

## **RICHARD STEINBERG**

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### *Experience*

#### LONDON SCHOOL OF ECONOMICS, LONDON, ENGLAND

- 2009-present. Chair in Operations Research.
- 2016-present. Faculty Group Lead, Operations Management, Department of Management.
- 2010-2013. Head of Management Science Group, Department of Management.
- 2001. Visiting Scholar.

#### UNIVERSITY OF CAMBRIDGE, CAMBRIDGE, ENGLAND

- 2013-2014. Visitor, Statistical Laboratory, Department of Pure Mathematics and Mathematical Statistics.
- 2004-2008. Reader in Operations Management, Judge Business School.
- 1996-2004. University Lecturer in Operations Management, Judge Business School.

#### GTE LABORATORIES, WALTHAM, MASSACHUSETTS

- 1995-1996. Acting Department Head, Economics and Statistics Department.
- 1994-1996. Senior Member of Technical Staff, Economics and Statistics Department.

#### AT&T BELL LABORATORIES, MURRAY HILL, NEW JERSEY

- 1991-1993. Member of Technical Staff, Service Concept and Business Analysis Department.
- 1985-1991. Member of Technical Staff, Operations Research Department (Holmdel, New Jersey).

#### COLUMBIA UNIVERSITY, NEW YORK, NEW YORK

- 1993-1994. Adjunct Associate Professor, School of Engineering and Applied Science.
- 1985. Associate Professor, Graduate School of Business.
- 1981-1985. Assistant Professor, Graduate School of Business.

#### UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS

- 1980-1981. Assistant Professor of Management Science, Graduate School of Business.

### *Education*

#### UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS

- 1980. Master of Business Administration. Concentration in Management Science.

#### UNIVERSITY OF WATERLOO, WATERLOO, ONTARIO, CANADA

- 1979. Doctor of Philosophy in Combinatorics and Optimization. Research conducted under W.T. Tutte.
- 1976. Master of Mathematics in Combinatorics and Optimization.

#### REED COLLEGE, PORTLAND, OREGON

- 1976. Bachelor of Arts. Major in Mathematics.

#### THE COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART, NEW YORK, NEW YORK

- 1971-1973. Major in Electrical Engineering. Scholastic Honors List. Transferred to Reed in January 1974.

## PUBLICATIONS

“Maximizing Social Welfare in Congestion Games via Redistribution” (with V. Naroditskiy), *Games and Economic Behavior* 93 (2015), 24-41.

“Congestion-Dependent Pricing and Forward Contracts for Complementary Segments of a Communication Network” (with M. Reiter), *IEEE/ACM Transactions on Networking* 20, 2 (2012), 436-449.

“Auction Pricing”, Chapter 27 (pp. 679-712) in: O. Ozer and R. Phillips, eds., *Oxford Handbook of Pricing Management*, Oxford: Oxford University Press, 2012.

“Progressive Adaptive User Selection Environment (PAUSE) Auction Procedure,” pp. 4253-4262 in: James J. Cochran, ed., *Wiley Encyclopedia of Operations Research and Management Science*, Volume 6, John Wiley & Sons, 2011.

“Congestion Pricing and Non-cooperative Games in Communication Networks” (with A. Ganesh and K. Laevens), *Operations Research* 55, 3 (2007), 430-438.

“A Contract and Balancing Mechanism for Sharing Capacity in a Communication Network” (with E. Anderson and F. Kelly), *Management Science* 52, 1 (2006), 39-53.

*Combinatorial Auctions* (edited with P. Cramton and Y. Shoham), Cambridge, MA: MIT Press, 2006.  
Second printing 2008. Third printing (paperback) 2010.

“Introduction to Combinatorial Auctions” (with P. Cramton and Y. Shoham), pp. 1-13 in: P. Cramton, Y. Shoham, and R. Steinberg (eds.), *Combinatorial Auctions*, Boston: MIT Press, 2006.

“PAUSE: A Computationally Tractable Combinatorial Auction” (with A. Land and S. Powell), Chapter 6 (pp. 139-157) in *Combinatorial Auctions*, Boston: MIT Press, 2006.

“Pricing Internet Service,” Chapter 6 (pp. 175-201) in: A.K. Chakravarty and J. Eliashberg, eds., *Managing Business Interfaces: Marketing, Engineering, and Manufacturing Perspectives*, Dordrecht: Kluwer Academic Publishers/ISQM, 2003.

“Internet Service Classes under Competition” (with R.J. Gibbens and R. Mason), *IEEE Journal on Selected Areas in Communications*, Special Issue on Quality of Service in the Internet, 18, 12 (2000), 2490 -2498. [Lead article]

“A Combinatorial Auction with Multiple Winners for Universal Service” (with F. Kelly), *Management Science* 46, 4 (2000), 586-596.

“The Allocation of Value for Jointly Provided Services” (with P. Linhart, R. Radner, K.G. Ramakrishnan), *Telecommunication Systems* 4, Nos. 3, 4 (1995), 151-175. [Lead article]

## PUBLICATIONS (continued)

“Marketing-Production Joint Decision-Making” (with J. Eliashberg), Chapter 18 (pp. 827-880) in: J. Eliashberg and G. Lilien, eds., *Handbooks in Operations Research and Management Science, Vol. 5, Marketing*, North-Holland, 1993. Also published in Japanese in *Marketing Handbook*, Tokyo: Asakura-Shoten, 1997

“Planar Ramsey Numbers” (with C.A. Tovey), *Journal of Combinatorial Theory, Series B* 59, 2 (1993), 288-296.

“An Update on the State of the Three Color Problem,” *Graph Theory Notes of New York* (New York Academy of Sciences) XXV (1993), 9-12

“The State of the Three Color Problem,” *Annals of Discrete Mathematics* 55 (1993), 211-248.

“Dynamic Pricing and Ordering Decisions by a Monopolist” (with A. Rajan and Rakesh), *Management Science* 38, 2 (1992), 240-262.

“Competitive Strategies for Two Firms with Asymmetric Production Cost Structures” (with J. Eliashberg), *Management Science* 37, 11 (1991), 1452-1473.

“Grötzsch's Theorem for the Projective Plane” (with D.H. Younger), *Ars Combinatoria* 28, Dec. (1989), 15-31.

“The Prevalence of Paradoxes in Transportation Equilibrium Problems” (with R.E. Stone), *Transportation Science* 22, 4 (1988), 231-241.

“Marketing-Production Decisions in an Industrial Channel of Distribution” (with J. Eliashberg), *Management Science* 33, 8 (1987), 981-1000.

“Common Cost Allocation in the Firm” (with G. Biddle), Chapter 2 (pp. 31-54) in: H.P. Young, ed., *Cost Allocation: Methods, Principles, Applications*, North Holland 1985.

“Allocations of Joint and Common Costs” (with G. Biddle), *Journal of Accounting Literature* 3 (1984), 1-45.  
[Lead article]

“Tutte's 5-flow Conjecture for the Projective Plane,” *Journal of Graph Theory* 8, 2 (1984), 277-289.

“The Prevalence of Braess' Paradox” (with W.I. Zangwill), *Transportation Science* 17, 3 (1983), 301-318.

“A Topological Space for which Graph Embeddability is Undecidable” (with S. Foldes), *Journal of Combinatorial Theory, Series B* 29, 2 (1980), 342-344.

“One Counterexample for Two Conjectures on Three Coloring” (with L.S. Mel'nikov), *Discrete Mathematics* 20, 2 (1977), 203-206.

## OTHER PUBLICATIONS

“Forward Contracts for Complementary Segments of a Communication Network” (with M. Reiter), *IEEE INFOCOM* (2010), 2705-2713.

“An Introduction to the Special Issue on E-Auctions for Procurement Operations” (with M. Bichler), *Production and Operations Management* 16, 4 (2007), 401-403.

“An Overview of Combinatorial Auctions” (with P. Cramton and Y. Shoham), *ACM SIGecom Exchanges* 7, 1 (2007), 3-14.

“Congestion Pricing and User Adaptation” (with A. Ganesh and K. Laevens), *IEEE INFOCOM* (2001), 959-965.

## EXPERT REPORTS

“Carbon Capture and Storage (CCS): Analysis of Incentives and Rules in a European Repeated Game Situation” (with D. Newbery, D. Reiner, T. Jamasb, F. Toxvaerd, and P. Noel), Electricity Policy Research Group, University of Cambridge. Prepared for the U.K. Department of Energy and Climate Change. June 2009.

“Comments on Public Notice DA 00-1075, In the Matter of Auction of Licenses in the 747-762 and 777-792 MHz Bands Scheduled for September 6, 2000” (with F. Kelly). Submitted before the U.S. Federal Communications Commission. June 2000.

“A Combinatorial Auction with Multiple Winners for COLR” (with F. Kelly), University of Cambridge. Submitted *ex parte* 18 March 1997 by Citizens for a Sound Economy Foundation before the U.S. Federal Communications Commission re CC Docket No. 96-45—Federal-State Board on Universal Service. March 1997.

“Consumer Benefit from Federal Preemption of Nationwide Caller ID Policy” (with P.B. Linhart, R. Radner, K.G. Ramakrishnan, and R. Rubin), AT&T Bell Laboratories memorandum. Prepared at the request of AT&T for use in a legislative or regulatory context. January 1994.

## WORK IN PROGRESS

“Competing Combinatorial Auctions” (with T. Kittsteiner and M. Ott).

“Combinatorial Auctions in Practice” (with D.C. Parkes).

“Pricing, Competition and Content for Internet Service Providers” (with P. Key).

“A Framework for Decentralized Combinatorial Auctions with Applications to Subadditive Bidders” (with M. Salek).

## OTHER ACADEMIC APPOINTMENTS

Massachusetts Institute of Technology, Cambridge, Massachusetts

Summer 2011. Visiting Scientist, Sloan School of Management.

Summer 1996. Visiting Scientist, Operations Research Center.

Stanford University, Stanford, California

Autumn 2008. Visiting Scholar, Department of Economics.

Autumn 2003. Visiting Associate Professor of Operations, Information, and Technology, Graduate School of Business.

University of Oxford, Oxford, England

Autumn 2006. Academic Visitor, Saïd School of Business.

CORE (Center for Operations Research and Econometrics), Université catholique de Louvain, Louvain-la-Neuve, Belgium

Autumn 2000. Research Visitor.

## RESEARCH GRANTS

ESRC (Economic & Social Research Council, U.K.)

- Grant of £288,000 as Principal Investigator on:  
“A Comparison of Centralized and Decentralized Combinatorial Auctions,” awarded January 2009.

CMI (Cambridge-MIT Institute)

- Grant of £167,000 as Principal Investigator on:  
“Internet Congestion Control using Pricing,” awarded January 2004.
- Grant of £10,000 as Co-Organizer (with M. Pollitt, University of Cambridge and P. Joskow, MIT) for workshop on:  
“Innovation and Liberalization in Network Markets,” awarded January 2001.

## EDITORIAL POSITIONS

*Manufacturing and Service Operations Management*

2002-present. Senior Editor / Associate Editor.

1999-2002. Member of Editorial Review Board.

*Production and Operations Management*

2003-present. Senior Editor, E-Business and Operations.

- Special Issue Editor (with M. Bichler), “E-Auctions for Procurement Operations” 16, 4 (2007)
- Special Issue Associate Editor, “Operations Management in Business to Business Markets” 20, 2 (2011)
- Special Issue Associate Editor, “Marketing and Operations Management Interfaces and Coordination” 15, 3 (2006)

## WORKSHOP ORGANIZATION & INVITED TALKS

### *Workshop Organization*

*Combinatorial Auctions for Spectrum: State of the Art*, September 2013

Ofcom-LSE Workshop held at the London School of Economics.  
Co-organized with Geoffrey Myers, Ofcom.

*Innovation and Liberalization in Network Markets*, January 2001

Cambridge-MIT Institute Workshop held at the University of Cambridge.  
Co-organized with Michael Pollitt, University of Cambridge and Paul Joskow, MIT.

### *Keynote Talks*

Austrian Computer Society, Vienna, Austria

Keynote speaker on: "Pricing Internet Service."  
*Workshop on Advanced Internet Charging and QoS Technology (ICQT'01)*, September 2001.

The Cato Institute, Washington, DC

Keynote speaker on: "New Ideas for Universal Service: Are Auctions the Answer?"  
*Roundtable Luncheon*, April 1999.

### *Selected Invited Talks*

Columbia Institute for Tele-Information, Columbia University, New York, New York

- Symposium: *Spectrum Auction Design, Experience and Post Auction Market Structure*, June 2014
- Symposium: *Wireless Communications and Universal Service*, December 2005

The Royal Society, London, England

- *Workshop on Net Neutrality*, December 2006

Schloss Dagstuhl, Wadern, Germany

- Seminar: *Computing and Markets*, January 2005
- Seminar: *Electronic Market Design*, June 2002

The Aspen Institute, Wye River Conference Center, Queenstown, Maryland

- *NEXTOR Workshop on National Airspace System Resource Allocation*, March 2002
- *FCC Conference on Combinatorial Bidding*, May 2000

Statistical Laboratory, University of Cambridge, Cambridge, England

- *Stochastic Networks Workshop*, December 2000
- *Stochastic Networks Workshop*, December 1996

International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria

- *Task Force Meeting on Cost Allocation*, August 1983

## TEACHING

### *Courses Taught*

#### *MBA & MSc Management*

- Operations Management (LSE, Cambridge, Columbia, Chicago)
- Operations Research (Columbia)
- Management Science (Chicago)
- Scheduling and Inventory Control (Columbia)
- Mathematics for Business (Columbia)
- Manufacturing Management (Cambridge)

#### *MS & MEng & MSc Management Science*

- Auctions and Game Theory (LSE)
- Dynamic Processes and Game Theory (LSE)
- Quantitative Techniques in Operations Management (Cambridge)
- Facilities Layout and Planning (Columbia)

#### *PhD & MPhil*

- Topics in Operations Management (Cambridge)
- Production Scheduling (Columbia)
- Transportation Networks (Columbia)

#### *Undergraduate*

- Operations Management (Cambridge)
- Operations Management for Engineers (Cambridge)
- Scheduling (Cambridge)
- Production Scheduling (Cambridge)
- Inventory Control (Cambridge)
- Modeling of Queuing Systems (Cambridge)

#### *M.Math. Supervision*

- Supervised Cambridge University M.Math. students on Part III essay, “Applicable Combinatorial Auctions,” 2013-14

#### *Ph.D. Supervision*

- Miklós Reiter, University of Cambridge (PhD 2007)  
Thesis: “Internet Congestion Pricing: Long-Term Bandwidth Contracts and Investment in Oligopoly”
- Mira Slavova, University of Cambridge (PhD 2006)  
Thesis: “Uncertainty, Microstructure and Bidding Behavior in Internet Auction Marketplaces”
- Sang-Bum Lee, Columbia University (PhD 1985)  
Thesis: “Topics in Dynamic Lot-Sizing”

#### *Executive Education*

- “Pricing Internet Service,” Thought Leadership Seminar, British Telecom, Adastral Park, Ipswich, England, May 2004

## INDUSTRIAL EXPERIENCE

### *Bell Laboratories*

1993: CONSUMER BENEFIT FROM FEDERAL PREEMPTION OF NATIONWIDE CALLER ID POLICY<sup>[1],[2]</sup>

Co-developed (with P.B. Linhart, R. Radner, K.G. Ramakrishnan, and R. Rubin) economic analysis determining the benefit to consumers of Federal preemption of call blocking of Caller ID service. Co-authored brief explaining economic argument to be used by AT&T before U.S. Congress. (See *Expert Reports*.)

1992-1993: FRIENDS AND FAMILY RESPONSE<sup>[3]</sup>

Organized and contributed to joint project (with P.B. Linhart, R. Radner, and K.G. Ramakrishnan) involving design of computer simulation tool to study possible AT&T pricing responses to MCI's Friends and Family services.

1991-1993: VALUE OF CALLER ID<sup>[3]</sup>

Organized and contributed to joint project (with P.B. Linhart, R. Radner, and K.G. Ramakrishnan) on pricing for Caller ID services. Implemented game-theoretic models and linear programming to examine strategies for allocating profits among participating companies. (See PUBLICATIONS.)

1991-1993: SPLIT-CABLE ADVERTISING EFFECTIVENESS STUDY

Designed and implemented tracking analysis to monitor difference in usage rates for two groups of households, with one group shielded from AT&T advertising. Represented AT&T in contract negotiations with consultant.

1989-1990: TRANSACTIONAL COST ANALYSIS

Used Activity-Based Costing to analyze cost of sales effort per product across AT&T General Business Systems product line throughout the U.S.

1988: A TOOL FOR SUPPLIER INVENTORY MANAGEMENT

Co-designed information system at AT&T Allentown Works to control the manufacture and inventory of integrated circuits used as components at other AT&T factories.

1987: THE EFFECTS OF NEW AND CHANGED DESIGN ON INVENTORY

Designed PC-based tool, based on the newsvendor model, for use at AT&T Oklahoma City Works to determine optimal inventory levels for electronic circuit board production.

1985-1986: MANUFACTURING DISRUPTIONS MANAGEMENT AND CONTROL

Studied several product lines at AT&T's Columbus Works, North Carolina Works, and Omaha Works, and made recommendations for improvement to reduce frequency and severity of disruptions to manufacturing processes.

### *Special Recognition from Bell Laboratories*

[1] Contribution to report "Consumer Benefit from Federal Preemption of Nationwide Caller ID Policy" (see *Expert Reports*) acknowledged with appreciation by Arno Penzias, Vice President of Research, AT&T Bell Labs. (Oct. 1994).

[2] Work on project "Consumer Benefit from Federal Preemption of Nationwide Caller ID Policy" acknowledged with appreciation by Arno Penzias (Sept. 1993).

[3] Received Bell Laboratories Mathematical Sciences Research Center's *Member of Technical Staff Merit Award* for work on "Value of Caller ID" and "Friends and Family Response" projects (Nov. 1992). See AWARDS.

### *Additional Bell Laboratories Project*

1989-1990. Developed new internship program, called the "Martin Farber Internship," to promote theoretical research in the Operations Research Department.



## **INDUSTRIAL EXPERIENCE (continued)**

### ***GTE Laboratories***

#### **1995-1996: TELECOMMUNICATIONS AUCTION DESIGN**

Developed Web-based auction model for use in determining carrier responsibility for Universal Service. Worked with public interest group (“Citizens for a Sound Economy”), and hired/supervised members of project team.

#### **1994-1995: BUSINESS SIMULATION MODELING II**

Co-developed PC-based planning tool to enable GTE business planners to address strategic level questions about various communications businesses engaged in by the company.

#### **1994-1995: BUSINESS SIMULATION MODELING I**

Enhanced and modified externally developed UNIX-based business planning tool, and supported clients at corporate headquarters in use of the tool.

### ***Other Industrial Appointments***

#### **MICROSOFT RESEARCH, CAMBRIDGE, ENGLAND**

2010-2012. Visiting Researcher in the Networks, Economics and Algorithms Group.

#### **SALOMON BROTHERS, NEW YORK, NEW YORK**

Summer 1979. Summer Associate under Martin Leibowitz in the Bond Portfolio Analysis Group.

Presented a series of talks to the Bond Portfolio Analysis Group that introduced the firm to duration-based hedging (called “bond immunization” at the time). This subsequently developed into a major product for Salomon Brothers.

### ***Consulting***

#### ***Auctions***

#### **CANADIAN 2500 MHZ SPECTRUM AUCTION**

2015. Provided bidder support.

#### **U.K. NATIONAL AUDIT OFFICE**

2013-2014. Supporting Advisor/Project Lead on project to evaluate the UK 4G spectrum auction held Jan-Feb 2013. Advised NAO on their final report, issued 6 March 2014, “4G Radio Spectrum Auction: Lessons Learned.”

2013. Advised NAO on their “scoping exercise” addressing the outcome of the UK 4G spectrum auction, held Jan-Feb 2013, with respect to revenue generated, effect of the auction rules, and individual strategies of the bidders.

#### **U.K. DEPARTMENT OF ENERGY AND CLIMATE CHANGE**

2009. Designed auction (with F. Toxvaerd) for the UK to submit to the European Union to select demonstration projects for Carbon Capture and Storage.

#### **U.S. FEDERAL COMMUNICATIONS COMMISSION**

1997-1998. Advised FCC Office of Plans and Policy on design of combinatorial auctions of licenses for spectrum.

#### ***Other***

#### **WESTMINSTER CITY COUNCIL, LONDON**

2013. Advised Westminster City Council on assessing fire service proposals in relation to critical emergency response in London. Expert witness at Central London Forward Fire Scrutiny held by Westminster City Council on April 22nd.

## AWARDS

- Bell Laboratories Mathematical Sciences Research Center *Member of Technical Staff Merit Award*, 1992  
“For facilitating, organizing, and contributing to a joint project between BL05143 [Consumer Communications Services Center] and BL01121 [Mathematical Sciences Research Center] (Linhart, Radner, Ramakrishnan) investigating the economic theory of pricing for caller ID services, particularly using game-theoretic models and linear programming to examine strategies for allocating profits among participating companies cooperating to provide such a service for long-distance calls. Also played a significant role in interactions between these two organizations studying pricing for Friends and Family services.”
- M&SOM (Manufacturing and Service Operations Management) *Meritorious Service Award*, 2004, 2009, 2010
- Production and Operations Management Society, award and plaque, 2016  
“For the outstanding work performed as a Senior Editor, E-Business and Operations, for its research journal, Production & Operations Management.”
- London School of Economics *Top Ten Teachers in the Department of Management*, 2015-16

## SERVICE

### *Major University Service*

#### London School of Economics

- Course Convenor for Management Science Methods, LSE External Degree program, 2016-2017
- PhD Director for Management Science, LSE, 2012-2017 (not including 2013-2014)
- Member, REF (Research Excellence Framework) Strategy Committee, LSE, 2011-2013
- Chair of the Examination Board, Department of Management MSc Electives, LSE 2010-2013
- Chair of Research Committee, Department of Management, LSE, 2010-2013

#### University of Cambridge

- External Examiner, University of Cambridge Mathematics Tripos, Part II, 2013-2016  
Responsible for all courses in probability, statistics, and operations research
- Chair of Examiners, Management Studies Tripos, University of Cambridge, 2003-2006

### *PhD Thesis Committees*

- University of Cambridge, Department of Pure Mathematics and Mathematical Statistics, 2011, 2004
- London Business School, Management Science and Operations, 2010
- Columbia University, Department of Electrical Engineering, 1982

### *Prize Committees*

- Frederick W. Lanchester Prize, 2013, 2014
- INFORMS Expository Writing Prize, 2010, 2011, 2012 (Chair)
- MSOM Student Paper Competition, 2006-2011
- Fulbright Scholar Award, 1996
- George Nicholson Student Paper Competition, 1991

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