Data Envelopment Analysis International Conference 2017
Joint with Taiwan Productivity Workshop

2017 数据包络分析学术研讨会暨台湾生产力研讨会

Conference Handbook

Emerald Lake Campus, Hefei University of Technology
合肥工业大学•翡翠湖校区
July 7-9, 2017, Hefei, China
2017 年 7 月 7-9 日 中国•合肥

Co-organized by
School of Economics, Hefei University of Technology
合肥工业大学•经济学院
College of Auditing and Evaluation, Nanjing Audit University
南京审计大学•审计与评估研究院
Taiwan Efficiency and Productivity Association
台湾效率与生产力学会

Sponsored by
Hefei University of Technology
合肥工业大学
Nanjing Audit University
南京审计大学
Springer
斯普林格

CONTENTS

1 Guidelines for Participants

参会者指南

Conference Venue

会议地点

The conference will be held in School of Economics, Hefei University of Technology (Emerald Lake Campus). To find more detailed information, please check the conference schedule and map.

本次会议将在合肥工业大学（翡翠湖校区）经济学院举行，详细信息请察看下文“地图和路线”

Address

地址

485 Danxia Road, Hefei, Anhui 230601, P. R. China

安徽省合肥市丹霞路485号，邮编：230601

Conference Registration Desk

会议注册处

July 7, 2:00 p.m. - 9:00 p.m. Hefei Lakeside Hotel: NO.1 Rongcheng Road, Shu Shan District, Hefei

7月7日，下午2点到晚上9点，翡翠湖迎宾馆：合肥市蜀山区容成路1号

July 8, 8:30 a.m. - 11:30 a.m., Architectural & Art Building: Basement level 1

7月8日，上午8点半到11点半，建筑与艺术馆负一楼

Accommodation

住宿

Hefei Lakeside Hotel: NO.1 Rongcheng Road, Shu Shan District, Hefei

翡翠湖迎宾馆：合肥市蜀山区荣成路1号

Qingyuan Hotel: NO.111 Jiu Long Road, Shu Shan District, Hefei

磬苑宾馆：合肥市蜀山区九龙路111号

Maps & Transportation

地图和路线

Note that YIFU Architectural & Art Building is called YIFU building below.

The routes from airport and railway station to HFUT (Emerald Lake Campus)

从机场及火车站到合肥工业大学（翡翠湖校区）的路线图

(1) Xinqiao Airport to School of Economics, HFUT (Emerald Lake Campus)

（1）新桥机场到合肥工业大学（翡翠湖校区）经济学院

You have two paths to get to the destination from Xinqiao Airport

从新桥机场到达目的地可有以下两条路径

a. Taxi. It will take 50-55 minutes, costing about RMB 100 yuan.
出租车，50到55分钟，约100元

b. Bus. You can take Airport Express line 3 to South Gate Transfer Center, then take a taxi to HFUT (about RMB 20 yuan).
公交车，您可以乘坐机场巴士三号线至南门换乘中心站，然后乘坐出租车（约20元）到达

(2) Hefei South Railway Station to School of Economics, HFUT (Emerald Lake Campus)

（2）合肥南站到合肥工业大学（翡翠湖校区）经济学院

You have two paths to get the destination from Hefei South Railway Station

从合肥南站到达目的地可有以下两条路径

a. Taxi. It will take 25-30 minutes, costing about RMB 25 yuan.
出租车，20到25分钟，约25元

b. Bus. You can take Bus line 57, get off at the station of west Lotus district, then take a taxi to HFUT (RMB 8 yuan).
公交车，您可以乘坐公交57路线至芙蓉西区，然后乘坐出租车（8元）到达

(3) Hefei Railway Station: you can arrive by taxi (about 35 minutes & RMB 40 yuan) or bus line 226 (the last stop) to HFUT

（3）合肥站：您可乘坐出租车（约35分钟 & 40元）或公交226路线（终点站）到达

Place and Time for Meals

用餐时间及地点

Breakfasts for participants will be provided by Hotel. Details for lunches/dinners throughout the conferences are:

参会者的早餐由宾馆提供，会议期间的午餐及晚餐安排详见下表：

Date 日期	Location 地点	**Shuttle bus information** **班车**
Dinner of July 7 7月7日的晚餐	Hefei Lakeside Hotel 合肥翡翠湖迎宾馆	Within walking distance 步行可达
Lunch of July 8 7月8日的午餐	Fengda International Hotel 丰大国际大酒店	Time to go: 11:50 a.m. 去程时间 Pick-up location: west gate of YIFU Building 接车地点：建艺馆西门口
		Time to go back: 1:10 p.m. 回程时间 Pick-up location: drop-off point 接车地点：下车点
Dinner of July 8 7月8日的晚餐	Tong Qing Lou Restaurant 同庆楼	Time to go: 6:10 p.m. 去程时间 Pick-up location: gate of West Science Building 接车地点：科教楼西楼门口
		Time to go back to hotel: 8:10 p.m. 回程时间 Pick-up location: drop-off point 接车地点：下车点
Lunch of July 9 7月9日的午餐	Fengda International Hotel 丰大国际大酒店	Time to go: 11:50 a.m. 去程时间 Pick-up location: west gate of YIFU Building 接车地点：建艺馆西门口

		Time to go back: 1:10 p.m. 回程时间 Pick-up location: drop-off point 接车地点：下车点
Dinner of July 9 7月9日的晚餐	Pi Yun Hui Fu Restaurant 披云徽府	Time to go: 6:40 p.m. 去程时间 Pick-up location: gate of West Science Building 接车地点：科教楼西楼门口
		Time to go back to hotel: 8:40 p.m. 回程时间 Pick-up location: drop-off point 接车地点：下车点

Notes: Please bring your voucher

注意：请凭券就餐

Weather

天气

The weather during the conference may be changeable, with temperatures ranging between 25℃ and 33℃, and rainy.

会议期间天气可能多变，温度在25℃到33℃之间，下雨

Emergency Contacts

紧急联系人

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Speech Notes

(1) Each keynote speaker has 60 minutes for presentation.

(2) Each session speaker has 20-25 minutes for presentation.

(3) After all the presentation, there are 10-20 minutes for Q&A in each session.

(4) The name of each presenting author is in bold.

2 Conference Program

Conference Program 会议日程

Day 1 (Friday, July 7)	Agenda	Venue
2:00 P.M. - 9:00 P.M.	**On-site Registration** **现场注册**	**Hefei Lakeside Hotel** 合肥翡翠湖迎宾馆
2:00 P.M. -	**Check-in** **登记入住**	**Hefei Lakeside Hotel** 合肥翡翠湖迎宾馆
6:30 P.M. - 7:30 P.M.	**Dinner**	**Hefei Lakeside Hotel** 合肥翡翠湖迎宾馆

Day 2 (Saturday, July 8)	Agenda	Venue
8:30 A.M. - 9:00 A.M.	**Opening Ceremony** ***开幕式*** **Chair: Huaqing Wu**, Professor, Dean of SOE, HFUT **主持人：吴华清**，教授，合肥工业大学经济学院院长	**YIFU Building: Basement level 1** 建艺馆负一楼
8:30 A.M. - 8:45 A.M.	**Welcome Address: Liang Liang**, President of HFUT **欢迎辞：梁樑**，教授，合肥工业大学校长	**YIFU Building: Basement level 1** 建艺馆负一楼
8:45 A.M. - 8:55 A.M.	**Address 1: Joe Zhu**, General Chair **致辞 1：朱乔**，大会主席	**YIFU Building: Basement level 1** 建艺馆负一楼
8:55 A.M. - 9:00 A.M.	**Address 2: Hung-Jen Wang**, Program Co-Chair **致辞 2：王泓仁**，项目联合主席	**YIFU Building: Basement level 1** 建艺馆负一楼
9:00 A.M. - 9:20 A.M.	**Group Photo** ***合影***	
9:20 A.M. - 10:20 A.M.	**Keynote Speech 1**: Professor Lawrence M. Seiford Data Envelopment Analysis: A "Forty Year" Perspective ***主题演讲 1：Lawrence M. Seiford 教授*** **Chair: Joe Zhu**, Professor, Foisie Business School, Worcester Polytechnic Institute **主持人：朱乔**，教授，伍斯特理工学院福伊西商学院	**YIFU Building: Basement level 1** 建艺馆负一楼
10:20 A.M. -10:40 A.M.	**Coffee Break & Refreshment**	
10:40 A.M. -11:40 A.M.	**Keynote Speech 2**: Professor Joseph C. Paradi DEA and the Financial Services Industry - A Modelling View ***主题演讲 2：Joseph C. Paradi 教授*** **Chair: Yao Chen**, Professor, Manning School of Business, UMass Lowell **主持人：陈瑶**，教授，麻省大学洛威尔分校曼宁商学院	**YIFU Building: Basement level 1** 建艺馆负一楼
12:00 P.M. - 1:40 P.M.	**Lunch & Networking**	**Fengda International Hotel** 丰大国际大酒店
1:40 P.M. - 3:40 P.M.	**Session D1A1, Chair: Shiuh-Nan Hwang**	**A106 at West Science Building** 科教楼西楼 A106 室
	Session D1A2, Chair: Yinsheng Yang	**A108 at West Science Building** 科教楼西楼 A108 室
	Session D1A3, Chair: Bing Wang	**A110 at West Science Building** 科教楼西楼 A110 室
	Session D1A4, Chair: Hung-Pin Lai	**A112 at West Science Building** 科教楼西楼 A112 室

3:40 P.M. - 4:00 P.M.	**Coffee Break & Refreshment**	
4:00 P.M. - 6:00 P.M.	**Student Session D1B1, Chair: Feng Yang**	**A106 at West Science Building** 科教楼西楼 A106 室
	Student Session D1B2, Chair: Sungmook Lim	**A108 at West Science Building** 科教楼西楼 A108 室
	Student Session D1B3, Chair: Juan Du	**A110 at West Science Building** 科教楼西楼 A110 室
	Session D1B4, Chair: Jie Wu	**A112 at West Science Building** 科教楼西楼 A112 室
6:30 P.M.	**Welcome Dinner**	**Tong Qing Lou Restaurant** 同庆楼

Day 3 (Sunday, July 9)	**Agenda**	**Venue**
8:30 A.M. - 9:30 A.M.	**Keynote Speech 3**: Professor William H. Greene Modeling Heterogeneity in the Stochastic Frontier Model ***主题演讲 3：*** *William H. Greene 教授* **Chair: Hung-Jen Wang**, Professor, Department of Economics, National Taiwan University **主持人：王泓仁，**教授，台湾大学经济系	**YIFU Building: Basement level 1** 建艺馆负一楼
9:30 A.M. - 10:30 A.M.	**Keynote Speech 4**: Professor Christopher O'Donnell Estimating Total Factor Productivity Change When No Price or Value-Share Data are Available ***主题演讲 4：*** *Christopher O'Donnell 教授* **Chair: Hung-Jen Wang**, Professor, Department of Economics, National Taiwan University **主持人：王泓仁，**教授，台湾大学经济系	**YIFU Building: Basement level 1** 建艺馆负一楼
10:30 A.M. -11:00 A.M.	**Coffee Break & Refreshment**	
11:00 A.M. -11:40 A.M.	**Invited Session 1**: Professor José L. Ruiz Benchmarking in pay-for-performance incentive plans using DEA ***特邀演讲 1:*** *José L. Ruiz 教授* **Chair: Wenbin Liu,** Professor, Kent Business School, Kent University **主持人：刘文斌，**教授，肯特大学肯特商学院	**A106 at West Science Building** 科教楼西楼 A106 室
11:00 A.M. -11:40 A.M.	**Invited Session 2**: Professor Cliff J. Huang Production Frontiers, Metafrontiers, and Technology Gaps ***特邀演讲 2:*** *Cliff J. Huang 教授* **Chair: Tsu-Tan Fu**, Professor, School of Business, Soochow University **主持人：傅祖坛，**教授，东吴大学商学院	**A108 at West Science Building** 科教楼西楼 A108 室
11:00 A.M. -11:40 A.M.	**Invited Session 3**: Professor Valentin Zelenyuk Central Limit Theorems for Aggregate Efficiency ***特邀演讲 3:*** *Valentin Zelenyuk 教授* **Chair: Hung-Jen Wang**, Professor, Department of Economics, National Taiwan University **主持人：王泓仁，**教授，台湾大学经济系	**A110 at West Science Building** 科教楼西楼 A110 室
11:00 A.M. -11:40 A.M.	**Introduction to Talents Recruiting** ***人才招聘推介***	**A107 at West Science Building** 科教楼西楼 A107 室
11:00 A.M. -11:40 A.M.	**PhD Study Opportunities in Taiwan** ***台湾读博求学机会***	**A112 at West Science Building** 科教楼西楼 A112 室

12:00 P.M. - 1:40 P.M.	**Lunch & Networking**	**Fengda International Hotel** 丰大国际大酒店
1:40 P.M. - 3:40 P.M.	**Session D2A1, Chair: Yang Li**	**A106 at West Science Building** 科教楼西楼 A106 室
	Session D2A2, Chair: Song Han	**A108 at West Science Building** 科教楼西楼 A108 室
	Session D2A3, Chair: Yongjun Li	**A110 at West Science Building** 科教楼西楼 A110 室
	Session D2A4, Chair: Mehdi Toloo	**A112 at West Science Building** 科教楼西楼 A112 室
3:40 P.M. - 4:00 P.M.	**Coffee Break & Refreshment**	
4:00 P.M. - 6:00 P.M.	**Session D2B1, Chair: Weiwei Zhu**	**A106 at West Science Building** 科教楼西楼 A106 室
	Session D2B2, Chair: Inmaculada Sirvent	**A108 at West Science Building** 科教楼西楼 A108 室
	Session D2B3, Chair: Zhongbao Zhou	**A110 at West Science Building** 科教楼西楼 A110 室
	Session D2B4, Chair: Guoliang Yang	**A112 at West Science Building** 科教楼西楼 A112 室
6:10 P.M. - 6:30 P.M.	**Closing Ceremony** ***闭幕式***	**YIFU Building: Basement level 1** 建艺馆负一楼
7:00 P.M. -	**Farewell Dinner** **Announcement of Award** **Welcome to Taipei DEA2018**	**Pi Yun Hui Fu Restaurant** 披云徽府

3 Parallel (Student) Sessions

Day 1 Session A1 - A4	
D1A1	**Session Chair: Shiuh-Nan Hwang** **Venue：A106**
Quality & Sustainability	1.Study of Regional Efficiency of China: Perspectives of FDI and Green Development **Yang Li** 2.Decomposition of the quality change of life: focusing on subjective factors **Shiuh-Nan Hwang**, Zhui-Liang Huang, Jian Wang 3.An empirical study of sustainable green growth of hotels in Hong Kong: The role of telecom functions **Pengzhen Ying**, Jingjing Ding 4.Efficiency measurement of healthcare service with consideration quality as an additional output and relationship analysis between quality and efficiency **Tao Du**, Lun Ran, Jin-lin Li, Xiao-fei Li
D1A2	**Session Chair: Yinsheng Yang** **Venue：A108**
Advances in DEA	1.Estimating Directional Returns to Scale in DEA **Guoliang Yang**, Wenbin Liu 2.Performance Evaluation through DEA Benchmarking Adjusted to Goals **Inmaculada Sirve**nt, José L. Ruiz 3.A general DEA approach for non-homogeneous DMUs with known internal working structure **Qianying Jin**, Zhongbao Zhou, Ximei Zeng, Wenbin Liu 4.An efficiency measure focusing on input attributes in data envelopment analysis **Lijing Jiang**, Feng Yang, Sheng Ang
D1A3	**Session Chair: Bing Wang** **Venue：A110**
Energy & Environment	1.A research of the impact of "low carbon" pilot policy on total factor productivity **Cenjie Liu**, Zhongbao Zhou, Ximei Zeng 2.Environmental regulation and productivity growth: a restricted cost function for Chinese fossil-fueled electric power plants **Bing Wang** 3.Energy congestion measurement in nonparametric analysis under natural disposability and managerial disposability **Zhenling Chen** 4.Determinants of environmental efficiency for China's agriculture sector from 1997 to 2014 **Xingle Long**, Yusen Luo, Huaping Sun, Gang Tian
D1A4	**Session Chair: Hung-pin Lai** **Venue：A112**
Stochastic Frontier Analysis	1. A Flexible Panel Stochastic Frontier Model with Serially Correlated Errors **Hung-Jen Wang** 2.The Panel Stochastic Frontier Model with Firm Heterogeneity and Dynamic Technical Inefficiency **Hung-pin Lai** 3.Measurement of Technical Efficiency in Stochastic Frontier Analysis with Limited and Qualitative Dependent Variable **Shih-Tang Hwu,** Wen-Jen Tsay

Day 1　Session B1 - B4	
D1B1	**Session Chair: Feng Yang** **Venue：A106**
Student Session	1.基于非同质假设的节能减排效率评价 朱卫未，**徐玫**，于娱 2.基于交互式迭代算法的中国省际碳减排目标研究 杜娟，胥敬华，**潘盟** 3.基于非同质决策单元的 DEA 评价方法研究：以美国男子篮球职业联赛球队的效率评价为例 杨敏，**魏宇琪**，梁樑 4.合同时长对员工绩效的影响研究：以 NBA 球员为例 **蔡华权**
D1B2	**Session Chair: Sungmook Lim** **Venue：A108**
Student Session	1.Assessing the regional performance of incubators for technology transfer in China: A two-stage DEA approach **Xiaoxiao Liu**, Yaoyao Song, Guoliang Yang 2.The Operation and Stock Analytics on Airlines Performance: A Two-stage DEA Approach **Qian Zhang**, Dimitrios Koutmos, Kun Chen, Joe Zhu 3.Group cross-efficiency evaluation in DEA: An application to Taiwan hotels **Menghan Chen**, Sheng Ang, Feng Yang 4.Frontier construction, DEA and network DEA models for two-stage systems **Qianying Jin**, Zhongbao Zhou, Tiantian Ren, Wenbin Liu 5.Environmental efficiency measurement of China's industrial sectors: A DEA model with non-homogeneous inputs and outputs Jie Wu, **Mingjun Li**, Qingyuan Zhu, Zhixiang Zhou, Liang Liang
D1B3	**Session Chair: Juan Du** **Venue：A110**
Student Session	1. Efficiency Evaluation of Taiwan's Commercial Banks: An Application of the Bootstrapped DEA Model **Chien Ting Lee**, Yang Li 2.Dynamic Performance Evaluation of Securities Industry in China: An Application of the Generalized Malmquist Productivity Index approach **Shu-Hua WU**, Tsu-Tan FU, Mei-Ying Huang 3.Non-Concave Metafrontier and Super Efficiency in the Presence of Network SBM Model: An Application to Bank Efficiency in China **Yantuan Yu**, Jianhuan Huang, Zhujia Yin 4.A DEA Method for Competitive Environment Analysis in Global Operations Strategy: Evidence from Retailing Industry **Jiawen Liu**, Yeming (Yale) Gong, Joe Zhu, Jinlong Zhang 5.Influencing Factors and Guiding Strategy of Low-carbon Transportation in China's YRDA **Huaping Sun**, Lingxiang Hu, Yong Geng, Guangchuan Yang, Shunfeng Song
D1B4	**Session Chair: Jie Wu** **Venue：A112**

Cross-efficiency & Cross-sectional DEA	1.DEA cross-efficiency evaluation and ranking method based on interval data Yu Yu, **Weiwei Zhu**, Qian Zhang 2.Cross-efficiency evaluation capable of dealing with negative data: a directional distance approach **Ruiyue Lin** 3.Multistage Network DEA: Decomposition and Aggregation Weights of Component Performance **Chuanyin Guo** 4.Estimation of Cycle Variation Errors in Cross-sectional DEA Efficiencies **Yi WooPyeong**, Sangmok Kang

Day 2 Session A1 - A4	
D2A1	**Session Chair: Yang Li** **Venue：A106**
Tourist Hotels	1.Measuring productivity of tourist hotels in Taipei by bootstrap data envelopment analysis **Erwin T. J. Lin** 2.Productivity Analysis of Taiwanese International Tourist Hotels: A Bootstrapped Metafrontier Model **Yu-Jung Chen**, Yang Li 3.Technological bias in the production and consumption processes of Taiwanese tourist hotels: A meta-frontier network DEA model **Ming-Miin Yu**, Li-Hsueh Chen 4.The Contribution of Various Diversification Strategies on the Chinese Hotel Industry **Lei-Ya Wang**, Xiaoying Guo, Yang Li
D2A2	**Session Chair: Song Han** **Venue：A108**
Two-stage Network DEA I	1.Second Order Cone Programming Approach to Two-stage Network Data Envelopment Analysis **Kun Chen**, Joe Zhu 2.Open the black box? The study on two-stage network DEA model **Song Han** 3.Evaluation of coordination efficiency in two-stage production systems **Jianhui Xie**, Ya Chen 4.Two-stage network DEA: an unified approach of efficiency decomposition **Li Haitao**, Joe Zhu, Zhang Jinlong
D2A3	**Session Chair: Yongjun Li** **Venue：A110**
Two-stage Network DEA II	1.Two-stage DEA model for haze emission efficiency assessment：Evidence from 31 provinces in China **Xianhua Wu**, Yufeng Chen, Jiawen Liu, Yeming Gong 2. Research on the Efficiency of China's Open-end Funds Based on a Two-stage Network DEA Model **Deyin Jia** 3.Two stage network DEA production game **Qianwei Zhang**, Zhihua Yang 4.A fixed cost allocation based on two-stage DEA and satisfaction degree **Ran Zhang**, Lun Ran, Tao Du, Jinlin Li
D2A4	**Session Chair: Mehdi Toloo** **Venue：A112**

Productivity Change & Growth	1.Source of Growth Analysis at industry-level for selected Asian Economies using DEA Malmquist and Asia KLEMS data bases **Tsu-Tan Fu**, Yih-Ming Lin 2.Productivity change evaluation in DEA models with single input or single output **Mehdi Toloo**, Mona Alibeik 3.Estimating the total productivity growth of insurance companies listed in the Iraqi Stock Exchange **Ahmad H. Battal**, Aysar Y. Fahad, Subhi Jarwaan 4.Measuring the productivity evolution of Chinese regional thermal industries using malmquist-luenberger productivity index **Yao-yao Song**, Xiao-xiao Liu, Guoliang Yang

Day 2 Session B1 - B4	
D2B1	**Session Chair: Weiwei Zhu** **Venue：A106**
DEA Theory & Application I	1.基于多时期网络 DEA 的航空公司运营效率和影响因素分析 **刘丹**，巩彦峰，贾培培，张文珊 2.成本共同邊界下麥式生產力缺口指數之研究：應用於中國與台灣銀行產業比較 **楊永列** 3.金融科技對中國大陸上市銀行與未上市銀行之績效影響 **陳哲明**，鄭政秉 4.中國銀行業營運風險與績效之效率分析：兩階段 DEA 之應用 **高立翰**，劉泓圻 5.台灣老人福利機構營運效率之研究：EBM-Metafrontier DEA 模型之應用 **林灼榮**，林師模，莊旻潔
D2B2	**Session Chair: Inmaculada Sirvent** **Venue：A108**
Banking & Farms	1.Metafrontier profit-oriented Luenberger productivity index: an application to Taiwanese and Chinese commercial banks **Xiang Chen**, Jia-Ching Juo, Tsu-tan Fu 2.Risk Preference and Efficiency in Chinese Banking **Ning Zhu**, Yanrui Wu, Bing Wang, Zhiqian Yu 3.Measuring Dynamic Biased Technical Change in Lithuanian Cereal Farms **Tomas Baležentis**, Alfons Oude Lansink 4.(R, S) policy with correlated demands **Mengyuan Xiang**, Roberto Rossi, Belen Martin-Barragan
D2B3	**Session Chair: Zhongbao Zhou** **Venue：A110**
Transportation & Logistics	1.Performance Evaluation of MRT Transit with Consideration of Undesirable Outputs: A Network DEA with Parallel Structure **Chao-Chung, Kang**, Cheng-Min Feng, Ping-Fung Chou 2.A super-efficiency model to evaluate dataset with undesirable outputs：The case of the evaluation of green ports **Guo-Ya Gan**, Qian-Feng Wang, Hsuan-Shih Lee 3.A Performance Evaluation of the Caribbean Container Ports

	Jose H Ablanedo Rosas, Wenyu Zhang, Hongfeng Liu 4.Productivity Change of Operational Efficiency for Seaport Terminals Kasypi Mokhtar, Nor Hasnaa' Kamilah Mohd Dalim, Ab Saman Abd Kader, Wan Muhamad Amir Wan Ahmad, Zalani Abdullah
D2B4	**Session Chair: Guoliang Yang** **Venue：A112**
DEA Theory & Application II	1.一种确定生产规模调整幅度的弹性模型 **王恰** 2.科学基金项目规模适宜性研究——以 X 学科面上项目和青年项目为例 **段培新**，孟激 3.专利技术对我国环境治理投资效率的滞后期的实证研究 **李洪伟**，李晓璐 4.基于网络 DEA 的高校三类研究科研效率评价 **陈浩**，郑跃，卓翔芝，王妮娜

4 Full Abstracts

Day 1 Session A1 - A4

Session D1A1: Quality & Sustainability

Session Chair: Shiuh-Nan Hwang

"Study of Regional Efficiency of China: Perspectives of FDI and Green Development"

Yang Li

Since the beginning of reform, China attracted foreign direct investment (FDI) in order to speed up industrialization and upgrade industry. Although FDI has contributed significantly to mainland China's economic growth, series of reform and preferential policies have strong area tendency, resulting in the unharmonious regional development in China. In addition, pollution heaven hypothesis suggests that it might result in environmental deterioration. Hence, this paper uses the two-stage DEA approach, proposed by Chen et al. (2010), to evaluate regional sustainable developments of mainland China. The data set, obtained from China statistical yearbook, consists of 30 provinces of China for the period 2006-2009. The empirical results show that the pollution heaven hypothesis is only supported in western region. In addition, optimal demands for origins of FDI in different regions are significantly different.

"Decomposition of the quality change of life: focusing on subjective factors"

Shiuh-Nan Hwang, Zhui-Liang Huang, Jian Wang

The measurement of Quality of Life (QOL) is meant to reflect the people's living condition for the government to formulate public policies to enhance social development and improve human well-being. Study on the measurement of QOL has been a long-term issue and is still ongoing. One major challenge on the measurement of QOL is how to effectively deal with the subjective factors like resident satisfaction. This research is to extend the model for measuring the quality change of life by merging it with Malmquist productivity approach, as expressed by Fare et al.(1995, Int. J. Production Economics 39, 137-147), and this quality change index can be decomposed into objective quality change index and subjective quality change index. Finally, this research also uses empirical data to demonstrate the applications of the model in evaluating the quality change of life for the 22 administrative regions in Taiwan. It was expected this study can provide the useful model for measuring the quality change of life and application.

"An empirical study of sustainable green growth of hotels in Hong Kong: The role of telecom functions"

Pengzhen Ying, Jingjing Ding

This study aims to investigate the role of Green IT in supporting sustainable development strategies in the hotel industry, taking both telecom and overall performance of hotels into consideration. The selected empirical case of 13 Hong Kong hotels uses data for the year 2014. The 13 hotel performances were classified into different efficiency levels using a context-dependent DEA model. Based on this, the current overall and telecom efficiency performance of each hotel were evaluated to examine the current sustainable development states of the hotels on different efficient frontier levels. Based on the clustering results, the relationships between the telecom performance and overall sustainable development of hotels were analyzed. Furthermore, to promote efficiency improvement as well as the sustainable development of hotels, improvement targets for each input or output variable were also calculated. Corresponding suggestions and implications for green IT and the sustainable development of Hong Kong hotels are discussed.

"Efficiency measurement of healthcare service with consideration quality as an additional output and relationship analysis between quality and efficiency"

Tao Du, Lun Ran, Jin-lin Li, Xiao-fei Li

Performance of healthcare service includes quality and efficiency, and there is a relationship between them inevitably. Healthcare quality directly concerns the rights and interests of the people's health and personal experience for healthcare services, and it is one of the main outcomes of healthcare service. In the existing literature, there is no research, to the best of our knowledge, takes the quality as an additional output to measure the efficiency of healthcare.

This article, firstly, uses TOPSIS method calculating relative quality index values of healthcare service of 31 provinces in China. It ensures the consistent comparison of 31 provinces' qualities to act the relative quality index as an additional output in the efficiency measurement process. Subsequently, we assess the 31 provinces' relative efficiencies of healthcare service both with consideration the quality as an output or not, respectively, by constructing DEA models. The result shows that the efficiency values with consideration of quality are not larger than the values without consideration of quality. Furthermore, this article analyzes the relationships between quality and efficiency from each group of the national, the east, the middle and the west, separately, through paired-samples t test. It is concluded that the relationships between quality and efficiency are different along with the both advantage degrees of quality and efficiency. Finally, Tobit regression is used to exam 12 environment variables' impacts on efficiency values both with consideration of quality or not. And the result indicates that the main drivers of efficiency of healthcare service are different while take quality as an additional output or not.

Session D1A2: Advances in DEA
Session Chair: Yinsheng Yang

"Estimating Directional Returns to Scale in DEA"

Guoliang Yang, Wenbin Liu

Data envelopment analysis (DEA) is one of the most commonly used methods to estimate the returns to scale (RTS) of the public sector (e.g., research institutions). Existing studies are all based on the traditional definition of RTS in economics and assume that multiple inputs or outputs change in the same proportion, which is the starting point to determining the qualitative and quantitative features of the RTS of decision making units (DMUs). However, for more complex products, such as the scientific research in institutes, changes of inputs or outputs are often not in proportion. Therefore, the existing definition of RTS in the framework of DEA may need to be extended to estimate the RTS in such situations. This paper proposes the definitions of directional scale elasticity and directional RTS in the DEA framework and estimates the directional RTS using DEA models. Further in-depth analysis is performed for an illustrative example of 16 basic research institutes in the Chinese Academy of Sciences (CAS) in 2010.

"Performance Evaluation through DEA Benchmarking Adjusted to Goals"

Inmaculada Sirvent, José L. Ruiz

This paper proposes a DEA-based approach for the evaluation of performance in organizations within a framework where some goals have been previously set. Such evaluation can thus be seen as part of a monitoring and control process, while at the same time it can provide certain degree of support to management planning. Benchmarking models are developed which make it possible an evaluation of performance in terms of targets that are attainable and represent best practices. In addition, these models seek to find DEA targets that are as close as possible to both actual performances and management goals. Specifically, a series of targets are provided by adjusting the importance attached to each these two objectives. To illustrate, we examine an example which is concerned with the evaluation of performance of public Spanish universities.

"A general DEA approach for non-homogeneous DMUs with known internal working structure"

Qianying Jin, Zhongbao Zhou, Ximei Zeng, Wenbin Liu

Data envelopment analysis (DEA), as originally proposed, is a methodology for evaluating the relative efficiencies of peer decision making units (DMUs). Although it is generally assumed that DMUs under evaluation constitute a homogeneous set, there are many situations where this assumption is not held. The existing literatures mainly focus on evaluating non-homogeneous DMUs under the black box assumption. In many instances, DMUs involved may perform several different and clearly identified functions. In this case, non-homogeneity will arise due to the choice of engaging in different sets of these functions. To address this, the current paper proposes a DEA-based methodology to allow for evaluating non-homogeneous DMUs with known internal working structure, which are able to handle many situations where different aspects of non-homogeneity exist. Specifically, to demonstrate the general model for non-homogeneity,

we apply it to the problem of evaluating financial holding companies (FHCs) where there exists non-homogeneity on both the input and output side. This evaluation provides important insights into not only the fair evaluation of FHCs, but as well provides suggestions for future resource allocation.

"An efficiency measure focusing on input attributes in data envelopment analysis"

Lijing Jiang, Feng Yang, Sheng Ang

In traditional data envelopment analysis (DEA), all decision-making units (DMUs) consume same types of input items to produce same types of output items, and the input and output items in various DMUs are only different in quantities. The identification of DEA efficiency for a DMU is equivalent to finding the lowest quantity of each input item and maximum amount of every output item within the production possibility set (PPS) according to a programming problem. In real word applications, the qualities of input and output items may be distinguishing in different DMUs besides quantities, then the existing DEA methods will be inapplicable. This paper focuses on the input attributes that lead to distinctions in qualities of input items. A new realistic PPS is built, and a corresponding efficiency measure method is introduced. The performance of a DMU is assessed from two aspects containing the quantity and quality. An inefficient DMU is able to be improved by changing the quantities of some input and output items or altering values of certain input attributes or changing the two factors together. The results of this paper show that the quality is as important as quantity in production promotion. A practical example is employed to illustrate the method proposed.

Session D1A3: Energy & Environment

Session Chair: Bing Wang

"A research of the impact of "low carbon" pilot policy on total factor productivity"

Cenjie Liu, Zhongbao Zhou, Ximei Zeng

As the largest carbon emitter, China is under great international and domestic emission reduction pressure. Chinese government has implemented a number of carbon reduction policies to regulate and restrain production activities. It is of great significance for Chinese green development to achieve energy saving and emission reduction goal as well as achieve sustainable economic growth. In this paper, considering different reduction costs of different production units, we construct the total factor productivity index with multiple reduction factors using DEA model and direction distance function. Then, we calculate the total factor productivity based on the panel data of Chinese cities in 2003-2014, which reflects the economic and environmental effects of emission reduction policies. In addition, we construct difference-in-difference model to analyze the effect of "low carbon" pilot policy on regional total factor productivity. It can provide support for Chinese government to promote the implementation of low-carbon development path around the country.

"Environmental regulation and productivity growth: a restricted cost function for Chinese fossil-fueled electric power plants"

Bing Wang

China's fossil-fueled electric power industry is a traditionally energy- intensive industry and is the focus of environmental regulation. In this paper, we propose a restricted cost function approach to measure the effect of environmental regulation on productivity growth for Chinese fossil-fuel electric power plants from 2005 to 2010. This approach allows us to overcome the problem of missing prices for some inputs. We decompose productivity growth into scale effect, the effect of environmental regulation and technical change effect. The empirical results find that there is an approximate U-sharp effect of environmental regulation on productivity growth, partly supporting the Porter hypothesis. Productivity growth is mainly dependent on technological progress. Substitution possibility between capital and energy is good sign for Porter hypothesis.

"Energy congestion measurement in nonparametric analysis under natural disposability and managerial disposability"

Zhenling Chen

This paper proposed a use of Data Envelopment Analysis to examine and measure energy congestion of China's coal-fired

power industry. The concept of energy congestion is classified into under natural disposability and under managerial disposability. This paper detected undesirable energy congestion (UEC) and desirable energy congestion (DEC) under natural disposability and managerial disposability by constructing novel UEC and DEC models. The new congestion models not only assess UEC and DEC of China's coal-fired industries, but also calculate the amount of UEC and DEC, and the driven force of inefficiency. This study finds some police implication: Firstly, Some regions have occurred undesirable energy congestion, most of them are in less developed areas. A reason for this is the proportion of new energy generation in these areas has improved, to some extent, limited the transport capacity of thermal power. Secondly, DEC have occurred in a few regions, however, the average amounts of desirable congestion have continued to increase with each successive year in China. This mean that more and more regions reduce carbon emission by technology innovation. Thirdly, The efficiency of China's regional unification is not high, and most areas have not reached the effective level. It is necessary to improve operational efficiency from two aspects of management efficiency and congestion efficiency. Analysis on UEC and DEC are very useful for the related interest subjects. Specifically, for coal-fired plant manager, it can help them to identify the source of undesirable congestion and made choose strategies on carbon reduction in order to improve operational efficiency. For relevant governments, it can help to detect which region should control or reduce the investment scale of coal-fired plant and which regions have the potential to develop advanced eco-technology in order to promote energy desirable congestion. Additionally, undesirable congestion can be an important index of risk prediction system.

"Determinants of environmental efficiency for China's agriculture sector from 1997 to 2014"

Xingle Long, Yusen Luo, Huaping Sun, Gang Tian

This paper mainly aims to investigate the determinants of environmental efficiency of China's agriculture. First, we estimate environmental efficiency of China's agriculture sector across 30 provinces from 1997 to 2014 through metafrontier SBM super efficiency, which allow for technology heterogeneity across different provinces. Then, we compare environmental efficiency in different regions. Furthermore, we also analyze whether heterogeneity of environmental technology widened or decreased through the comparison of technological gap ratio. Last, we also explore the determinants of environmental efficiency of China's agriculture through bootstrap truncation regression. We find that environmental production technology has lower heterogeneity in the east. Fertilizer intensity negatively affects environmental efficiency. Environmental regulation negatively impact environmental efficiency in the east and middle. Urbanization positively impact environmental efficiency in the east. It is significant use more organic fertilizer to decrease CO2 (carbon dioxide) emissions. It is also important to strengthen environmental regulation. It is important to enhance environmental innovation for China's agriculture.

Session D1A4: Stochastic Frontier Analysis

Session Chair: Hung-pin Lai

"A Flexible Panel Stochastic Frontier Model with Serially Correlated Errors"

Hung-Jen Wang

Recent developments on dynamic panel stochastic frontier models have attract attentions from empirical as well as theoretical researchers. In this paper, we propose estimation methods for a flexible dynamic panel stochastic frontier model. Features of the model include the follows. (1) It accommodates individual heterogeneity as well as time-varying inefficiency. (2) The dynamic takes place at the composed error of the model, rather than specific components of the error. (3) It allows flexible assumptions on the distribution of model residuals. (4) The composed error has a flexible ARMA(p,q) process. (5) The likelihood function is constructed using the method of prediction error decomposition.

"The Panel Stochastic Frontier Model with Firm Heterogeneity and Dynamic Technical Inefficiency"

Hung-pin Lai

Among most existing models of technical efficiency measurement, the main concern usually focuses on the temporal

behavior of inefficiency, not on its dynamics. Although the extension of the model from a static to dynamic one is necessary, inference in such models is relatively complicated. The main objective of this paper is to propose a panel stochastic frontier model that allows the dynamic adjustment of the technical inefficiency as well as firms' heterogeneity. We first show that the composite error of the transformed dynamic panel stochastic frontier follows a closed skew normal distribution. We then propose using the pairwise composite-likelihood (PCL), constructed using the products of all possible joint distributions of the paired subsample, to deal with the high dimension integration problem in the full likelihood function. Moreover, we also provide Monte Carlo simulation results to compare the finite sample performance of the full maximum likelihood (FML) and PCL estimators.

"Measurement of Technical Efficiency in Stochastic Frontier Analysis with Limited and Qualitative Dependent Variable"

Shih-Tang Hwu, Wen-Jen Tsay

As vividly demonstrated in Maddala (1983), limited and qualitative data
has been widely employed in modern econometrics analysis. However, existing methods for evaluating technical efficiency of stochastic frontier analysis can only be applied to continuous dependent variable. This paper considers analytical form for evaluating the technical efficiency of stochastic frontier analysis with limited and qualitative dependent variable, which can avoid the simulation bias and computation burdens due to numerical methods. We also show that our method can be applied to continuous dependent variable when the censoring interval degenerate to 0. Monte Carlo experiments reveal that the finite sample performances of our formula are promising.

Day 1 Session B1 - B4

Session D1B1: Student Session

Session Chair: Feng Yang

基于非同质假设的节能减排效率评价

朱卫未，徐玫，于娱

通常DEA假设一组DMU具有相同的投入、产出组合。然而某些情况下，这一假设并不成立。本文评价了美国39个生产部门的节能减排效率，投入的非同质表现在不同生产部门采取的节能减排措施不同。生产部门在提高能源效率的基础上，还可以采取改变行为模式，使用低碳能源，减少碳排放过程和提高运输效率等四种措施，根据采取措施的不同，将39个生产部门分成四组。研究结果表明，采取提高能源效率和改变行为模式的生产部门节能减排效率最高。针对这一结果，对改变行为模式这一变量进行灵敏度分析。

基于交互式迭代算法的中国省际碳减排目标研究

杜娟，胥敬华，潘盟

众所周知，温室气体的大量排放会引起气候变化和全球变暖等环境问题。其中，二氧化碳作为影响最大的温室气体，主要产生于人类活动。应对气候变化需要来自于全球各个国家的共同行动与努力。作为经济高速发展的发展中国家，中国已于近几年成为世界最大的能耗国和碳排放国。为积极应对温室效应，中国政府计划采取强有力的政策措施，实现节能减排并逐步建立全国碳交易市场。为确保应对气候变化国家方案的切实贯彻实施，如何将全国碳减排目标在各省份间进行合理分配，至关重要。在效率分析的理论框架下，借助于方向性距离函数评价含有非期望产出（碳排放）的绩效表现，在此基础之上提出一种交互式迭代算法，合理有效地将全国碳减排总目标分摊为各省级目标。结果表明，受到地理环境、经济状况、产业结构等因素的共同影响，不同区域相应承担不同水平的减排任务。绝大部分沿海发达地区的省份和直辖市需要大幅减少碳排放量，而中西部经济区则期望减排比例较小。分摊结果不仅显示了方法的有效性和易操作性，也针对各典型区域如何推进可持续发展提供了启发性建议。

基于非同质决策单元的 DEA 评价方法研究：以美国男子篮球职业联赛球队的效率评价为例

杨敏，魏宇琪，梁樑

非同质决策单元的效率评价是目前DEA理论研究中最为热门的领域之一。目前研究非同质DEA评价方法的文

章大多将研究对象限制于仅有投入非同质或仅有产出非同质的决策单元，然而在实际情况下，决策单元之间的非同质性可能会同时出现在投入与产出两个方面。为了解决这一问题，本篇文章提出一个改进的DEA评价模型用于评价非同质性同时体现在投入与产出两个方面中的决策单元。为了使得非同质的决策单元之间具有可评价性，我们将决策单元拆分成若干种同种类内彼此同质的子决策单元。并且，本文提出一种子决策单元的效率值计算方式，随后证明了这种子效率的参考价值。

与其他的非同质DEA研究相比，本文所提出的方法具有以下优点：（1）本文所提出的非同质DEA评价方法是其他非同质DEA评价方法的广义形式，即其他的非同质DEA评价方法都可以看作是本篇文章所提出方法的特殊形式。（2）本文所提出的方法可以精确的揭示决策单元无效的原因，并且能依据子决策单元的效率更为具体的为无效决策单元提供效率改进的建议。（3）本文中所提出的广义非同质决策单元的DEA评价方法同样可以被应用到同质决策单元的评价中。最后，我们将所提出的非同质DEA评价方法应用到30支NBA球队的效率评价中，得出的结果证明本文提出的方法是有效的。

合同时长对员工绩效的影响研究：以 NBA 球员为例

蔡华权

NBA是世界上最受欢迎的比赛之一，每场比赛经由媒体传播到世界各地。球场上球员的良好表现除了能够提高队伍的成绩，还能使其具有很好的广告价值。本文的研究内容是NBA球员效率与合同时长的关系。我们使用DEA的方法计算出球员的相对效率，将合同剩余年限作为有效合同时长。最后，我们发现，在有效合同时长6年至5年，球员的效率上升；在有效合同时长5年到2年，球员的效率下降；在最后一年，球员的效率比上一年上升。这表明，环境一旦安定下来，人们会松弛下来；当未来面临不确定性，人们会表现出更高的竞争力。

Session D1B2: Student Session

Session Chair: Sungmook Lim

"Assessing the regional performance of incubators for technology transfer in China: A two-stage DEA approach"

Xiaoxiao Liu, Yaoyao Song, Guoliang Yang

As start-up firms are often lack of technical, financial and network resources that necessary to their survival and grow up, so Technology Business Incubators (TBIs) emerged as an effective tool designed to overcome tenants business failure, by creating supportive environment for ‘‘hatching’’ of tenants, accelerating the development phase of successful firms, and stimulating innovation and regional development . As China is moving quickly toward a leading country in innovation, there is necessary to discuss TBIs practice in China. This paper proposes a two-stage network DEA (data envelopment analysis) approach based on slacks-based measure. In the described approach, we divide the incubation process into production stage and commercialization stage, and provide the corresponding measures to evaluate the two stages' efficiency, respectively. With the advent of the entrepreneurial tide of science and technology enterprises, the number of TBIs will be increased. A systematic evaluation of TBIs performance has important guiding significance to the development of TBIs.

"The Operation and Stock Analytics on Airlines Performance: A Two-stage DEA Approach"

Qian Zhang, Dimitrios Koutmos, Kun Chen, Joe Zhu

This study explores the performance of airlines via utilizing both operational and stock market indicators in a two-stage network data envelopment analysis (DEA) process. A nine major international airline companies from 2006 until 2016 are examined. In our analysis, we show that there is heterogeneity in the performance of all airlines across time. Most notably, during the 2008-09 financial crisis, we find that stock market-based efficiency scores declined significantly for all our sampled companies. We also show that while low cost carriers generally maintain higher operational-based efficiency scores than their full service counterparts, full service carriers earn higher efficiency scores based on stock market indicators. This finding lends support to our approach and our general premise which argues that performance evaluation methods can yield more comprehensive conclusions if both operational and stock market indicators are utilized.

“Group cross-efficiency evaluation in DEA: An application to Taiwan hotels”

Menghan Chen, Sheng Ang, Feng Yang

Previous studies have paid great attention to the performance of individual decision making units (DMUs). And cross-efficiency as an approach for peer-evaluation has been developed to improve thediscrimination power of DEA. However, DMUs can often be put into groups in practice and the overall performance of groups may be more significant than that of single DMUs for group managers. By far, there is not a jointly accepted methodology for the group evaluation. This paper extends the cross-efficiency evaluation into the group level. We first define the group efficiency in two ways. One is the average definition which defines the group efficiency as the average of its members' efficiencies, and a composite DMU created by all DMUs in the group is employed to calculate the average efficiency. Another is the worst-value definition that thinks the group efficiency is determined by the worst performed member, and a max-min program is modelled to obtain group efficiency. In both of the two self-evaluation models, a common weight bundle is applied to all DMUs in a same group. Then, the average of efficiencies evaluated with weights given by other groups is the group cross-efficiency. To solve the non-uniqueness problem of the group cross-efficiency, aggressive secondary formulations based on the assumption that groups compete with other, are designed. Finally, we assess four hotel chains in Taiwan from 2004 to 2008 using the proposed methodology.

"Frontier construction, DEA and network DEA models for two-stage systems"

Qianying Jin, Zhongbao Zhou, Tiantian Ren, Wenbin Liu

Data envelopment analysis (DEA) is a methodology for evaluating the relative efficiencies of peer decision making units (DMUs). Recently DEA models have been extended to examine the efficiency of DMUs with two-stage processes. In this paper, based on the production possibility set of the two-stage process, we investigate the efficient frontier of two-stage systems. Also we study the relationship between traditional DEA and network models.

"Environmental efficiency measurement of China's industrial sectors: A DEA model with non-homogeneous inputs and outputs"

Jie Wu, Mingjun Li, Qingyuan Zhu, Zhixiang Zhou, Liang Liang

Environmental problems brought by industry are attracting extensive attention so a comprehensive analysis of industrial environmental performance is increasingly important. However, the comparison of industrial sector efficiencies is complicated by the fact that the natural resources consumed and/or the pollutants discharged by each sector may differ. Data envelopment analysis (DEA) is generally used to evaluate the relative efficiencies of decision making units (DMUs) but the basic DEA models have a homogeneity assumption on the inputs and outputs of DMUs. Although previous research has studied non-homogeneous problems, such studies assume the DMUs have either non-homogeneous inputs or non-homogeneous outputs but not both. In this paper, we extend the DEA model to consider two-sided non-homogeneous problems, handling DMU sets that have non-homogeneity in both inputs and outputs. This new model is used to measure the environmental performance of China's industrial sectors and the empirical results show the sectors' efficiencies are low and unbalanced. With this more realistic analysis of environmental efficiency, the Chinese government can make more informed decisions to realize sustainable industrial development.

Session D1B3: Student Session

Session Chair: Juan Du

"Efficiency Evaluation of Taiwan's Commercial Banks: An Application of the Bootstrapped DEA Model"

Chien Ting Lee, Yang Li

Taiwanese banking sector is highly fragmented and competitive (PricewaterhouseCoopers, 2007), yet before 1990 Taiwan's commercial banks were highly regulated and mainly state-owned. Deregulation in Taiwan's banking industry consisted of two major aspects: Privatization of public enterprises and market entry opportunity for new banks. Because of the increasing competition, many banks expanded into multiple ventures, effectively increasing their risk and jeopardizing their productivity and management efficiency. The government therefore sought to improve the strength and competitiveness of the banking industry by promoting consolidation and divesting state holdings. Foreign banks increasingly became attracted to the potential opportunities offered by the country's growing market liberalization and

the rising demand for more extensive and sophisticated banking services. As a result, by the end of 2007 there were thirty-nine domestic commercial banks with 3,313 bank branches. Hence, the efficiency of the Taiwan banking industry has become an important issue.

Data envelopment analysis (DEA) is e was initially proposed by Charnes et al. in 1978, called the CCR model, assumeing that the production exhibits constant returns to scale (CRS), which is only appropriate when all DMUs are operating at an optimal scale. Banker et al. (1984) extended the CCR model to account for variable returns to scale (VRS), called the BCC model. If the technology exhibits CRS globally, the both technical efficiencies of CCR model and BBC model are consistent estimators, but the latter is less efficient than the former; on the other hand, if the technology displays VRS at some locations, then former is inconsistent but latter still remains consistent (Simar and Wilson, 2002).

Traditional DEA approaches rely on linear programming techniques for solution known to be deterministic and non-statistical nature, and therefore, are unable to perform statistical inference directly. We will use the bootstrap estimation procedures, proposed by Simar and Wilson (1998, 2002), to test returns to scale of Taiwan's Commercial banks. In addition, the generated bootstrap samples can also be used to test mean efficiencies of two groups of Taiwan' commercial banks to be equal or not; for example, holding banks versus non-holding banks, old banks versus new banks, local banks versus foreign-owned banks.

"Dynamic Performance Evaluation of Securities Industry in China: An Application of the Generalized Malmquist Productivity Index approach"

Shu-Hua WU, Tsu-Tan FU, Mei-Ying Huang

China stock market has experienced substantial growth since 2006. In recent years, Some Chinese securities firms have also evidenced to be very profitable. However limited study has made in-depth analysis on the dynamic performance of the Chinese securities firms. In this research we will evaluate the dynamic performance of 105 Chinese securities firms for the period from 2007 to 2013. Previous research on the evaluation of Chinese securities firms mainly emphasizes on the use of DEA methodology. To consider the randomness of data and the multiple-output characteristics of securities industry, this research adopts the input oriented stochastic distance function and the generalized Malmquist productivity index approach of Orea (2002) to evaluate the dynamic efficiencies of Chinese securities firms and to decompose the productivity change into efficiency and technical changes as well as scale effect. At last, we also investigate the determinants which affect the efficiency and productivity change of these Chinese securities firms. This will be the first research which applies the stochastic distance function and generalized Malmquist productivity index on the performance evaluation of Chinese securities industry. Therefore, the results will propose high academic value with good possibility to be published in international good quality journals. The empirical results can also be useful for Taiwan government authorities in making their policy formulation and for Taiwanese securities firms in making their investment plans to China.

"Non-Concave Metafrontier and Super Efficiency in the Presence of Network SBM Model: An Application to Bank Efficiency in China"

Yantuan Yu, Jianhuan Huang, Zhujia Yin

The performance of different types of banks may be varied due to the technology heterogeneity which can be considered by implementing metafrontier analysis. However, the metafrontier constructed in mostly existing literature is concave, leading to incorrect or irrational estimation of technology gap ratio (TGR) in network slacks-based measure (SBM) model, i.e., some TGRs are greater than 1. To figure out this dilemma and evaluate the bank efficiency in China over the years 2009-2014, we develop a new model, NCMeta-US-NSBM, incorporating a non-concave metafrontier framework, undesirable outputs and super efficiency into a network SBM model. The mainly empirical results show that: 1) for the overall (stage 1) efficiency, state-owned banks (SOB) perform better than foreign banks (FB), but poorer in terms of the stage 2, 2) the estimates of TGR evaluation of SOB, joint-stock banks (JSB) and FB in stage 1 are higher than those in stage 2, indicating most of the banks have a large space for improvement, especially for SOB and JSB in loan stage, 3) results from the kernel density estimation of efficiency scores reveal that the efficiencies deteriorated slightly from 2009 to 2014.

"A DEA Method for Competitive Environment Analysis in Global Operations Strategy: Evidence from Retailing Industry"

Jiawen Liu, Yeming (Yale) Gong, Joe Zhu, Jinlong Zhang

Competitive environment analysis is critical to global operations strategy research. When corporate performance relates to various operational dimensions with multiple input and output measures, environment analysis will become difficult to calculate the accurate operations efficiency. The objective of this research is to propose a method to conduct competitive environment analysis for GOS. Considering an operational decision in supply chain as an application example, we examine relationships between discretionary inputs of supply chain, non-discretionary inputs of environment, and organizational performance in retailing. We develop a non-discretionary Data Envelopment Analysis model to assess the corporate performance in retailing industry and verify the influence of the environment. Our main contribution is: (1) to provide a new method using data envelopment analysis integrated with econometric analysis in environment analysis for global operations strategy, and (2) to establish a new framework to understand the role of competitive environment in retailing supply chain strategy. Using first-hand and second-hand data of 124 organizations from 32 countries and regions in retailing industry, we find: (1) The efficiency of firms in retailing show striking regional difference; (2) Firms located in a high level market concentration and consumer spend per capita with small population are more likely to achieve the high efficiency in retailing. We provide the implications for practice: managers may adjust firms' inter operations with alignment with industrial organization environment to achieve optimal efficiency.

"Influencing Factors and Guiding Strategy of Low-carbon Transportation in China's YRDA"

Huaping Sun, Lingxiang Hu, Yong Geng, Guangchuan Yang, Shunfeng Song

This paper aims at checking the influencing factors and guiding strategy of low-carbon transportation in China's Yangtze River Delta Area (YRDA). Transportation in urban areas is an important carbon emission source and carrier. In this paper, based on the related panel data of three provinces and one city during 1995-2014 as an example, using partial least squares method and an extended STIRPAT model, an empirical impact analysis of factors affecting carbon emissions in transportation industry in the Yangtze River Delta was made. From the symbols of every variable coefficient in the model we can see that population size, GDP, civilian car inventory, energy intensity, passenger transportation, freight turnover and transport industry output of these seven factors of the transport sector and carbon emissions are positively correlated; while energy construction and transportation industry employees are two variables of the transport sector that control the carbon emissions. In the end, based on the results of empirical analysis for China's regional collaborative low carbon transportation, optimization mechanism and guiding strategy of low-carbon transportation in the YRDA are proposed. It is vitally important to continue to optimize the energy structure and minimize the negative effect of carbon emissions, develop and utilize new energy and new low-carbon technology. Currently the YRDA should seize the opportunity to upgrade the industry, advocate the low carbon awareness of urban residents and the concept of ecological driving, and optimize transport distribution, implement intelligent traffic management.

Session D1B4: Cross-efficiency & Cross-sectional DEA

Session Chair: Jie Wu

"DEA cross-efficiency evaluation and ranking method based on interval data"

Yu Yu, Weiwei Zhu, Qian Zhang

Data envelopment analysis (DEA) is an important method of efficiency evaluation. Cross-efficiency evaluation is one of the main aspects of research in the field of DEA that has been applied in various fields. In the traditional cross-efficiency evaluation model, the variable data of decision-making units is exact. Dynamic information is frequently unable to reflect the whole characteristic when determining the exact data. In this study, we select interval data to represent the dynamic information of some variables in the evaluation process. We then build a solution method based on interval efficiency and DEA cross-efficiency. This method retains the reflection of interval data on uncertain variable properties. Finally, the stochastic multi-criteria acceptability analysis 2 (SMAA2) is introduced to solve the whole sequence problem of interval

efficiency.

"Cross-efficiency evaluation capable of dealing with negative data: a directional distance approach"

Ruiyue Lin

Cross-efficiency evaluation is a commonly used technique for ranking decision making units (DMUs) in data envelopment analysis (DEA). The standard cross-efficiency evaluation is developed with the traditional DEA models, so it is applicable only to the set of DMUs characterized by positive inputs and outputs. This paper aims at extending the applicability of the cross-efficiency evaluation to the situation where inputs and/or outputs have both positive and negative values. We prove that the range directional measure (RDM) model under the constant returns to scale (CRS) condition yields a bounded efficiency score in the input-output data with negative values. Based on this, we explore the duality relation regarding the CRS RDM model and define the cross-efficiencies on the basis of the equivalences with some fractional programming problems. The newly proposed cross-efficiency evaluation provides self- and peer-evaluations of DMUs by measuring the inefficiency both in inputs and outputs simultaneously and generates a cross-efficiency score between 0 and 1 for each DMU. Three weight determination models that implement different alternative secondary goals are developed for choosing weights among multiple optimal solutions. A numerical example is tested to show the validity and effectiveness of the proposed cross-efficiency evaluation in dealing with the negative data and the characteristics of weight determination models.

"Multistage Network DEA: Decomposition and Aggregation Weights of Component Performance"

Chuanyin Guo

Data envelopment analysis (DEA) is a technique for measuring the performance of peer decision making units (DMUs) that have multiple performance metrics. If the performance is viewed as efficiency, then the DEA frontier can be viewed as a production function along with the performance metrics characterized as inputs and outputs. However, DEA can be used as a benchmarking tool where the DEA frontier represents best practice frontier. A significant body of work has been directed at problem settings where the DMU is characterized by multistage or network processes. The current paper first examines weighted additive performance of two-stage process and then extends the methodology to examine general network structures. Under the condition of isolating the impact of stage weights on the overall performance, we propose a new overall performance as convex linear combination of multi-stage performance and prove that the existence of maximum score for the resulting new overall performance. We illustrate our findings through numerical and empirical data sets.

“Estimation of Cycle Variation Errors in Cross-sectional DEA Efficiencies”

Yi WooPyeong, Sangmok Kang

A DEA technical efficiency measure can be expressed by ratio of productivity of a DMU to productivity of frontier. Since input factors of each DMU is not perfectly flexible, productivities can be fluctuated by common external shocks such as business cycle, a demand or factor prices shocks. If some DMUs are more sensitive to external shocks than the others, even cross-sectional efficiency measures can be distorted by external shocks. We named this distortion a Cycle Variation Error. The reason why the term ‘error’ is used for its name is that external shocks are less related technology or managerial ability of the DMU itself; that is, it is just a noise as a viewpoint of technical efficiency measure. In case there are only random errors in DEA efficiencies, regression models whose dependant variable is DEA efficiencies can have consistent estimator for coefficients. However, if Cycle Variation Errors exist, the estimator would be inconsistent because the distribution of a Cycle Variation Error is not normal. We show the existence of Cycle Variation Error and suggest the way to estimate cycle variation error and remove it from DEA efficiency by using time structures of the data based on firm level statistics of Korean cyclical industries.

Day 2 Session A1 - A4

Session D2A1 Tourist Hotels
Session Chair: Yang Li

"Measuring productivity of tourist hotels in Taipei by bootstrap data envelopment analysis"

Erwin T. J. Lin

Data Envelopment Analysis (DEA) has become a popular method for evaluating performance of tourism industries, however, DEA has been criticized for not considering statistical noise and lacking any hypothesis testing. In this study, we apply Bootstrap DEA (BDEA) method to measure Malmquist Productivity Index (MPI) and its components for 43 tourist hotels in Taipei. The data set comes from Database of Tourism Bureau, Taiwan over the year of 2011 to 2016. We choose Room Revenue (RR), Food & Beverage Revenue (FBR) as outputs, and select the number of employees (NE), the number of rooms (NR), as inputs. For comparison, the study also adopts DEA method to measure the MPI and its components. The empirical results reveal that the productivity index grows in the period of 2011 to 2015 but regresses in 2016, compared with 2015 due to efficiency deterioration. The results also indicate that the MPI of tourist hotels under study using DEA method seems to be biased. Finally, based on our empirical results some strategies for improving performance of tourist hotels and possible avenues of future research are proposed.

"Productivity Analysis of Taiwanese International Tourist Hotels: A Bootstrapped Metafrontier Model"

Yu-Jung Chen, Yang Li

Benefited from the expansion of international tourist market, Taiwan's international tourist hotels (ITHs) have expanded rapidly with the support of government policies and aid.

Given the simultaneous and perishable nature of hotel service, managing demand from customers and service capacity influences the profitability of ITHs notably. Hence, how to appropriately evaluate the service performance of ITHs attracts the attention of scholars and governments.

The Malmquist productivity index (MPI), proposed by Fare et al. (1994) and based on the data envelopment analysis (DEA), is commonly used to measure total factor productivity (TFP). It assumes that all decision making units (DMUs) operate under the same technology. However, when DMUs operating under different technologies were assessed by the same efficiency frontiers, the evaluation results obtained by DEA methods might be inaccurate (O'Donnell et al., 2008). If Taiwanese ITHs do exist heterogeneous technologies, the appropriate approach to evaluate their TFP is to measure MPI under the metafrontier framework, which can further decompose the TFP change into within-group efficiency change, within-group technical change, and technical leadership change.

The primary problem is that being a linear-programming-based measure and lack of statistical nature, DEA can neither test whether Taiwanese ITHs do exist heterogeneous nor conduct hypothesis tests appropriately. In addition, ITHs inherently possess a high proportion of fixed costs such as guest rooms and the area of the F&B department, which cannot be adjusted to their optimal value in the short run; therefore, it results in overestimating ITHs' adjustment capabilities without incorporating this constraint in the empirical specification. Hence, this study will extend the bootstrapping approach, proposed by Simar and Wilson (1998, 1999), by taking into account the property of quasi-fixed inputs to measure MPI of Taiwanese ITHs under the metafrontier framework. Given the sampling distribution obtained by the appropriate bootstrapping method, we can test whether Taiwanese ITHs exist heterogeneous technologies, conduct research hypotheses, and construct the conference intervals for MPI and their decompositions.

"Technological bias in the production and consumption processes of Taiwanese tourist hotels: A meta-frontier network DEA model"

Ming-Miin Yu, Li-Hsueh Chen

The development of tourism industry has promoted the expansion of hotel industry. However, the booming hotel industry led to fierce competition among hotels. In order to survive in the long run, the performance will be an important determinant. In addition, by understanding the relative marginal rate of transformation (MRT) and marginal rate of

technical substitution (MRTS), analysts and managers can understand the trade-offs between inputs or outputs, and then make the choices between alternative production plans. In the hotel industry, hotels may face different operational technologies, and their services are usually produced and consumed concurrently. In order to estimate the performance, MRT and MRTS with considering the heterogeneity problem and distinguishing the production of services from the consumption of services, we build a novel network meta-frontier data envelopment analysis model, which combines the network data envelopment analysis model and meta-frontier data envelopment analysis model, to simultaneously evaluate the production efficiency and service efficiency. Through the relative MRTSs among inputs between a specific group and the whole hotel industry and the relative MRTs among outputs between a specific group and the whole hotel industry, we can compare the difference between meta-technology and group technology, and investigate the technological bias of individual hotels. An empirical application 109 Taiwanese tourist hotels in 2015 is provided. The empirical results indicate that the sources of inefficiency among tourist hotels mainly results from the input excess and output shortfall. The directions of technological bias for individual hotels are different. In order to pursue the advance technology, most hotels should correct their production and consumption technology styles.

"The Contribution of Various Diversification Strategies on the Chinese Hotel Industry"

Lei-Ya Wang, Xiaoying Guo, Yang Li

Benefited from the expansion of international tourist market, the tourist hotel industry has also experienced a rapid growth. In the face of rapid development and increasing intra-industry competition, diversification becomes an important strategy of the tourist hotel industry to reduce risk, increase revenue, and improve performance. However, services are typically produced and consumed simultaneously, the characteristic of inseparability. Previous studies analyzed the effect of the diversification strategy on the tourist hotel industry by revenue diversification only which is from the viewpoint of production, and lack of consideration from consumption side. This could be one of possible reasons why empirical studies of diversifications on the performance of the tourist hotel industry cannot get a consistent conclusion. We argue that one dimension of diversification (from production side) is insufficient to explain influences of the diversification strategy on tourist hotel industry, and need at least another dimension (related to the viewpoint of consumption) to completely analyze the relationship between diversification strategy and performance of the tourist hotel industry.

Many studies have used the two-stage approach to analyze how environmental variables influence operating efficiencies, by employing Data envelopment analysis (DEA) to obtain efficiency scores in the first stage and then regressing the efficiency scores on environmental variables in the second stage. Most of them have specified the tobit model in the second stage by observing that several efficiencies are equal to unity, suggesting a probability mass at one and a concept of latent variables. Simar and Wilson (2007) argued that it is primarily an artifact of the finite samples of the DEA model to decide whether efficiency equals one and not the property of latent variables. Hence, the appropriate approach in the second stage should be the truncated regression model. In addition, the dependent variable, estimated by the DEA model, is serially correlated, and the random distance in the second stage is also correlated with environmental variables. They therefore introduced bootstrap procedures to overcome the above problems. Hence, this study uses the bootstrapped truncated regression model, proposed by Simar and Wilson (2007), to analyze how various diversification strategies influences the efficiency of the Chinese hotel industry.

Session D2A2: Two-stage Network DEA I

Session Chair: Song Han

"Second Order Cone Programming Approach to Two-stage Network Data Envelopment Analysis"

Kun Chen, Joe Zhu

Efficiency aggregation and efficiency decomposition are two techniques used in modeling decision making units (DMUs) with two-stage network structures under network data envelopment analysis (DEA). Multiplicative efficiency decomposition (MED) is usually used in a very specialized two-stage structure when constant returns to scale (CRS) is

assumed. MED-based network DEA retains the property of the conventional DEA in the sense that input- and output-oriented models yield the same efficiency scores. Compared with the additive efficiency decomposition (AED), MED does not require predetermined weights to combine individual stage efficiencies. However, if there are external inputs to the second stage, and/or some outputs leave the first stage and do not become inputs to the second stage, or if we assume variable returns to scale (VRS), MED has limited capability to address these extensions. Alternatively, multiplicative efficiency aggregation (MEA),which is highly nonlinear and is impossible to be transformed into a linear programming problem, defines the overall efficiency as a product of stage efficiency scores and can be easily applied to general two-stage network structures. The current study discovers that MEADEA model for general two-stage networks corresponds to a cone structure in disguise, and can be transformed into the form of second order cone programming (SOCP). Therefore, MEA in two-stage network DEA can be effectively and efficiently solved, regardless of the network structures. We show that AED can also be solved using SOCP and demonstrate that input and output-oriented AED models may not yield the same efficiency scores under CRS. The current research enables us to solve both MEA and AED using SOCP which is considered as effective as linear programming.

"Open the black box? The study on two-stage network DEA model"

Song Han

The classic DEA model is called the black box model, because that it can not analysis the structure of the Decision making unit. The network DEA model have been set up from 1996, it can measure the overall efficiency of the DMU with intermediate product or intermediate input. That means it can open the black box. In many cases DMUs may consist of two-stage network structures with intermediate measures, and there are plenty of research of network DEA in methodology and applications. In this paper, we compare with several different network DEA models with two stages series structure, and prove the relationship of them. Then we want to show which models can really open the black box. At the end, we measure Chinese commercial banking overall efficiency and sub-stage efficiency using these models.

"Evaluation of coordination efficiency in two-stage production systems"

Jianhui Xie, Ya Chen

Previous two-stage network data envelopment analysis models decompose the overall efficiency of decision making units to the efficiencies of their two sub-stages. Two problems exist in these decomposition methods: 1) The efficiencies of the two sub-stages are not unique; 2) the coordination effect between the two sub-stages is ignored. In this paper we attempt to define the coordination efficiency and propose a novel data envelopment analysis -based approach to evaluate the performance of two-stage production systems. Our approach considers coordination effect and provides unique efficiency scores. The current study shows that our approach works under both constant returns to scale and variable returns to scale assumptions and can be applied to general two-stage production systems. Two numerical examples illustrate the advantage of our method.

"Two-stage network DEA: an unified approach of efficiency decomposition"

Li Haitao, Joe Zhu, Zhang Jinlong

In two-stage network DEA process, the centralized model has been widely used to evaluate DMU’s efficiency. There may exist some flexibility in decomposing the overall efficiency into stage efficiencies due to the existence of multiple optimal weights in linear program. Generally, there are three major methods dealing with this problem, which is called uniform efficiency distribution method, Nash bargaining game method and leader-follower method. In this current paper, we simplified uniform efficiency distribution method through demonstrating several geometric properties of Pareto front , and further proved the equivalence in essence between uniform efficiency distribution method, and Nash bargaining game method. By redefining the fairness of efficiency decomposition from the original DEA idea, this current paper proposes a ranking-based efficiency decomposition approach. This new approach includes uniform efficiency distribution method and Nash bargaining game method as a special case when one parameter takes zero value , and leader-follower method as another special case when another parameter takes extreme value. In words, the new approach reasonably explains the fairness of efficiency decomposition, and includes three major traditional efficiency decomposition methods

in a unified framework. At last, an empirical case is studied to illustrate the new approach.

Session D2A3: Two-stage Network DEA II

Session Chair: Yongjun Li

"Two-stage DEA model for haze emission efficiency assessment：Evidence from 31 provinces in China"

Xianhua Wu, Yufeng Chen, Jiawen Liu, Yeming Gong

The hazy weather in China is increasingly serious. It is urgent for China to reduce haze emissions in environmental governance. According to the characteristics that the haze is secondary particle, the haze generation stage is taken as the first stage, the haze management stage as the second stage. A two-stage DEA model with intermediate input and intermediate output is constructed, where the haze generation stage is taken as the first stage and the haze management stage as the second stage. This paper calculates the output efficiency of the 31 provinces in China, and evaluates the efficiency of each province. The results showed that, all the efficiency values of the two-stage of provinces are different except Tibet whose haze generation efficiency and management efficiency is both 1, which is DEA efficient. As a whole, the efficiency values of the first stage in the eastern region are the highest efficiency, followed by the western region, the central region of the lowest. The efficiency values of the second stage in the western region are the highest efficiency, followed by the central region, the eastern region of the lowest. In this paper, the Network DEA model for the evaluation of haze emission efficiency is constructed for the first time, which extends the scope of DEA applications and the conclusion can provide reference for the treatment of similar pollutants such as haze.

"Research on the Efficiency of China’s Open-end Funds Based on a Two-stage Network DEA Model"

Deyin Jia

In this paper, we treat the fund business as a series network structure of two stages, and established a two stage network DEA model with intermediate variables based on the actual situation. The first stage is the operation and management stage, and the second stage is portfolio management stage. We choose 94 open-end funds of year 2016 as the research object from the Wind financial information database, and the inputs of the first stage are management fees, trustee fees and service fees, and the outputs of the first stage which are also the inputs of the second stage are net assets value and the fund size, and the outputs of the second stage are return rate and alpha (which is the excess return rate). According to the size of the funds, we divide them into three groups, and obtain the efficiency value and ranking of the whole and each group respectively. We combine the evaluation results and some basic situation of the fund to analyze the following aspects. First of all, we compare the overall efficiency values, the sub-stage efficiency values and rankings of the funds, and analyze the different performance of the funds in two stages. Secondly, we find that the efficiency situation of small sized funds is better than large sized funds by comparing the ranking of all funds. Finally, we analyze the significance and realistic meaning of the efficiency results according to other indicators of funds, such as the investment concentration, team stability and Wind comprehensive rating. One important conclusion is that the lower the investment concentration is, the better the efficiency value of the fund is.

"Two stage network DEA production game"

Qianwei Zhang, Zhihua Yang

This paper studies the two stage network DEA production games. Organizations with two stage production processes are assumed to possess available resources and technologies, where the technologies are generated from the observed units based on network DEA production possibility set. Five types of cooperation are considered: In the first type, the organizations share both the available resources and the technologies for both stages. In the second type, the organizations share the available resources while keep their own technologies for both stages. In the third type, the organizations keep their available resources while share the technologies for both stages. In the fourth type, the organizations share the available resources and the technologies for the first stage, while keep their own technologies for the second stage. In the last type, the organizations keep their technologies for the first stage, while share the available

resources and the technologies for the second stage. Five models of maximizing revenues of coalitions are established based on the network DEA production possibility set, by which the maximal revenues for the five types of cooperation can be calculated. The revenue among the coalitions can be allocated based on nucleolus and Shapley value. Numerical examples are given to illustrate the proposed approach. Conclusions are drawn that the more cooperativeness, the more revenue each organization can get.

"A fixed cost allocation based on two-stage DEA and satisfaction degree "

Ran Zhang, Lun Ran, Tao Du, Jinlin Li

This paper consider the fixed cost allocation problem among the decision making units (DMU) with two-stage and have the same input and outputs. Regard the fixed cost as a new input, establish an additive two-stage DEA model. First, we proved that each DMU could find at least one allocation plan to make its total and each stage Pareto effective. Then, we proved that there was at least one allocation plan for all the DMU and their stages to be Pareto efficient under a common weight. Further, we gave this efficient fixed cost allocation set. In order to obtain an equitable allocation, we defined the satisfaction degree of each DMU's stage. Through Maximizing the minimal satisfaction degree, we could get the final allocation plan. The numerical example shows that our approach is feasible and valid. We consider the efficiency and fairness together, and the fixed cost allocation obtained from our approach is fair and valid.

Session D2A4: Productivity Change & Growth

Session Chair: Mehdi Toloo

"Source of Growth Analysis at industry-level for selected Asian Economies using DEA Malmquist and Asia KLEMS data bases"

Tsu-Tan Fu, Yih-Ming Lin

The industry-level source of growth analysis using the KLEMS data base has recently been widely adopted for cross-country productivity comparisons. While these studies adopt the growth accounting methods, they fail to decompose the total factor productivity into the components of technical change and efficiency change, which may cause unreliable estimates of productivity and thus mislead the policy implication. The purpose of this research is to integrate panel data production frontier models (DEA Malmquist) with the Asia KLEMS data base for measuring source of output growth and productivity components in Asian economies such as Taiwan, Korea, and Japan. We also identify the major drivers of output growth for each industry of each country investigated and for each time period in 1980-2012. Cross-country comparisons on industrial structure and growth pattern for manufacturing and service industries, as well as results of source of growth and productivity change analysis, are undertaken in this research. This is an innovative research which attempts to integrate the KLEMS data with production frontier models. Therefore, research results will provide great academic value and references to policy makers.

"Productivity change evaluation in DEA models with single input or single output"

Mehdi Toloo, Mona Alibeik

This paper deals with the performance evaluation of single input or single output productions. We provide an efficient and easy procedure to acquire the optimal solution of both input- and output-oriented linear programming problems without solving any optimization problem. The optimal solutions obtained by the proposed approach significantly reduces the computational burden required to measure the Malmquist productivity index (MPI) including catch up and frontier-shift effects. Two numerical examples illustrate and validate our new approach.

"Estimating the total productivity growth of insurance companies listed in the Iraqi Stock Exchange"

Ahmad H. Battal, Aysar Y. Fahad, Subhi Jarwaan

The study aimed to measure the total productivity growth in the insurance companies listed in the Iraqi Stock Exchange for the period 2005-2014. By employing the Malmquist productivity index, which is widely used to estimate total productivity, this index are consists of two parts, the first is technological change and the second is due to the technical efficiency change. The study sample included five insurance companies listed in the Iraqi Stock Exchange for the period

(2005-2014). The data were obtained from the Iraqi Stock Exchange website.

The results showed that there was a negative growth of Iraqi insurance companies during the study period and the growth rate of the negative 15% according to the Malmoxet total productivity index. This negative growth is due to the decrease of technical efficiency growth by 21% and the decline of technological growth by 11%. The general average shows the weakness of the performance of insurance companies and the decline in their financial role during the period of study, and may be due to weak financial depth and financial desolation in Iraq.

"Measuring the productivity evolution of Chinese regional thermal industries using malmquist-luenberger productivity index"

Yao-yao Song, Xiao-xiao Liu, Guoliang Yang

Chinese thermal power industry has experienced rapid development recently, and it has become the major way of Chinese power generation. But it turned to be the major source of air pollution in China because it relies on the consumption of coal. To solve the resource consumption and environmental pollution problems, the productivity of Chinese thermal industries have aroused widespread concern in society. In this paper we use data envelopment analysis (DEA) and global Malmquist-luenberger productivity (GMLP) index for measuring the productivity evolution on Chinese regional thermal industries. The results reveal that although the change of technical efficiency and scale efficiency had different influence in each year among different regions, the overall GMLP index change shows a close relationship with the contemporaneous frontier shift, which indicates that Chinese government should focus on the promotion of the implementation of policy and regulations in thermal industries for the purpose that the contemporaneous frontier can shift toward the global technology frontier in the direction of more desirable outputs and less undesirable outputs.

Day 2 Session B1 - B4

Session D2B1: DEA Theory & Application I

Session Chair: Weiwei Zhu

基于多时期网络 DEA 的航空公司运营效率和影响因素分析

刘丹，巩彦峰，贾培培，张文珊

近年来，亚太地区尤其是中国的强劲经济增长带来了航空运输市场的扩张和更大的航空连通性。国际民航组织（ICAO）的年度统计报告显示：2015年亚太地区仍是航空运输业务量最大的地区，占全球航空业务量的32%，增长率高达9.2%。亚太地区航空公司运营的效率和质量则直接关系到全球航空业发展的稳定性和可持续性，因此，有效评估和分析亚太地区航空公司的运营效率及其效率影响因素，具有重要的现实意义。

目前许多学者使用数据包络分析方法,研究航空公司的运营效率,但多数研究将航空公司运营过程看成一个"黑箱"，忽略其内部运营子过程对整体效率的影响。虽然一些研究打开"黑箱"将航空公司运营过程分解为不同的子过程，但是均未考虑多个时期运营子过程的效率对公司整体效率的影响，并对各子过程效率的影响因素探讨不足。

针对既有研究的不足，本文应用多时期网络DEA方法，以2011-2015年亚太地区16家主要航空公司为样本，测评其总效率和生产及销售两个子过程的运营效率。重点探讨航空公司生产及销售两个子过程对航空公司总运营效率的影响，以及不同时期效率对样本期内总运营效率的影响，并对航空公司生产子过程效率和销售子过程效率的影响因素进行实证分析，以期为航空公司管理者提供决策参考。

成本共同邊界下參式生產力缺口指數之研究：應用於中國與台灣銀行產業比較

楊永列

自從Solow (1957) 提出新古典成長理論(neoclassical growth theory)，預測各國的平均實質所得水準終會收斂至穩定狀態 (steady state)，此即為收斂假說(convergence hypothesis)。 Solow之論點，無法合理解釋先進國家與後進國家每人實質所得成長之事實。Lucas (1988) 與Romer (1986) 等遂提出內生成長理論或新成長理論，利用人力資本累積及其他機制，試圖解決新古典成長理論的缺失。自此，經濟成長的議題廣受經濟學家討論。以效率與生產力文獻為例， Lozano – Vivas and Pastor (2006) 引進總體經濟收斂假說，檢驗各國銀行部門生產力對總體經濟表現收斂與發散之影響。另外，自1970年代以來，世界主要經濟先進國家推動一連串金融改革之後，引發不同發展程度國

家包括台灣、中國在內，陸續從事改革。受上述文獻啟發，本研究思考：經過這一段不算短的金融改革歷程，不同發展程度國家銀行業之效率與生產力差距是否存在縮小現象?

目前討論跨國銀行產業效率與生產力比較研究之文獻，分別從生產面或成本面，利用DEA、SFA模式，進行估計與比較不同國家銀行業效率或生產力數值，再據以推論造成差異之來源。然而，對於造成生產力差異來源之技術缺口之幅度到底為何，以及是否隨時間經過而擴大或縮小等相關訊息，則缺乏有系統的估計與討論。這些動態資訊不僅有助於研判「收斂假說」是否適用於銀行業，對於銀行本身、銀行產業，甚至金融管理機構，研議改善銀行體質，提升競力作法，能夠提供較明確方向的指引。

2012年8月31日兩岸正式簽署「兩岸貨幣清算合作備忘錄」，目前已有不少大金融機構展現拓展中國市場的意願。為規避以往台灣製造業移轉生產基地至中國後，所衍生之利弊得失，台灣銀行產業相對於先進國家（如美國）、中國之技術落差為何？這是繼「兩岸貨幣清算合作備忘錄」簽署後，未來可能進一步擴大金融服務業往來之時刻，值得我們嚴謹以對的關鍵議題。

基於上述三點理由，本研究將以新古典成長理論之收斂假說為理論基礎，結合 Battese and Rao(2002) 的 Meta-frontier（共同邊界），重新架構 Maniadakis and Thanassoulis (2004) 的 CM 分解法，形成Meta- CM生產力缺口指數（Meta-CM-Productivity Gap index，Meta-CM-PG）分解。以來補抓中國與台灣銀行業之技術收斂效果。

金融科技對中國大陸上市銀行與未上市銀行之績效影響

陳哲明，鄭政秉

本文探討金融科技對中國大陸上市銀行與未上市銀行的經營績效影響，研究對象為2014年至2015年間中國的8家上市銀行以及6家未上市銀行。研究方法分為資料包絡分析法(Data Envelopment Analysis, DEA)與隨機邊界法(Stochastic Frontier Analysis, SFA)兩大架構。本文研究發現資料包絡分析法與隨機邊界法的結果具有高度的一致性。在衡量金融科技對銀行效率影響的方面，兩方法皆顯示手機銀行用戶總數與銀行的經營效率為負相關，潛在原因可能為手機銀行對於傳統臨櫃業務的替代率太高，造成銀行既有的勞動投入過多；而手機銀行交易總額與銀行的經營效率為正相關，顯示透過手機銀行交易的金額愈大則銀行經營效率愈佳。在經營效率方面，非上市銀行整體平均優於上市銀行，原因在於國有銀行的經營績效不佳使得上市銀行的整體效率變低。

中國銀行業營運風險與績效之效率分析：兩階段 DEA 之應用

高立翰，劉泓圻

有別於過去研究以仲介法(intermediation approach)的投入與產出探討銀行效率表現的方式，本研究利用附加價值法(value-added approach)將營運風險視為中間產出，並以風險投入所創造之營收績效來分析銀行之經營效率。透過兩階段資料包絡分析法(two-stage DEA)分析中國大陸銀行2008-2015年之經營資料，並區分不同屬性間之營運風險與營收績效之效率表現後，可獲致以下結論。在風險產出的效率表現上，不同屬性銀行間所呈現之風險效率值雖然相近，但總效率值仍以國有五大銀行表現最佳。而在2008年的金融風暴後，中國銀行業的風險效率值漸有提升，但隨著網路金融興起與地方銀行大量設立的衝擊下，最近三年(2013-2015)之風險效率值表現則有下降趨勢。在最終產出的效率表現，中國大陸各銀行間的營收績效效率值雖然相近，但在考量風險後之總效率值卻有明顯差異，代表銀行經營效率之衡量，受到風險層面之影響甚鉅。綜上所述，中國大陸之銀行經營效率雖仍以國有大型銀行表現較佳，但除了應考慮風險因素以外，亦應檢視國有持股對經營效率的影響，以獲得更全面的評估。

台灣老人福利機構營運效率之研究：EBM-Metafrontier DEA 模型之應用

林灼榮，林師模，莊旻潔

本文以台灣綜合型與養護型老人福利機構為研究對象，結合Epsilon基礎衡量與共同邊界等二組嶄新的資料包絡分析法，推估群組技術效率、技術缺口比率與共同邊界技術效率。實證結果顯示：(1)以投入產出可兼顧固定與變動比率調整之Epsilon衡量法，所推估之技術效率，顯著異於傳統資料包絡分析法；且發現綜合型與養護型存在顯著效率邊界差異，而有必要使用Metafrontier進行實證分析。(2)綜合型之營運規模顯著大於養護型，但前者共同邊界技術效率之平均數(0.548)卻顯著低於養護型(0.642)，顯示前者所需效率改善空間(45.2%)高於後者(35.8%)。(3)效率等於1之標竿單位，除了台北市社會局老人自費安養中心外，其餘8家群組技術效率等於1，4家共同邊界技術效率等於1，皆為私利機構，隱示私營之誘因機制優於公營。

Session D2B2: Banking & Farms
Session Chair: Inmaculada Sirvent

"Metafrontier profit-oriented Luenberger productivity index: an application to Taiwanese and Chinese commercial banks"

Xiang Chen, Jia-Ching Juo, Tsu-tan Fu

In order to compare and measure the sources of productivity change and their gaps, this study applies the data envelopment approach and extends the group-specific profit Luenberger productivity indicator to define the mate profit Luenberger productivity indicator under meta production technology. By using the gap of the group-specific technology and its meta potential technology, this study defines the productivity gap as the difference of these two productivity indicators to estimate the convergence of the group profit frontier to the meta profit frontier. And this study further measures and compares the gaps of the decomposition of the productivity change to estimate the variations in the productivity change components across groups. To implement the comparison, this study use 31 Taiwanese banks and 50 Chinese banks for the 2010-2014 period to empirically measure and compare the productivity and its decompositions as well as their gaps.

"Risk Preference and Efficiency in Chinese Banking"

Ning Zhu, Yanrui Wu, Bing Wang, Zhiqian Yu

Departing from earlier efficiency studies considering banking risk preference, this paper employs a multi-directional efficiency analysis approach to measure technical efficiency of 49 Chinese commercial banks during 2004-2012. This approach allows for endogenous classification of three risk preferences, namely the conservative, moderate and aggressive risk modes, by changing direction vectors, and hence efficiency estimates based on the optimal risk preference. The findings show that the moderate risk preference is the most appropriate strategy to achieve technical efficiency in the Chinese banking sector. It is also shown that low risk costs, compulsory credit spreads and scale expansion played a critical role in promoting the development of Chinese banking sector in earlier years, but their effect decreases rapidly. The findings also imply that the average technical efficiency scores of joint stock commercial banks and city commercial banks were higher than those of state-owned commercial banks under the optimal risk preference, and that efficiency mainly shows a trend of improvement over time.

"Measuring Dynamic Biased Technical Change in Lithuanian Cereal Farms"

Tomas Baležentis, Alfons Oude Lansink

In this paper, we propose a novel environmental Luenberger-Hicks-Moorsteen Total Factor Productivity indicator and its decomposition incorporating negative externality into the measurement of economic performance. The special cases of the generalized environmental directional distance function are involved in the definitional and decomposition proposed. We suggest applying the weak disposability environmental technology in lines with a non-parametric approach to implement the proposed decomposition. The LHM indicator decomposes into the three terms representing technical change, technical inefficiency change, and scale inefficiency change. The changes in the environmental TFP for OECD countries are then estimated by applying the data set covering years 1990-2014. We then show the differences of the proposed framework for decomposition of the LHM indicator if opposed to some existing ones. The results suggest the proposed approach diverges from the strong disposability approach in terms of the cumulative environmental TFP.

"(R, S) policy with correlated demands"

Mengyuan Xiang, Roberto Rossi, Belen Martin-Barragan

This paper addresses the single-item single-stock location stochastic lot-sizing problem under (R, S) policy. We assume demands in different periods are dependent, and modelled as an autoregressive process. We present a mixed integer linear programming (MILP) model for computing optimal (R, S) policy parameters. This model is built upon the piecewise linear approximation of the first order loss function. Our model can be extended to discuss different variants of the stochastic lot-sizing problem that include penalty cost scheme, service level constraints (α , β , and β cyc). It can also be operated under lost sale settings. Our computational experiments demonstrate the effectiveness and versatility of our

model.

Session D2B3: Transportation & Logistics

Session Chair: Zhongbao Zhou

"Performance Evaluation of MRT Transit with Consideration of Undesirable Outputs: A Network DEA with Parallel Structure "

Chao-Chung, Kang, Cheng-Min Feng, Ping-Fung Chou

The MRT (Mass Rapid Transit) system has been wildly introduced by the public agency to offer transport service to passengers in metropolitan area. The performance evaluation of MRT is an indication that public agency and operators used to modify their operation strategy. The traditional DEA (data envelopment analysis) approach has been wildly utilized to measure performance for public transport industries by many previous studies. However, most studies have focused on assessing efficiency changes and few studies explored simultaneously the efficiency and effectiveness of MRT systems and explored the performance changes of the subsystems of MRT. In addition, the undesirable output such as accident, has not always been considered in the assessment model by the previous studies.

This study proposes a network DEA model with parallel structure to measure simultaneously the efficiency and effectiveness of MRT system and its subsystems. In addition, the undesirable outputs, accidents, of MRT system have been incorporated into the assessment model. The case study with Taipei MRT system is conducted for assessing performance of MRT system and sub-systems. The empirical study shows that average overall operational effectiveness is 0.9885, smaller than one which implies that the Taipei MRT company needs to modify about 1.15% of their inputs, bad or final outputs for reaching the effectiveness frontier situation. On the other hand, the efficiency and effectiveness in the Medium Capacity Transit System is higher than that of High Capacity Transit System. Results of empirical study show that the model proposed by this study can be applied to measure performance for other MRT systems with sub-systems.

" A super-efficiency model to evaluate dataset with undesirable outputs：The case of the evaluation of green ports"

Guo-Ya Gan, Qian-Feng Wang, Hsuan-Shih Lee

Sustainable development is always an important issue for the operational research and daily lives. During the production process, one challenge for the managers is to balance the mix management problems of improving the traditional production performance (desirable outputs) while reducing the terrible influence (undesirable outputs), especially for the environmental protection issues. However, the standard Data Envelopment Analysis (DEA) model, used to measure the relative efficiency of decision making units (DMUs) with multiple inputs and outputs, is always focusing on only improving the production performance as ‘‘desirable outputs’’ when maintaining or reducing the investments. Then, Hwang et al. (2012) proposed a new approach to evaluating a DMU’s sustainable design performance via treating the undesirable factors as the dominating factors. Due to the new approach is a modified version of Färe et al. (1989) based on the output-oriented BCC model, the discrimination power of the new approach would be seriously reduced when the number of evaluated DMUs is few. To provide a clear ranking for all evaluated DMUs, this study has tried to directly extend the approach proposed by Hwang et al. (2012) to the super-efficiency model while maintaining the dominating position of the undesirable factors. However, we identified some irrationality results evaluated by the extended super-efficiency model appears, and a detailed interpretation is presented. Further, this study modified the super-efficiency model for a more reasonable evaluation results. And an application of the performance evaluation of green ports’ operating equipment is utilized to demonstrate the reasonability of the modified super-efficiency model.

"A Performance Evaluation of the Caribbean Container Ports"

Jose H Ablanedo Rosas, Wenyu Zhang, Hongfeng Liu

Port terminals are major components of transportation and logistics systems, and play an important role in the operational performance of global supply chains. The Caribbean port system is of significant interest for international trade. The Caribbean port terminals have access to the United States of America, one of the most important international

markets, and to emergent economies such as Mexico and Brazil, who are both producers and consumers in the global economy. This paper investigates the operational performance of the major Caribbean port terminals based on a cross-evaluation data envelopment analysis model. The utilized cross-efficiency model eliminates the drawback of traditional cross-efficiency approaches; it generates a unique set of positive weights with minimal variation among them, which are used to cross-evaluate the port terminals (decision making units). Furthermore, the cross-evaluation scores during time are estimated and their relationship with port's connectivity is studied. Different data envelopment analysis models and performance factors are discussed as well. The analysis of results shows that performance evaluation of port terminals is a complex task of critical importance for attaining competitiveness in current global supply chain networks. The approach proves to be highly discriminant among decision making units, and eminently useful for decision makers.

" Productivity Change of Operational Efficiency for Seaport Terminals"

Kasypi Mokhtar, Nor Hasnaa' Kamilah Mohd Dalim, Ab Saman Abd Kader, Wan Muhamad Amir Wan Ahmad, Zalani Abdullah

As an interface between land and sea, seaport plays multimodal role in delivery cargoes worldwide. The evolution of containerized cargo has change the landscape movement of goods drastically. Current generation of cellular vessels require high level of efficiency and productivity of terminals. Therefore, efficiency and productivity are significance indicators to ensure terminals performance are in place. Thus, research aims is to measure empirically efficiency and productivity of container terminals with allocated resources and forecast terminals throughput by using Data Envelopment Analysis and Eviews. The research is using constant and variable return to scale on output-orientated model with focus on the expansion of production as an analysis. A set of 2005-2015 data from reliable resources are achieved for analysis. Efficiency outcome shows significant efficient of constant and variable return to scale. As well for Malmquist Productivity Index, significant progress for constant and variable year pairs derived. Forecast outcomes of 2015-2025 depict reasonable moving average of throughput for allocated terminals. The research indicates that utilization of terminals are subject to internal and external factors to be considered.

Session D2B4: DEA Theory & Application II
Session Chair: Guoliang Yang

一种确定生产规模调整幅度的弹性模型

王恰

规模弹性（SE）能够定量分析决策单元规模收益高低，是决策者进行生产规模调整的重要参考依据。现有DEA方法研究大多关注于如何计算出规模弹性，判断投入规模调整方向，而忽略了给出调整幅度。根据弹性的定义，决策单元只能在无穷小范围内调整规模，所以决策者难以把握扩大或者缩小投入量的大小。本文从单输入单输出情况出发，分析DEA技术有效前沿的弹性特征，将投入规模调整范围从无穷小推广至局部，并建立一种能够确定投入调整幅度的弹性模型。

科学基金项目规模适宜性研究——以X学科面上项目和青年项目为例

段培新，孟激

在科学基金项目愈发强调绩效情境下，本文以X学科为例，选取NSFC最具代表性的面上、青年项目为研究对象，基于科学基金项目投入不等比例变化，存在"阻塞"的特点，采用方向DEA模型，计算"阻塞"存在情况下，科学基金项目规模适宜性，并运用问卷调与DEA结果相互验证。研究发现NSFC历年平均资助强度在项目经费预算申请中具有强引导性，依赖评审专家加强项目经费预算合理性审查目的未有效实现。通过问卷调查及DEA模型相互验证结果：X学科2011年面上项目规模收益状态优于青年项目，面上项目可以适当增加资助强度，青年项目资助强度和资助范围不宜继续扩大，应进一步提高青年项目资助质量。

专利技术对我国环境治理投资效率的滞后期的实证研究

李洪伟，李晓璐

我国不断加大环境治理力度，不仅增加环境治理投资，而且加大技术研发，以期通过技术进步推动我国环境治理投资效率的提高，究竟技术进步是否真正提高了我国环境治理投资效率尚未得到证实。为了解决上述问题，

本文以专利授权量作为技术进步标志，探讨专利授权量对环境治理投资效率的影响，以期正确的验证技术研发对我国环境治理投资效率的影响。采用基于2006-2015年我国30个省市（除西藏外）的环境治理投入与产出数据，构建我国环境治理投资效率的评价指标体系，利用投入导向的DEA-BCC模型测算各省市的环境治理投资效率，并探讨专利授权总量对环境治理投资效率的滞后期数，验证专利授权总量对环境治理投资效率的滞后作用。

基于网络 DEA 的高校三类研究科研效率评价

陈浩，郑跃，卓翔芝，王妮娜

已有的研究将高校的科研系统视为一个黑箱，忽视了基础研究、应用研究和试验发展三类研究在高校科技发展中的差异性，以及三类研究之间创新的连续性。本文构建网络DEA模型来评价创新不同阶段的三类研究科研效率；并对我国各省市高校在九五、十五和十一五期间的科研效率进行区域对比，指出各省市高校在三类研究的短板。在研究结论的基础上，给出提升我国高校科研竞争力的对策建议。

5 Talents Recruiting

Introduction to Talents Recruiting from School of Economics at Hefei University of Technology

合肥工业大学经济学院人才招聘简介

The School of Economics at Hefei University of Technology (HUT) is planning to fill up to 10 full-time faculty positions in the coming 3 years. It invites applications for faculty positions at all levels (Assistant Professor, Associate Professor and Full Professor) in, but not limited to, Finance, Trade, Econometrics, Information Economics, Industrial Organization and Regional Economics, beginning in fall of 2017. Candidates should have a PhD in Economics or related field from an internationally renowned university and be able to teach the relevant subjects at the undergraduate and graduate levels. Preference will be given to those who have relevant teaching experience with graduates majored in Economics, and/or research experience with outstanding academic achievements. Mandarin Chinese is not pre-requisite and candidates of any nationalities are encouraged to apply for, but non-Chinese origin should have basic Chinese communication skills.

The successful candidate will be appointed to appropriate rank based on their qualification and experience. For successful junior level candidates, HUT and the school offer competitive salary, startup research fund, excellent benefits and relocation fund. Successful senior level candidates will be hired as “Huangshan Scholars” at Hefei University of Technology, which offers a nationally competitive compensation package and startup research fund, commensurable with the applicant's qualification and experience. Fringe benefits include public medical care, life insurance, spouse’s job placement, excellent children’s local education and housing subsidy, etc.

To be assured of consideration, interested applicants should submit an application to wuhuaqing@hfut.edu.cn and liuqingdm@hfut.edu.cn using “Economic application – applicant’s name” as the subject of your e-mail. A complete application should consist of:

1. Cover letter and updated curriculum vitae
2. Three letters of recommendation (including references’ names and contact information)
3. Featured publications
4. Teaching evaluations

We will review applications as they arrive until the positions are filled. We will work with interested candidates to work out interview schedules; furthermore, we welcome interested candidates to give lectures at HUT at their convenience.

For more information about the school and the university, please visit our website: http://www.hfut.edu.cn/ch/. As to some personnel information, please visit http://rcb.hfut.edu.cn/. For more information in Chinese, please visit:

http://jjxy.hfut.edu.cn/main/index.php/xwgg/news1/tzgg1/item/1596-2016-09-30-08-19-22

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