such as quantiles) are essential inputs to decision-making in the face of uncertainty. However, the most common type often comes in the form of point forecasts. As such, it is necessary for the decision maker to construct uncertainty measures around the obtained point forecasts. One simple approach proposed in the literature suggests leveraging historical forecast errors to create quantile estimators around the given point forecast (referred to as the E2Q method). The sample quantile and normal approximation are two popular E2Q estimators. The former relies on the empirical distribution of the forecast errors while the latter treats the underlying distribution as if it were normal. Despite their prevalence, the relative performances of the two estimators remain unknown. In this paper, we find that the performance of a quantile estimator depends on its bias and variance. In particular, higher variance always leads to worse performance. Furthermore, unbiasedness is never optimal for a fixed variance and becomes less and less appealing as variance increases. Thus, as an asymptotically unbiased estimator, the sample quantile is appealing only when its variance is small. We confirm our theoretical findings using the M5 forecast competition data. Since this competition consists of both the "accuracy" (point) and "uncertainty" (quantile) tracks, we also compare the E2Q method with other methods that directly forecast quantiles. We found that the E2Q method using the top point forecasts can outperform the top direct quantile forecasts. This empirical finding suggests that the E2Q method can be a promising alternative to forecasting quantiles directly.

Parallel Session (E8) - Smart supply chain application and Innovation

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z505

Session Chair: Weihua Liu, Tianjin University

Title: An Empirical Study on Traditional Offline Retailer's Switching Intention Towards Community-based Group Buying Program: A Push-Pull-Mooring Model

Presenter: Xiaoran Shi, Tianjin University
Co-author(s): Zihan Guan, Bo Peng

Abstract:
To enter the offline channel, the community-based group buying platform usually recruits group leaders to perform corresponding tasks (i.e., creating new customers, information disseminating, marketing and goods delivering). A major type of group leader is the traditional offline retailer, who runs a convenience store in the community. In this study, we propose a push-pull-mooring model to investigate the willingness factors that influence convenience storekeeper's switching intention to become the group leader, while incorporating the TAM model as a pull factor for analysis. Results of this study may help traditional offline retailer adapt to this competitive market better and improve the sustainability of CGB program.

Title: Decision Optimization in Service Supply Chain: The Impact of Demand and Supply Driven Data Value and Altruistic Behavior

Presenter: Di Wang, Shanxi University of Finance and Economics
Co-author(s): Weihua Liu, Yanjie Liang, Shuang Wei

Abstract:
In the era of digital economy, service integrators and service providers transform data value from different sources, which leads to the demand and supply-driven data, respectively. As the leader of service supply chain, the SI may show altruistic behavior. We construct a service supply chain consisting of two SPs and one SI and establishes five analytical models. The results show that, the optimal pricing and value-added service level decrease with the demand-driven data value. Supply-driven data value leads to the increase in optimal decisions and SI can achieve the "free-riding effect". There is a "transmission effect" among altruistic behavior, demand-driven and supply-driven data value, and customers can obtain an "optimal purchasing area" when the parameters meet a certain condition.

Title: The Impact of the Announcement of the In-depth Integration and Development of Logistics and Manufacturing on the Stock Market Value

Presenter: Yang He, Tianjin University

Abstract:
The collaborative interaction between logistics industry and manufacturing industry bring new opportunities and challenges to the operation and management of supply chain. We use the Event study method and Probit regression to explore the impact of company cooperation announcements on stock market value. We find announcements has a significant impact on market returns. In particular, the announcement that manufacturing is a seller has more significant effect on stock market. And, asset investment and technology upgrade are important indicators that affect the increase of stock value. In addition, companies with higher supply chain network related indicators may get better cooperation benefits.

Title: The Impact of Carbon Neutral Policies on the Stock Market from a Supply Chain Perspective: Taking the Action Plan for Carbon Dioxide Peaking Before 2030 of China as an Example

Presenter: Yongzheng Gao, Tianjin University
Co-author(s): Weihua Liu

Abstract:
The Chinese government continuously improves its carbon neutrality policy system. This paper uses the event study method to explore the impact of carbon neutrality policies on China's stock market by taking the Action Plan for Carbon Dioxide Peaking Before 2030 as an example. Based on the perspective of resource theory, this paper also reveals the moderating effect of four selected supply chain network structure characteristic indicators (supplier concentration, customer concentration, in-degree centrality, out-degree centrality) and smart supply chain on the stock market response brought about by the promulgation of the Plan. Our results support some expected assumptions, and also obtain some counterintuitive conclusions.

Parallel Session (E9) - Emerging Transportation Technologies and Management

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z506

Session Chair: Wei Liu, The Hong Kong Polytechnic University

Title: Real-Time Vehicle Relocation and Staff Rebalancing in One-Way Electric Carsharing Systems Considering Demand Uncertainty and Nonlinear Charging Profile

Presenter: Min Xu, The Hong Kong Polytechnic University
Co-author(s): Dr. Ting Wu, Dr. Abdelrahman E.E.Eltoukhy

Abstract:
Vehicle relocation in electric carsharing services is complicated by ad-hoc demand and charging requirement of electric vehicles. The additional staff rebalancing consideration exacerbates the complexity as staff scheduling constraints come into play. In this study, we investigate a real-time vehicle relocation and staff rebalancing problem for one-way electric carsharing services considering the demand uncertainty and nonlinear charging profile of battery. The problem is formulated as a Markov Decision Process. An efficient concurrent-scheduler-based policy embedding a constrained non-dominated charging strategy is proposed. Numerical experiments show that the proposed policy improves the service level and profitability compared to a decomposition-based benchmark policy.

Title: Individual Scheduling Approach for Multi-Class Airline Cabin Crew with Manpower Requirement Heterogeneity

Presenter: Xin Wen, The Hong Kong Polytechnic University
Co-author(s): Sai-Ho (Nick) Chung, Jiuh-Biing Sheu

Abstract:
Traditionally, cabin crews are scheduled based on teams for each aircraft type. Recently, airlines operate with increasingly-diversified aircraft types with heterogeneous manpower requirements. Thus, sticking to the team scheduling approach would lead to severe cost inefficiency. Hence, many airlines start to schedule cabin crews individually. This study conducts an analytical study aiming at improving manpower utilization while reducing costs by developing a new individual cabin crew pairing generation approach. Several unique cabin crew operations characteristics are modelled. A column generation based solution

algorithm is developed. Computational experiments based on real flight schedules validate the merits of the new pairing approach.

Title: Unmanned Aerial Vehicle (UAV) Service Network Design for Urban Monitoring

Presenter: Bolong Zhou, The Hong Kong University of Science and Technology
Co-author(s): Wei Liu, Hai Yang

Abstract:
This study examines the multi-depot location-routing problem of UAVs for urban monitoring (MDLRP-UM). MDLRP-UM appears in several service networks in urban environments such as daily security patrols or monitoring the operation of infrastructures. The problem can be modeled as a mixed integer quadratically constrained program, where we jointly optimize the service routes of the UAVs, the service intensity (frequency) on each route, and the location of the depots to minimize the overall cost. We propose an adaptive large neighborhood search (ALNS) heuristic to solve real-world large-scale problems, of which the efficiency and effectiveness are demonstrated by extensive numerical experiments.

Title: Two-Stage Pilot Matching for an Airline

Presenter: Bin Yu, National University of Singapore
Co-author(s): Tan Hong Ming, Jussi Keppo

Abstract:
We develop a two-stage approach for pilot scheduling that considers pilots' preferences over both co-pilots and flights. In the stable crew stage, pilots first report their preferences over co-pilots, and then based on those, we solve for the stable partition of crew pairing. In the flight matching stage, our allocation model assigns a flight to each crew pair.

Parallel Session (E10) - Emerging mobility solutions

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z507

Session Chair: Fangni Zhang, The University of Hong Kong

Title: Simulation, Optimization and Artificial Intelligence for on-demand ride services

Presenter: Jintao Ke, The University of Hong Kong
Co-author(s): Siyuan Feng, Hai Yang

Abstract:
On-demand ride services or ride-sourcing services, offered by transportation network companies like Uber, Lyft and Didi, have been experiencing fast development and steadily reshaping the way people travel in the past decade. This work proposes a novel multi-functional and open-sourced simulation platform for ride-sourcing systems, which can simulate the behaviors and movements of various agents (including drivers and passengers) on a real transportation network. It provides a few accessible portals for users to train and test various optimization algorithms, especially reinforcement learning algorithms, for a variety of tasks, including on-demand matching, idle vehicle repositioning, and dynamic pricing.

Title: Modelling and Improving the Passenger Evacuation Process in a Bi-modal System with Bus and E-hailing Modes after Mass Gathering Events

Presenter: Hang Su, Tongji University; The Hong Kong Polytechnic University
Co-author(s): Xiaolei Wang, Wei Liu, Xiaoning Zhang

Abstract:
When metro system experiences a sudden disruption or at the end of some large-scale gathering events like concerts and carnivals, passenger travel demand would surge immediately within a small area and bring about severe safety risk. The popularity of e-hailing services in the recent decade makes it an attractive mode for passengers to leave the area. This paper develops a mathematical model to depict the dynamic passenger evacuation process and traffic conditions within a demand-surge area in a bi-modal system with both bus and e-hailing vehicles being available for passenger evacuation, and demonstrates the double-edge effect of e-hailing services on passenger evacuation

efficiency. Two perimeter control strategies are proposed to regulate the total inflow rate of e-hailing vehicles and background traffic, and their effectiveness is examined and validated through simulation experiments.

Title: How to Build a Green Mobility System? A dilemma between Market Growth and Emission Reduction

Presenter: Yanyan Ding, The Hong Kong University of Science and Technology
Co-author(s): Sisi Jian

Abstract:
Replacing gasoline vehicles (GVs) with electric vehicles (EVs) is conducive to a green mobility system, while this inevitably increases the operational costs of mobility service providers (MSPs). Government agencies commonly integrate the carbon cap-and-trade policy and the industrial policy (e.g., inducing MSPs to install exhaust reduction devices for GVs) to tackle this problem. Competitive MSPs need to reconsider the number of operating vehicles and the EV adoption rates in response to those policies. We propose a sequential-move game model to capture the interactions between MSPs and the government agency. Results show that as the government agency sets stricter regulations, MSPs will increase the EV adoption rates while reducing the cumulative number of operating vehicles.

Title: Modular Vehicle-based Transit System for Passenger and Freight Co-modal Transportation

Presenter: Jie Lin, The University of Hong Kong
Co-author(s): Fangni Zhang

Abstract:
Modular transit vehicles enable flexible capacity adjustment by docking and undocking modules at specific transformation stations to accommodate fluctuating transportation needs. This study investigates a bi-directional co-modal transit system for passenger and freight, where modular transit vehicles fulfill both time-dependent passenger flows and freight requests. We optimize the strategic planning of transformation locations, as well as operational strategies of capacity adjustment and freight/passenger assignment. The problem is formulated as a MILP problem and an algorithm is proposed to solve the problem efficiently. A case study shows that the modular transit system significantly enhances the overall transportation efficiency.

Parallel Session (E11) - Healthcare Operations and Pandemic

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z410

Session Chair: Jin Qi, Hong Kong University of Science and Technology

Title: Cost-effectiveness of a Network of Lethal Ovitraps for the Prevention and Control of Dengue Fever

Presenter: Yvonne Huijun Zhu, National University of Singapore
Co-author(s): Joel Aik, Shuzhen Sim, Joel Goh

Abstract:
We analyze the system-level cost-effectiveness of a network of lethal ovitraps for Dengue control. Benefits are modeled using an age-stratified multiple-infection epidemiological model and measured as reductions in disability-adjusted-life-years (DALYs). We estimate labor costs by modeling the workload needed for periodic maintenance of the traps via Traveling Salesmen Problems (TSPs).

Title: Model and Approximation of Patient Flow in Emergency Departments

Presenter: Chengye Zou, City University of Hong Kong
Co-author(s): Zhankun Sun

Abstract:
Modeling patient flow process in emergency departments (EDs) is challenging because of the time-varying demand, patient abandonment, and multi-stage services between physicians' assessments and tests. In this study, we propose an approximation model based on physician productivity rates to reduce the high dimensionality. Simulation results show that our model can capture the time-dependent patient waiting time fairly accurately when the traffic intensity is high and the average testing time is sufficiently short.

Title: Travel Restriction Game Of Communicating Regions During Pandemic

Presenter: Nana Li, Hong Kong University of Science and Technology
Co-author(s): Jin Qi, Xiangtong Qi

Abstract:
As COVID-19 spreads worldwide, many countries suffered economic damage from preventing severe pandemic breakout. However, lockdown may be devastating to the economy. Thus, travel restriction becomes an alternative, and the problem is how to determine travel restriction levels in different regions during the pandemic. This work introduces a game between different regions that determines the travel restriction level of each region, where each region wants to minimize its own travel restriction cost and infection cost, several regions together achieve a Nash Equilibrium, which varies with treatment cost and system parameters.

Title: Distributionally Robust Group Testing with Correlation Information

Presenter: Yu Sun, The Chinese University of Hong Kong
Co-author(s): Daniel Zhuoyu Long, Jin Qi, Aiqi Zhang

Abstract:
Group testing is promising to conduct massive tests. Given the information on prevalence and correlation, we construct the ambiguity set of the uncertain joint distribution of the infection status and formulate a distributionally robust group testing problem to minimize the expected number of tests and misclassifications (false-positive and false-negative) under the worst-case distribution. With pairwise correlation, we investigate the structural property of the optimal partition and derive an efficient algorithm to obtain the optimal partition. With generalized partial correlation, we discuss a special case and provide managerial insights. Numerically, we show that the consideration of correlation information is beneficial.

Parallel Session (E12) - New Frontiers of Operations

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z411

Session Chair: Philip Zhang, The Chinese University of Hong Kong

Title: Policy Learning with Adaptively Collected Data

Presenter: Ruohan Zhan, Hong Kong University of Science and Technology
Co-author(s): Zhimei Ren, Susan Athey, Zhengyuan Zhou

Abstract:
Learning optimal policies from historical data enables personalization in many applications. The growing policy learning literature focuses on settings with pre-specified treatment assignment policies. However, adaptive data collection is becoming more common for allowing to progressively improve inferential efficiency and operational performance. In this talk, we study policy learning with adaptively collected data. We propose an algorithm based on generalized augmented inverse propensity weighted estimators and establish its finite-sample regret bound, which is complemented by a lower bound that characterizes the fundamental difficulty. We show that our algorithm is minimax optimal when equipped with prior knowledge on data-collection mechanism.

Title: Myopic Quantal Response Policy: Thompson Sampling Meets Behavioral Economics

Presenter: Jingying Ding, Shanghai Jiao Tong University
Co-author(s): Yifan Feng, Ying Rong

Abstract:
We study a new family of multi-armed bandit algorithms called Myopic Quantal Response (MQR). It prescribes a simple way to randomize over arms according to a "coefficient of exploitation," which explicitly controls the exploration-exploitation trade-off. We show that MQR partially extends the Thompson Sampling algorithm. It is also a dynamic version of quantal response models where the expected utilities are directly estimated from historical rewards. MQR can be used to structurally estimate how a given policy (either generated by computer algorithms or human beings) is "under" or "over" exploring. It can also inspire new MAB algorithms that improve asymptotically-optimal algorithms in a non-asymptotic setting.

Title: Asymptotically Optimal Policies for Dynamic Ambulance Dispatch in Emergency Medical Service System

Presenter: Cheng Hua, Shanghai Jiao Tong University
Co-author(s): Tong Wang, Jingwei Zhang, Ziyan Zhou

Abstract:
We consider a dynamic ambulance dispatch problem in an emergency medical service system, in which a decision maker dynamically observes call arrivals, modeled as Poisson process, then decides which unit to be dispatched to serve the call, where the service time is assumed to follow an exponential distribution. To alleviate potential ethical issues, we consider a large penalty for each unserved request, which is rarely considered in the existing papers on dispatching problems. This problem is formulated as a Markov decision process (MDP) while it is intractable due to the curse of dimensionality. We develop two easy-to-implement heuristics from a deterministic linear program and a Lagrangian relaxation, and have provably near-optimal performances as the arrival rate and the number of units grow large.

Title: Estimating Demand with Unobserved No-purchases on Revenue-managed Data

Presenter: Anran Li, The Chinese University of Hong Kong
Co-author(s): Kalyan Talluri, Muge Tekin

Abstract:
This paper investigates the joint estimation of the consumer arrival rate and choice model parameters when ``no-purchasers'' are not observable. Estimating demand even with the simplest discrete-choice model such as the MNL becomes challenging. Some previous approaches have proposed using market-share to pin down the parameter; however, market-share data are difficult to obtain in practice. Another complication is the sales are ``revenue-managed", that is, optimized nearly continuously by analysts and algorithms. In this paper we propose a two-step GMM based robust method when the firm cannot observe no-purchases, has no market-share information, and the data has been revenue-managed.

Parallel Session (E13) - New topics in Operations Management

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z412

Session Chair: Biying Shou, City University of Hong Kong

Title: Assortment Display, Price Competition, and Fairness in Online Marketplaces

Presenter: Hanwei Li, City University of Hong Kong
Co-author(s): Hongyu Chen, David Simchi-Levi, Michelle Wu, Weiming Zhu

Abstract:
As the increasing number of sellers on a platform leads to intensified competition and results in sellers setting lower prices for the products, it is unclear whether displaying all the sellers to the entire customer base maximizes platform revenue. Motivated by the unique setting of Airbnb, we consider a game-theoretical setup in which each seller on the platform provides a single-unit product to a heterogeneous customer base and competes with one another on price. We develop an algorithm to determine sellers' optimal pricing decisions and the platform's optimal assortment display policy. Additionally, we incorporate constraints to guarantee a certain degree of seller and customer fairness.

Title: From Social to Purchase: Customer Selection in Social Group Buying

Presenter: Yan Cheng, Tsinghua University
Co-author(s): Shaochong Lin, Zuo-Jun Max Shen

Abstract:
Social scope group buying has become an increasingly popular marketing strategy and has served as a newcustomer acquisition tool. In the service industry, companies use social group buying (SGB) to recruit newcustomers and promote full-price products. Through SGB activities, customers can trade their social capitalto form buying groups and experience SGB-offered sample products, further resolving uncertainty towardan expensive full-price product and making a final purchase. We investigate this new SGB phenomenon byexamining customers' decisions during the "experience-conversion" processes in relation to social attributesof the SGB, such as social cost and social learning. In collaboration with a leading online educational plat-form, we study customers' grouping behavior during SGB activities and analyze their subsequent purchases.Interestingly, our analysis identifies a distinctive pattern whereby nongrouped customers make a higher per-centage of full-

price product purchases than grouped customers. Based on a Bayesian learning framework,we model customers' three-stage discrete-choice decision-making processes and identify the social cost gen-erated through forming the buying group as one influencing factor of the pattern. Meanwhile, our studyinvestigates the impact of group-level social learning on customers' purchase decisions. Specifically, we dis-cuss how the first customer of a buying group influences other group members' decisions and identify thetypes of customers with a high purchase potential for the full-price product. We provide actionable insightsinto recognizing customers with different levels of social costs and implications for the SGB design. Throughanalyzing the social attributes of SGB, our study sheds light on customer targeting and management insimilar businesses.

Title: The Value of Endogenous Product Information in Position Auctions

Presenter: Shaoyu Wang, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Pin Gao, Yang Li, Ying Ju Chen

Abstract:
In some novel marketing tools, such as live-streaming and video advertising, ad agencies can flexibly control the product information that are sequentially demonstrated to customers. In this work, we show how such flexibility will improve the ad agencies' profits in position auctions and potentially benefit the advertisers. Our analysis also suggests that, due to its discriminatory role in serving heterogeneous advertisers, this flexibility can significantly alter the structure of optimal mechanisms, where low-margin advertisers may be charged higher per-click commissions and their products may be displayed in higher ad positions.

Title: EV Market Share and Profit Driven Competition with Service Sharing

Presenter: Fengfeng Xie, City University of Hong Kong; South China University of Technology
Co-author(s): Baozhuang Niu, Biying Shou, Pengfei Guo

Abstract:
Many EV companies (e.g., Tesla, XPeng, and Li Auto) include market share as an important part of the company objective. We are interested in how such a weighted average objective of market share and profitability influences the EV companies' pricing decisions for "EV

product + charging service", and whether they have incentive to share their superior charging networks with their rivals. Interestingly, we find that the company under a weighted average objective of market share and profitability could actually obtain a higher profit than that under a profit maximization objective. Sharing superior charging networks promotes competing EV companies' cooperation and diversifies their competition when the consumers can switch between EV product purchasing and charging service competition. This not only benefits the companies but also the social welfare, so an all-win situation can be achieved

Parallel Session (E14) - Information in Operations

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z413

Session Chair: Zhenyu Hu & Yangge Xiao, National University of Singapore

Title: Waiting Experience in Open-Shop Service Networks: Improvements via Flow Analytics & Automation

Presenter: Manlu Chen, Renmin University of China
Co-author(s): Opher Baron, Avishai Mandelbaum, Jianfu Wang, Galit B. Yom-Tov, Nadir Arber

Abstract:
This paper, motivated by a collaboration with a health screening clinic, studies open-shop service networks with two service-level measures: macro-level overall wait and micro-level probability of excessive waits. Via an empirical analysis, we discover that the clinic's automated customer routing system has a negligible impact on customers' total wait. However, it enables more sophisticated priority and routing policies. We propose the advanced customer priority (ACP) policy and a buffer strategy to improve customers' experience. We analytically show the effectiveness of these policies in a stylized two-station open-shop network and verify in a simulation model calibrated with the clinic's data.

Title: Early or Late Warnings

Presenter: Feng Tian, The University of Hong Kong
Co-author(s): Shouqiang Wang, Feifan Zhang

Abstract:
We study how public agencies disseminate early warnings when facing a looming disaster such as an epidemic outbreak. We look at how they trade off the incentives to trigger timely yet costly preemptive actions with the benefits of collecting more accurate information. We characterize the optimal warning policy, which may induce governments to distort their proprietary information.

Title: Information Design of a Delegated Search

Presenter: Yangge Xiao, National University of Singapore
Co-author(s): Zhenyu Hu, Shouqiang Wang

Abstract:
A principal delegate a sequential search to an agent, who bears search cost and controls when to terminate searching. Upon termination, the search payoff is split between the principal and agent. However, only the principal can evaluate search outcomes. The principal designs an information policy to strategically disclose private outcomes over time. We show the optimal policy makes a binary recommendation in each period, which the agent will voluntarily follow. Specifically, the principal specifies a threshold at each period, such that the agent is recommended to continue searching if and only if the payoff from search is below that threshold.

Title: Attribute Disclosure and Pricing of New Product with Consumer Search

Presenter: Zihao Chen, Hong Kong University of Science and Technology
Co-author(s): Xingyu Fu, Pin Gao, Ying Ju Chen

Abstract:
Consumers must incur search costs to trial the product in the brick-and-mortar store to obtain real experience. In this work, we study how such search cost affects the product attribute disclosure and pricing policy of a firm. We show that the firm should conceal information if the search cost is mild, whereas disclose attribute information if the search cost is high. Interestingly, we find that the consumer and the society may benefit from a higher search cost. This result is robust under several model extensions, including heterogeneous attributes and multiple consumers (i.e., auction).

Parallel Session (E15) - The Impacts of Ride-Hailing/Sharing on Individual Decision

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z509

Session Chair: Ying Xu, Singapore University of Technology and Design

Title: Platform Competition in Ridehailing

Presenter: Costas Courcoubetis, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Mihalis Kanakakis, Saif Benjaafar

Abstract:
We consider a 2-sided market for transportation mediated by online platforms, where individuals use their personal vehicles to transport others for a fee. We propose a novel approach for modeling this market as a large anonymous game where strategic decisions of individuals determine demand and supply to the platform. We use this model to study monopoly and duopoly competition among platforms. Our results suggest that the cost structure of the economy greatly affects the resulting equilibria that capture the long-term evolution of the market, and that competition might not always increase social welfare.

Title: The Impact of Ride-sharing Transportation on Patient No-Show Rates: Evidence from a Quasi-Experiment

Presenter: Shihong Xiao, Fudan University
Co-author(s): Saif Benjaafar, Jason Chan, Nathaniel Witte

Abstract:
This work investigates the extent to which access to healthcare services can be improved through programs providing free ride-sharing transportation to medical appointments for patients. This empirical study examines the impact of such a program on no-show rates using a quasi-experiment that contrasts treated patients with control patients over time. We find that the program is effective on average, but its effectiveness tends to dwindle over time, except that its effect sustains only for patients with low clinic attending frequency. We also investigate patient and appointment characteristics with larger benefits relative to other patients and appointments.

Title: Improving Quantal Cognitive Hierarchy Model Through Iterative Population Learning

Presenter: Shih Fen Cheng, Singapore Management University
Co-author(s): Yuhong Xu, Xinyu Chen

Abstract:
Game-theoretic equilibrium is an ideal solution concept for strategic interaction among agents, however, it is known to fail when agents have limited rationality. Behavioral game theory is an attempt to fix this, and the recent quantal cognitive hierarchy model allows us to include both non-strategic level-0 and strategic level-k agents. For level-k agents, it's assumed that they would optimize by assuming that all competitors have levels less than k with a fixed distribution. In this talk, we introduce a learning-based method to iteratively estimate the empirical distribution of agents' reasoning levels, which is shown to improve the current state-of-the-art results.

Title: The Impacts of Ride-hailing on Car Ownership under Individual Choice Endogeneity

Presenter: Ying Xu, Singapore University of Technology and Design
Co-author(s): Yuliu Su, Shih-Fen Cheng, Costas Courcoubetis

Abstract:
Our paper aims to quantitatively evaluate the impact of ride-hailing services on individual car demand. We adopt an equilibrium choice model to study a heterogeneous population's choices of car ownership, car usage, and transportation modes in the presence of ride-hailing. In the model choice utilities endogenously depend on choice outcome in that the utilities of being platform drivers or users depend on supply and demand in the whole ride-hailing market (i.e., the choice share of the entire population). Through counterfactual analysis, we evaluate how driving costs and platform pricing schemes affect car ownership, traffic flow, platform profits, and environmental impacts.

Parallel Session (E16) - Optimal Pricing Strategy

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z510

Session Chair: Yunjuan Kuang, The Hong Kong Polytechnic University

Title: Bundling Ancillary Services: Going Vertical or Horizontal?

Presenter: Junxue Zhang, Hong Kong University of Science and Technology
Co-author(s): Chenguang (Allen) Wu, Ying Ju Chen

Abstract:
Many firms provide ancillary services to support their main service, and the presence of multiple ancillaryservices creates abundant room for innovative selling strategies that firms can exercise. We study two dimensions ofbundling these services, namely, averticaldimension that bundles the main service with one ancillary service, and ahorizontaldimension that bundles multiple ancillary services altogether, and both. We demonstrate how the optimal(un)bundling strategy varies with the market heterogeneity as well as the correlations between valuations for the ancillaryservices. In particular, our result suggests that the optimal pricing strategy depends on the market heterogeneity in dif-ferent dimensions: low heterogeneity in valuations for the main with one ancillary service favors

vertical bundling, andlow heterogeneity in valuations for ancillary services favors horizontal bundling. In contrast with one-ancillary-servicesettings that only accommodate the vertical dimension, under multiple-ancillary-service settings, firms can utilizebothbundling dimensions when devising bundling tactics. Newly introduced pricing strategies, such ascustomized bundlingandancillary services bundling, can be optimal and their optimality conditions are non-trivial. Furthermore, the correla-tion between ancillary services impacts the market heterogeneity and alters the optimal pricing strategy. While traditionalwisdom in bundling literature suggests that negatively-correlated commodities usually favor (vertical) bundling, our resultreveals that correlation between ancillary services works differently: positive correlation decreases vertical heterogene-ity and thus favors vertical bundling; negative correlation decreases horizontal heterogeneity and thus favors horizontalbundling.

Title: Consumer Deliberation and Capacity Pricing

Presenter: Tao Zhang, University of Electronic Science and Technology of China
Co-author(s): Quan Zheng

Abstract:
Many business contexts feature both supply capacity constraints and consumer valuation uncertainty. This motivates us to investigate the strategic interaction between consumers' endogenous preference-learning behavior (i.e., consumer deliberation) and a firm's capacity pricing strategy. We first characterize three types of pricing strategies with respect to the capacity level and deliberation cost. Then, we examine the roles of information friction and consumer deliberation in shaping the equilibrium. We also discuss the operational implications of consumer empowerment and quality improvement for the firm. In addition, several extensions are explored to enrich our findings.

Title: Managing Presales with Two Payments and Return Policy in Selling to Time-Inconsistent Consumers

Presenter: Yunjuan Kuang, The Hong Kong Polytechnic University
Co-author(s): Li Jiang

Abstract:
We consider a firm using presales with two payments (an upfront deposit and a postponed arrear) to sell a product to time-inconsistent consumers under various return policies. With the passage of time, each consumer decides whether to preorder the product by paying the deposit, whether to settle the balance by paying the arrear on the due date, and (if returns are allowed) whether to return the fully paid product for a refund after its fitness is revealed. Consumers exhibit time-inconsistency when making purchasing decisions. We characterize the firm's optimal pricing strategy and return policy.

Title: The Impact of Secondary Markets on Selling Blind Boxes with Set Bonuses

Presenter: Chenxi Sun, The Chinese University of Hong Kong
Co-author(s): Chaolin Yang, Yinbo Feng

Abstract:
We develop an analytical framework in which a firm sells a blind box, from which two horizontally differenti-ated items are randomly drawn. Two types of customers have different valuations for the two items. A customer gains anextra utility, called a set bonus, if she obtains a complete set of items; hence, she may repeat purchases until her expectedutility is maximized. We study and compare the selling of blind boxes in two settings, with and without a secondarymarket. Without a secondary market, customers buy products from the firm only. With the secondary market, customers purchase products from the firm in the first period and then trade the items they have obtained in the second period. We prove that with the secondary market, the firm's problem is equivalent to a principal-agent problem. We use a linearprogram and its dual problem to solve the secondary market equilibrium and the firm's profit. We identify two effects ofthe secondary market: the growth effect and the incompatibility effect. The former is positive, but the latter is negative.Utilizing the growth effect and reducing the incompatibility effect are not always countervailing, especially when the setbonus is large. We find that the secondary market hurts the firm if and only if customers' preferences are highly polarized,and the set bonus is positive but

small. Our model can easily be extended to a general model in which the blind boxincludes multiple items. Our main insights still hold in the general model.

Parallel Session (E17) - Emerging Topics in Operations Management
Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z511

Session Chair: Hyun Seok (Huck) Lee, Korea University Business School

Title: The Impact of Increasing Entry Fee on Emergency Department Traffic

Presenter: Hyun Seok (Huck) Lee, Korea University Business School
Co-author(s): Eric Park, Siu Chung Leung, Timonthy H. Rainer

Abstract:
Overcrowding in emergency departments (EDs) is a prevalent issue in many countries as it disrupts providing a service to life-threatening patients. A policy that has been adopted in several countries to mitigate ED overcrowding is to heighten the financial burden for access by increasing the ED entry fee in hopes of reduced traffic from non-urgent patients. However, its impact has not been rigorously studied in prior literature. We empirically study the impact of a fee increase from HK$1 to HK$18 in June 217 on ED patient visit behavior in the universal public health system of Hong Kong SAR.

Title: Prediction model of lung cancer therapy response based on graph attention network

Presenter: Yuanyi Gao, Tongji University
Co-author(s): Chunyan Duan

Abstract:
Predicting the tumor's response to radiotherapy is fundamental for doctors to administer moderate and effective doses of precise radiotherapy to patients with lung cancer. With the calculated uncertainty of 2D slices of images, we use graph attention network to predict the response to radiotherapy at the 3D image level, in which each slice is regarded as a node in graph structure, and the spatial topological relationship between slices is represented by edges. This model can assist doctors to make radiotherapy dose decision. Compared with traditional methods, this method can extract the spatial features of 3D images and doesn't require large-scale training datasets.

Title: Battery R&D and Pricing Strategies in a New Energy Vehicle Supply Chain under Co-opetition

Presenter: Guangqiang Wu, Guizhou University of Finance and Economics
Co-author(s): Kaifu Yuan

Abstract:
To determine battery R&D and pricing strategies, focusing on two competing automakers (firm A and B), we developed two profit-maximization models, i.e., firm B can choose to develop batteries independently (case I), or to procure batteries from firm A (case CO). Results show that when the competitive intensity is relatively weak, firm B will choose case I, and a stronger R&D capability of firm B will make firm A more profitable. Otherwise, firm B will choose case CO even though its R&D capability slightly stronger than that of firm A.

Title: Supplier-base Concentration and Inventory Management Performance: Evidence from Chinese Manufacturers

Presenter: Jun Shan, Jinan University

Abstract:
This study empirically examines the relationship between supplier-base concentration and inventory holdings in Chinese manufacturers. Using the financial report data of more than 1600 listed firms during 2012–2021, we find that manufacturers with a more concentrated supplier base hold fewer inventories, and the efficiency primarily flows through the raw materials and work-in-process inventory accounts. We address the association for firms of different sizes and find that small firms benefit more from a concentrated supplier base in inventory efficiency than large firms do. We also examine the relationship between supplier-base concentration and customer-base concentration and find that the positive effect of supplier-base concentration on inventory efficiency is stronger as customer-base concentration increases.

Parallel Session (E18) - Sustainable Operations

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z512

Session Chair: Wei Zhang, City University of Hong Kong

Title: Green Packaging and Communication: The Implications of Bring-Your-Own-Container

Presenter: Yunlong Peng, Tsinghua University
Co-author(s): Jian Chen, Fei Gao

Abstract:

A growing eco-trend among eco-conscious consumers is "Bring-Your-Own-Container" (BYOC), where con-sumers take their own reusable packaging to buy and consume products to reduce the waste of single-usepackaging. In this paper, we study the impacts of BYOC on a firm's packaging and communication deci-sions. We build a stylized model to study a firm's packaging choice and communication decisions and theirimplications on the environment. Our main results follow. First, the increasing popularity of BYOC amongeco-conscious consumers may reduce the incentive for a firm to make fraudulent green claims about itsdisposable product packaging and thus help prevent the greenwashing phenomenon. Second, when a firmchooses to offer green disposable packaging, it may not be profitable to adopt a credible third-party certi-fication to disclose the packaging's environmental quality, even if the certification is costless. Third, froman environmental perspective, it is not always wise for the government to require firms to have their greenclaims verified by a third party; such regulation can help eliminate the greenwashing phenomenon in themarket, but it may also cause a negative impact on the environment given the BYOC trend. Finally, when afirm begins to offer reusable packaging (in place of the traditional disposable packaging), consumers need toreturn the container after each time of use for cleaning, and we find that a more convenient return processmay not always improve the firm's profit.

Title: Plastic Recycling Schemes in Agriculture Industry

Presenter: Qiong Chen, Southwestern University of Finance and Economics
Co-author(s): Wenli Xiao, Yinping Mu, Feifei Shan

Abstract:
In this study, we compare three prevailing forms of agricultural film recycling schemes: Penalty Scheme, Reward Scheme and Service Scheme to address the following questions: (1) Which scheme can promote recycling more effectively? (2) Which scheme is the best choice from the perspective of the farmer, manufacturer and social planner? Our analytical results suggest that the social planner should set a sufficiently high penalty if the manufacturer is responsible for collection and a moderate penalty if the farmer is responsible for collection.

Title: Walking a Tightrope: Impact of Adopting Voluntary Right-to-Repair Policy on Firm Profit and Consumer Welfare

Presenter: Sayan Chowdhury, Indian Institute of Management Bangalore
Co-author(s): Nishant Kr. Verma

Abstract:
Motivated by the current discourse on Right-to-Repair (RTR), we examine the conditions under which a firmdecides to voluntarily adopt a pro-RTR policy in the absence of legislation. Understanding such conditionscan guide firms and regulators alike. We propose utility theory-based models to capture a firm's profitfunction when it adopts either a pro-RTR (PRR) or an anti-RTR (ARR) policy. The key distinction betweenARR and PRR policy is the availability of self-repair option in PRR. Additionally, we consider the presenceof unauthorised third-party repairers (TPRs), a commonly observed phenomenon worldwide. We find that afirm adopting PRR policy would benefit by improving the cost-effectiveness of its repair operations. Effectiverepair operations allow a firm to set a superior pricing policy while adopting PRR over ARR. For instance,it allows the firm to set lower product prices without infusing anti-consumer practices to dissuade them fromgoing to unauthorised TPRs. We analyse the conditions under which PRR policy outperforms ARR policyboth in terms of firm profit and consumer surplus (“win-win”). We find that designing products that areeasy to repair and, interestingly, ineffective repair operations helps in achieving “win-win” status. Further,we show that the PRR policy is more suitable for sustainability-conscious

markets where consumers preferrepair over a new purchase. In such markets, a firm with a PRR policy can set lower product prices whileoptimally setting the part sales margin for the self-repair option.

Title: Dynamic Incentives for Sustainable Contract Farming

Presenter: Wei Zhang, City University of Hong Kong
Co-author(s): Long Gao, Mohammad Zolghadr, Dawei Jian, Elhafsi Mohsen

Abstract:
The rise of contract farming has transformed millions of farmers' lives. We study a new class of contract farming prob-lems, where the farmer holds superior information and can invest effort to improve productivity over time. Despite theirprevalence, the literature offers little guidance on how to manage such farmers with dynamic incentives. We build a game-theoretic model that captures the dynamic incentives of learning and gaming, with hidden action and information. Wecharacterize the optimal contract: it internalizes both the vertical and intertemporal externalities, with performance payand deferred payment; the performance pay is to motivate the farmer to invest and improve the relationship-specific pro-ductivity; the deferred payment is to ensure that the farmer is willing to share information and behave honestly over time.Even with random yield, the optimal contract can still have a simple implementation of yield-adjusted revenue sharingpolicy. We find that, once dynamic incentives are considered, private information need not harm efficiency, and optimalproduction can employ upward and downward distortion at the same time. Using real data, we show that the learningeffect is significant. We then quantify when and how contract farming can improve smallholder farmers' productivityand income, creating shared value. We find when buyers have a long-term perspective and can internalize the benefit offarmer improvement, they will pay higher prices to ensure farmers' long-run viability. The resulting long-term policy canremedy both incentive and information deficiencies of spot transactions. Our results inform the policy debate on contractfarming: traditional pro-competitive policies (based on spot transactions) can be counterproductive for modern agrifoodvalue chains, hurting both buyers and farmers. By highlighting the critical role of dynamic incentives, this study deepensour understanding of contract farming theory and practice.

Parallel Session (E19) - Data-driven Operations Management

Day 2: 8th Jan (Sun) 16:00 – 17:30 Venue: Z513

Session Chair: Hongyuan Lin, National University of Singapore

Title: Optimizing Emergency Resources Location and Allocation for Railway Flood Management

Presenter: Mingyuan Zhu, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Lei Xu, Xiaoqiang Cai

Abstract:
Preparing emergency resources (e.g., excavators and bulldozers) for flood control is essential to preventing future disasters. This paper is the leading work on railway flooding management based on practical needs of Chinese railway groups, to optimally solve resource positioning and allocation problems. We develop a two-stage optimization-based model in which, in the first stage, limited flooding control resources are positioned before a flooding event is determined, and, in the second stage, optimal transportation and allocation of emergency resources are performed once disaster is identified. Solutions of our model have been implemented and tested in practical scenarios, which significantly improve railway flooding management efficiency.

Title: Online Order Acceptance with Postponable Production

Presenter: Chunyan Zheng, Shanghai Jiao Tong University
Co-author(s): Chung Piaw Teo, Guohua Wan

Abstract:
We consider an online revenue management problem with postponable production, where the order acceptance decisions are made upon order arrivals but the production decisions can be delayed till the end of sales season. We employ the Bayes selector approach and propose solution algorithms to deal with differentcases with postponable production and real-time production, respectively. These algorithms have constant expected regrets when the arrival process satisfies some mild conditions, independent of the total arrivalsand the resource budget, and they converge to optimal solutions quickly. Our numerical experiments show the algorithms can achieve near optimal solutions with both stationary and non-stationary arrival processes. Furthermore, we compare postponable production

with real-time production and analyze the value of post-ponement strategy. We then conduct numerical experiments to study the effects of different factors on thevalue of postponement. The results show that, a firm can earn the highest profit from postponement strategyif it has small production capacity but faces large demand, but its value is not significant if the productioncapacity is large. The study provides some insights for online revenue management when postponementstrategy can be adopted.

Title: Shall We Only Store Popular Products? Warehouse Assortment Selection for E-Companies

Presenter: Hongyuan Lin, National University of Singapore
Co-author(s): Xiaobo Li, Fang Liu

Abstract:
This paper studies the single-warehouse assortment selection problem that aims to minimize the order fulfill-ment cost under the cardinality constraint. We propose two types of fulfillment-related cost functions, which correspondto different preferences toward spillover fulfillment and order-splitting. This problem includes the fill rate maximizationproblem as a special case. We show that the objective function is submodular for a broad class of cost functions. We thenshow that even the fill rate maximization problem with the largest order size being two is NP-hard. Next, we proposemixed integer linear programming (MILP) formulations to solve the general warehouse assortment problem under differ-ent cost functions. Finally, we propose a simple heuristic called the marginal choice indexing (MCI) policy that stores themost popular products. Although the performance of MCI can be arbitrarily bad in some extreme scenarios, we find a gen-eral condition under which the MCI policy is optimal, and it is satisfied by all classic discrete choice models and severalmulti-purchase choice models. In addition, we demonstrate by synthetic experiments that the average performance of theMCI policy is good, and more importantly, it is robust when the observed demand is noisy. Through extensive numericalexperiments on a real-world dataset from RiRiShun Logistics, we find that the MCI policy is surprisingly near-optimalin all the settings we tested. Simply applying the MCI policy, the fill rate is estimated to improve by 9.18% on averagecompared to the current practice for the local transfer centers (LTCs) on the training data set. More surprisingly, the MCIpolicy outperforms the optimal policy in 14 out of 25 cases on the test data set, reiterating its robustness against the noiseof demand estimation.

Conference Venue

Direction to The Hong Kong Polytechnic University

The Hong Kong Polytechnic University (PolyU) is located at the centre of the city. It is easily accessible by various means of public transportation:

- **By MTR**
  The nearest MTR station is Hung Hom Station and a footbridge at Exit A1 leads you to the campus.

- **By Bus**
  Two major bus stops around campus are Hung Hom Station and Cross Harbour Tunnel Toll Plaza (Kowloon side).

- **By Taxi**
  Three types of taxis are operating in Hong Kong: Urban red taxi, New Territories green taxi, and Lantau Island blue taxi. All three types of taxis serve Hong Kong International Airport, but ONLY Urban red taxis go to PolyU. First 2 kilometres or any part thereof of hiring a red taxi costs HK$27. For details, please read TAXI FARE. Additional charges occur for large baggage. The toll and return toll are both payable by a passenger for cross-harbour hiring.

From the airport to PolyU

- **By MTR**
  Take Airport Express from Hong Kong International Airport to Tsing Yi Station, interchange to Tung Chung Line for Hong Kong Station, and interchange at Nam Cheong Station to Tuen Ma Line to Hung Hom Station. A footbridge at Hung Hom Station Exit A1 leads you to the campus. It takes around 40 minutes and HK$65 (Octopus)/HK$70 (Smart Ticket).

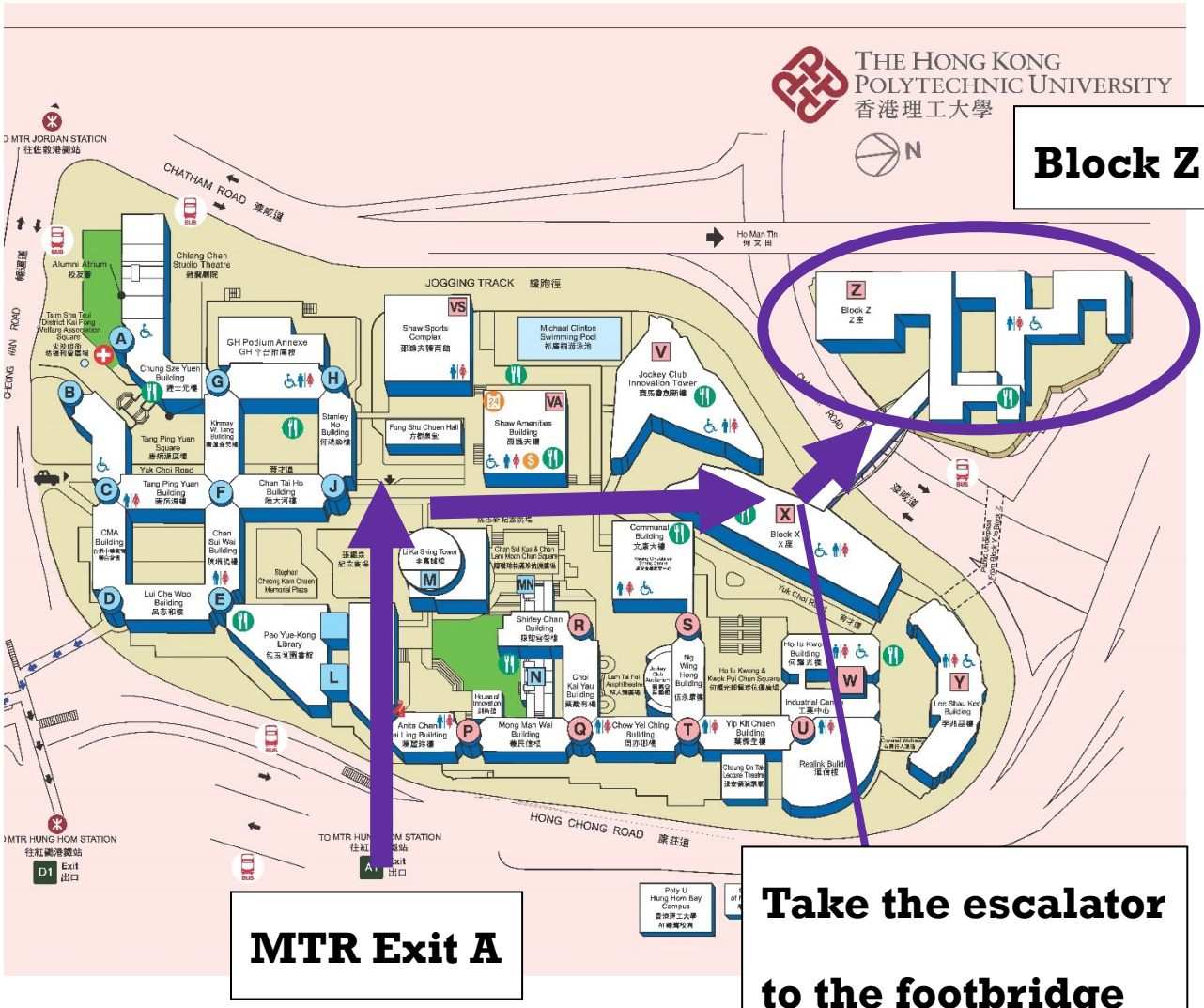
- **By Bus**
  Bus A21 goes from Airport (Ground Transportation Centre) Bus Terminus to Hung Hom Station. A footbridge at Hung Hom Station Exit A1 leads you to the campus. It takes around 1 hour and HK$33.

From Railway Terminal (Hung Hom Station)

- **On foot**
- Intercity Through Train Concourse is at Hung Hom Station Exit A. A footbridge at Hung Hom Station Exit A1 leads you to the campus.

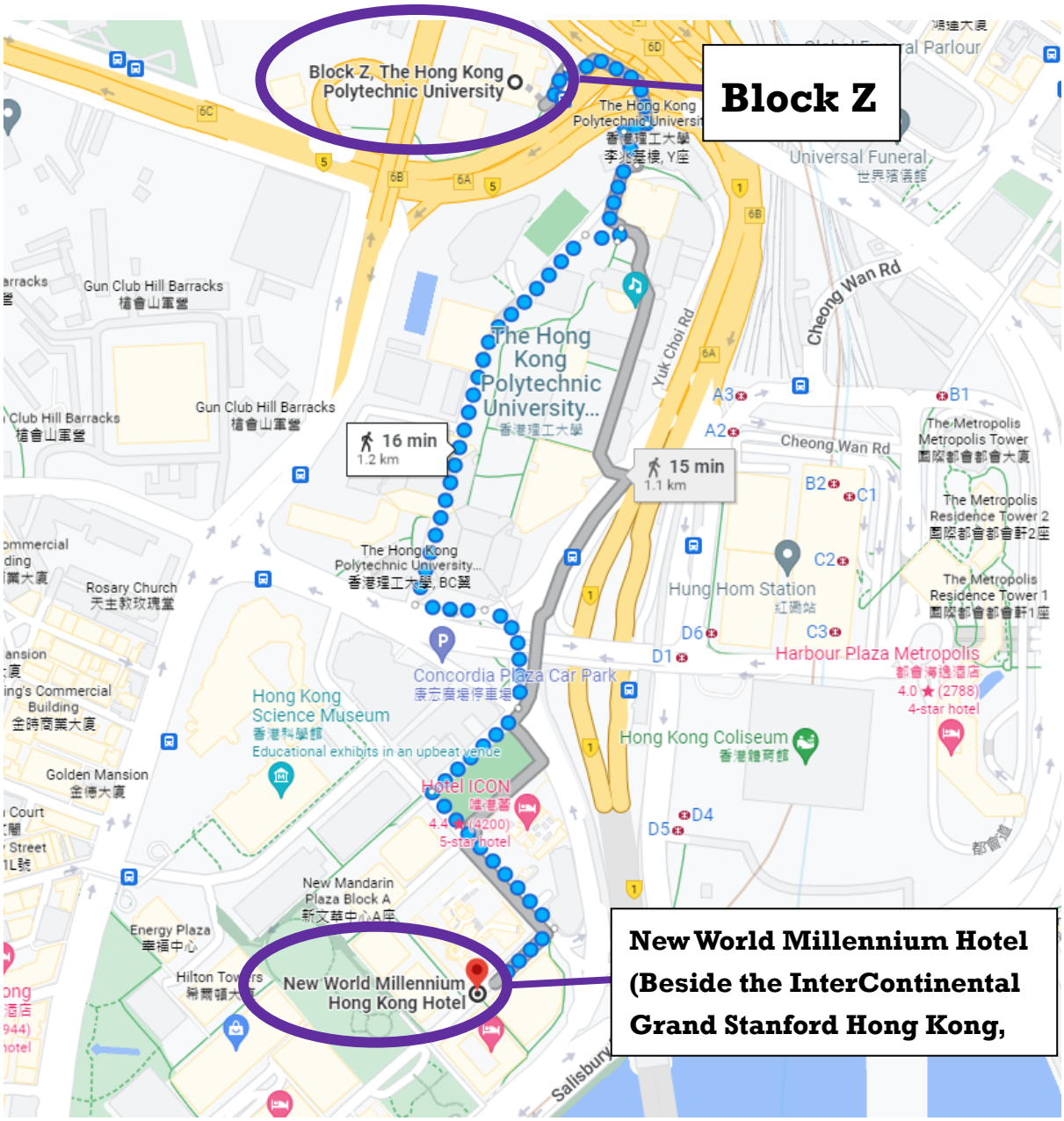
Conference Venue

Direction to Block Z, The Hong Kong Polytechnic University



Gala Dinner Venue

Direction to the New World Millennium Hotel



Source: Google.com

Gala Dinner Venue

Front of New World Millennium Hotel

Source: ticati.com

Location:

Grand Ballroom, 2/F., New World Millennium Hong Kong Hotel, 72 Mody Road, Tsim Sha Tsui East, Kowloon, Hong Kong.

Contact:

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