

Patrick Timothy Harker

Office:

Office of the President
University of Delaware
104 HULLIHEN HALL
Newark, DE 19716-0101
(302) 831-2111 FAX: (302) 831-1297
E-mail: harker@udel.edu

Marital Status: Married with three children

Research Interests

- Service operations management and economics
- Financial services operations and technology
- Transportation systems
- Operations Research methodology: mathematical programming

Education

Ph.D. Civil Engineering (Program in Transportation Systems Analysis and Economics), University of Pennsylvania, August 1983.
M.A. Economics, University of Pennsylvania, May 1983.
M.S.E. Civil and Urban Engineering, University of Pennsylvania, December 1981.
B.S.E. Civil and Urban Engineering, University of Pennsylvania, May 1981.

Professional Experience

7/07- President, University of Delaware with an appointment as Professor of Business Administration and Economics and a joint appointment as Professor of Civil and Environmental Engineering.

2/00-6/07 Dean and the Reliance Professor; Professor of Operations and Information Management, The Wharton School, University of Pennsylvania; with a secondary appointment in the Department of Management and the Department of Electrical and Systems Engineering, School of Engineering and Applied Science; Senior Fellow, Wharton Financial Institutions Center.

8/99-2/00 Interim Dean, The Wharton School, University of Pennsylvania.

7/99-3/00 Deputy Dean, The Wharton School, University of Pennsylvania.

7/97-6/99 Chairman, Department of Operations and Information Management, The Wharton School, University of Pennsylvania.

1/97-2/00 UPS Transportation Professor of the Private Sector, Professor of Operations and Information Management, The Wharton School, University of Pennsylvania; with a secondary appointment in the Department of Systems Engineering; Senior Fellow, Wharton Financial Institutions Center.

7/94-12/96 UPS Transportation Professor for the Private Sector, Professor of Systems Engineering and Chairman of Systems Engineering, School of Engineering and Applied Science, University of Pennsylvania; with a secondary appointment in the Department of Operations and Information Management, The Wharton School.

Professional Experience (continued)

- 7/91-6/94** UPS Transportation Professor of the Private Sector, Professor of Operations and Information Management, The Wharton School, University of Pennsylvania; with a secondary appointment in the Department of Systems Engineering and appointments to the Graduate Groups in City and Regional Planning, Transportation, and Regional Science.
- 7/89-6/94** Director, Fishman-Davidson Center for the Study of the Service Sector, The Wharton School.
- 7/93-6/94** Coordinator of the Operations and Information Management Ph.D. Program.
- 9/91-8/92** Special Assistant to the Director, F.B.I. Selected by President Bush as a WHITE HOUSE FELLOW for 1991-92, one of sixteen chosen in the country.
- 7/87-6/91** Associate Professor of Decision Sciences, The Wharton School, University of Pennsylvania.
- 1/89-2/89** Visiting Scholar, Department of Operations Research, Stanford University.
- 7/86-6/88** Coordinator of the Decision Sciences Ph.D. Program.
- 7/84-6/87** Stephen M. Peck Term Assistant Professor of Decision Sciences, The Wharton School, University of Pennsylvania.
- 7/83-6/84** Assistant Professor of Geography, University of California, Santa Barbara.
- 5/80-1/81** Engineer, Louis T. Klauder and Associates, Philadelphia, PA.
- Summer 1979** Product Support Analyst, Sun Information Services, Inc., Radnor, PA.

Corporate Board Memberships

- Trustee, Goldman Sachs Trust and Goldman Sachs Variable Insurance Trust, 2000 – Member, Board of Advisors, Decision Lens, Inc., 2005 -
- Member, Board of Managers, Goldman Sachs Hedge Fund Partners Registered Fund LLC, 2004 – 2009
- Chair of the Advisory Board, Traffic.com, Inc., 2001-2006

Community and Nonprofit Service

- Member, Board of Directors, National Leadership Roundtable on Church Management, 2005-
- Member, Board of Directors, First State Innovation, 2007 –
- Member, Board of Directors, Delaware Technology Park, 2007 –
- Member, Regional Leadership Initiative Steering Committee, Council on Competitiveness, 2008 –
- Member, Christiana Care Health System Board, 2008 –
- Member, Board of Directors, Easter Seals of Delaware, 2009 -
- Member, St. Peter Celestine School Board, 1994-96
- Membership Trustee, Haddon Glen Swim Club Board, 1998-2000
- Member, Diocesan Finance Council, Diocese of Camden, NJ, 2001-2006

Honors and Awards

- Joseph Wharton Award, Wharton Club of Washington, D.C., November 2008
- Ivy Football Association honoree, January 2007
- Omega Rho Distinguished Lecturer, INFORMS, November 2006
- Named ISI Highly Cited Researcher (Mathematics), October 2004
- 2002 Alan Goldman Lecturer. Department of Mathematical Sciences, The Johns Hopkins University
- 2002 Wei Lun Distinguished Visiting Professor, Chinese University of Hong Kong
- 1998 David W. Hauck Award for Outstanding Teaching in the Undergraduate Division, the Wharton School
- Laurent Picard Distinguished Lecturer, McGill University, Montreal Canada, 1998.
- CORE Lecturer, Center for Operations Research and Econometrics, Universite Catholique de Louvain, Belgium, 1993
- 1992 Miller-Sherrerd MBA Core Teaching Award, The Wharton School
- Named by President Bush as a White House Fellow 1991-92
- National Science Foundation Presidential Young Investigator Award 1986-1991
- Second Place, Leslie Fox Competition in Numerical Analysis 1988
- Honorable Mention, ORSA Transportation Science Section Dissertation Prize 1983
- Second Prize, ORSA George E. Nicholson Student Paper Competition 1983
- National Science Foundation Graduate Fellowship
- Argonne National Laboratory Graduate Fellowship
- Tau Beta Pi Deuchler Fellowship
- University of Pennsylvania Graduate Fellowship
- James Howard Weiss Memorial Award, University of Pennsylvania--for high scholastic achievement and service to the University
- Honorable Mention, New Jersey Dept. of Transportation's 1979 Traffic Circle Design Competition

Patents and Copyrights

- United States Copyright No. 441-941 for Scheduler Analyzer II: SCAN II (joint with Dejan Jovanovic), October 15, 1990.
- United States Patent No. 5,177,684 for A Method for Analyzing and Generating Optimal Transportation Schedules for Vehicles such as Trains and Controlling the Movement of Vehicles in Response Thereto (joint with Dejan Jovanovic), issued January 5, 1993; Australian Patent No. 644664 issued April 22, 1994; Canadian Patent Application 2,046,984-6 filed July 12, 1991.

Professional Affiliations

- Member of the American Economic Association, IEEE - Senior Member, International Federation of Operations Research/ Management Science (INFORMS)-full member, Mathematical Programming Society, Society for Industrial and Applied Mathematics.
- Member (elected), International Academy of Management

Editorial Service

- Member of the Advisor Board, *Operations Research*, 2005-
- Editor-in-Chief, *Operations Research*, 1996-1999
- Member of the Editorial Board, *International Studies in the Service Economy*
- Former Area Editor-**Services**, *Operations Research*, 1991-96
- Former Associate Editor, *American Journal of Mathematical and Management Sciences*, *Computational Optimization and Applications*, *The Annals of Regional Science*, *Applied Mathematics Letters*, *Journal of Regional Science*, *Journal of Service Research*, *Management Science*, *Socio-Economic Planning Sciences*, *Transportation Research*.
- Referee for numerous journal in operations research, applied mathematics, economics, transportation and regional science.
- Reviewer and panel member for the National Science Foundation.

Other Professional Service

- Member of the Program Committee, 31st North American Regional Science Association Meetings, Denver, CO, November 1984.
- Member of the Program Committee, 32nd North American Regional Science Association Meetings, Philadelphia, PA, November 1985.
- Member, ORSA Nicholson Prize Committee, 1987
- Member, ORSA Transportation Science Section Dissertation Prize Committee, 1987-91
- Member of the Scientific Committee, 5th World Conference on Transportation Research, Yokohama, Japan, July 1989
- Program Co-Chairman, 1990 TIMS/ORSA National Meeting, Philadelphia, PA, October 1990
- Chair, ORSA Doctoral Colloquium, October 1990
- Member of the ORSA Transportation Science Section Council, 1988-91
- Member of the Scientific Committee, Triennial Symposium on Transportation Analysis 1 (TRISTAN I), Montreal, June 1991
- Minisymposium Organizer, Second International Conference on Industrial and Applied Mathematics, Washington, DC, July 1991
- Member of the Scientific Committee, 6th World Conference on Transportation Research, Lyon, France, July 1992
- Member of the Scientific Committee, Triennial Symposium on Transportation Analysis 2 (TRISTAN II), Capri, Italy, June 1994
- Panelist, *Computerworld* Smithsonian Awards, 1995 - 1998
- Organizer, Workshop on Service Design and Management in Railroad Operations, co-sponsored by the Rail Applications Special Interest Group of INFORMS and the University of Pennsylvania, Philadelphia, PA, July 1995
- Program Committee, 1999 INFORMS National Meeting, Philadelphia, PA, November 1999
- Chair of the International Advisory Board, School of Business Administration, Southwestern University of Finance and Economics, Chengdu, P.R.C., October 2007 – present.

University Activities

- 1986-1989 Committee on Recreation and Intercollegiate Athletics
- 1986-1988 Member, Wharton Doctoral Policy Committee
- 1986-1991 Faculty advisor, Penn TIMS/ORSA Student Chapter
- 1987-1989 Wharton Doctoral Admissions Committee
- 1989-1990 Wharton Undergraduate Executive Committee
- 1990-1991 Undergraduate Advisor, Decision Sciences Department
- 1990-1991 Wharton Undergraduate Curriculum Committee
- 1990-1991 University Committee on Undergraduate Admissions and Financial Aid
- 1992-1994 Faculty Liaison, University Trustee Committee on Budget and Finance
- 1992-1994 Wharton Advisory Committee on Faculty Personnel
- 1993-1994 Wharton Doctoral Executive Committee
- 1993-1996 President's Cost Containment Oversight Committee, University of Pennsylvania
- 1994-1996 Administrative Committee, School of Engineering and Applied Science
- 1995-1996 Provost's Task Force on University Computing Services
- 1995-1996 Chair, Search Committee for the University Chaplain
- 1998-1999 Provost Review Committee on Technology Transfer
- 1998-1999 Search Committee for the Dean of the Wharton School

Consulting Activities

- 1984-1985 U.S. Department of Energy: application of the AHP to nuclear security
- 1985 U.S. Army: theoretical aspects of the AHP
- 1986 Maxima Inc.: review of the use of AHP for promotions in the U.S. Air Force
- 1988-1991 Chena Software Laboratory: computational methods for the AHP
- 1988-1990 Zeta-Tech, Assoc.: analysis of computer-aided dispatching methods
- 1988-1990 Software A&E Inc.: analysis of various railroad control problems
- 1992-1993 F.B.I.: management of criminal justice information service and total quality
- 1994 Union Pacific Railroad - re-engineering rail operations
- 1997-1998 Furash Inc.: call center design and management in banking; distribution channel design in banking

Courses Taught

University of California, Santa Barbara

- Introduction to Regional Planning and Modeling (GEOG 107)
- Introduction to Transportation Systems Analysis (GEOG 146)
- Techniques of Geographical Data Analysis (GEOG 172)
- Nonlinear Systems and Geographical Analysis (GEOG 296)

The Wharton School, University of Pennsylvania

- Introduction to Management Science (DS 20)
- Management Decision Analysis (BA 650)
- Introduction to Operations Research (BA 652)
- Quantitative Methods II (BA 807)
- Service Process Management (OPIM 658)
- Concepts of Mathematical Programming (OPIM 910)
- Computation of Equilibria (OPIM 918)
- Service Operations Management and Economics (OPIM 989)
- Microeconomic Theory (RS 601)
- Managing Services: Reengineering for Customer Satisfaction (Wharton Executive Education)

Department of Systems Engineering, University of Pennsylvania

- Service Systems Engineering (SYS 544)
- Economic Systems Analysis (SYS 600)
- Mathematical Programming (SYS 604)
- Computation of Equilibria (SYS 616)
- Advanced Continuous Optimization (SYS 618)

Research Grants

- 1983-1984** P.I., "The Generalized Spatial Price Equilibrium Model: Conceptual Extensions, Algorithmic Enhancements, and Empirical Tests", University Research Grant, University of California--Santa Barbara, \$5,000.
- 1983-1984** Co-P.I., "Hazardous Materials Transportation: Management Strategies and Facility Location Issues", Institute of Transportation Studies, University of California, \$5,000.
- 1984-1986** P.I., "Freight Transportation Systems Modeling: Supply and Demand Side Extensions", National Science Foundation, \$48,000.
- 1985-1986** P.I., "Solution and Application of Concave Minimization Problems Over General and Network Polytopes", University of Pennsylvania Research Fund, \$10,000.
- 1985-1986** Co-P.I., "Monopoly, Deregulation and Coordination of Public Mobility Services", Urban Mass Transportation Administration, U.S. Department of Transportation, \$80,100.
- 1986-1989** P.I., "Network Capacity and Pricing Games Via Variational Inequality Theory", AT&T Program in Telecommunications Technology, \$137,000.
- 1986-1991** P.I., "Presidential Young Investigator Award", NSF, \$25,000 per year plus \$37,500 in matching funds (total award \$312,500).
- 1986-1991** P.I., "The Use of Global Positioning Information for Real-Time Control of a Rail Network", Burlington Northern Railroad, \$456,500.
- 1987-1988** P.I., "Solving Multicommodity Flow Problems with Convex Costs and Bounded Arc Flows by Restricted Simplicial Decomposition", IBM Program in Academic Computer Support, 100 CPU hours on an IBM 3090 plus travel expenses.
- 1992-1993** P.I., "High Performance Workplaces in Services", National Center for Educational Quality of the Workforce, \$28,000.
- 1992-1998** Co-P.I., "The Financial Services Industry: Current Problems, Future Prospects," Alfred P. Sloan Foundation, \$3.4 million for 1992-95; \$2.25 million for 1995-98.
- 1994** P.I., "Reengineering Railroads," Union Pacific Railroad, \$35,000 for six months.
- 1995-1997** Co-PI, "Acquisition of Equipment for a Customized Production Systems Laboratory," Academic Research Infrastructure Program, National Science Foundation, \$473,238.
- 1996-1999** Co-PI, "Efficiency and Quality in Financial Services," Transformations to Quality Organizations Program, National Science Foundation, \$296,770.
- 1996-1999** Co-PI, "Market-Based Systems for Workflow Scheduling," Decision, Risk and Management Science Program, National Science Foundation, \$300,000.
- 1996-1999** Co-PI, "A Distributed Decision Framework Integrating Manufacturing Planning and Multiple Supply Chain Management," Operations Research and Production Systems Program, National Science Foundation, \$340,000.
- 1999-2004** Co-PI (joint with Lehigh University), "IGERT Formal Proposal: An IGERT Fellowship Program in Manufacturing Logistics," Integrative Graduate Education and Research Training (IGERT) Program, National Science Foundation, \$2.7 million.
- 2000-2001** Co-PI (joint with Lehigh University), "Scalable Enterprise Systems: Distributed and Collaborative Enterprise Decision Making in the Electronic Supply Chain," Design, Manufacturing and Industrial Innovation Program, National Science Foundation, \$200,000.

Ph.D. Supervision

- Seung-Chan Choi, *Equilibrium Analysis of Optimal Product Positioning*, Decision Sciences Department, August 1988.
- Daniel Stefek, *Extension of Simplicial Decomposition for Solving the Multicommodity Flow Problem with Bounded Arc Flows and Convex Costs*, Decision Sciences Department, The Wharton School, December 1988.
- Dejan Jovanovic, *Improving Railroad On-Time Performance: Models, Algorithms and Applications*, Department of Systems, University of Pennsylvania, December 1989.
- Baichun Xiao, *Global Newton Methods for Nonlinear Programs and Variational Inequalities: A B-Differentiable Equation Approach*, Decision Sciences Department, The Wharton School, December 1990.
- Bintong Chen, *A Continuation Method for Monotone Variational Inequality and Complementarity Problems: With Application to Linear and Nonlinear Programming*, Decision Sciences Department, The Wharton School, December 1990.
- Taekwon Kim, *Optimal Design of Multiproduct Production and Operations Systems*, Decision Sciences Department, The Wharton School, December 1990.
- Sungwook Hong, *Incentive-Compatible Capacity Pricing for Congested Transportation Facilities: A Game-Theoretic Approach*, Regional Science Department, University of Pennsylvania, August 1991.
- David Kraay, *Learning Methods in Optimization: With Application to Railroad Control*, Decision Sciences Department, The Wharton School, August 1993.
- Susan Hallowell, *Optimal Dispatching Under Uncertainty: With Application to Railroad Scheduling*, Department of Systems, University of Pennsylvania, December 1993.
- Pamela Armstrong, *A Systems Approach for Analyzing Quality in High Contact Services*, Operations and Information Management Department, The Wharton School, December 1994.
- Frances Frei, *The Role of Process Design in Productivity and Performance: Evidence From Retail Banking*, Operations and Information Management Department, The Wharton School, May 1996.
- Zeynep Aksin, *Managing Capacity in Congestion Prone Service Delivery Processes: A Study of Inbound Call Centers in the Financial Services Industry*, Operations and Information Management Department, The Wharton School, August 1996.
- Ruijin Qi, *Spatial Equilibrium Models with Discontinuous Functions: Theory, Algorithms, and Application to Pricing of Congested Transportation Systems*, Operations and Information Management Department, The Wharton School, May 1997.
- Edwin R. Kraft, *A Reservations-Based Railway Network Operations Management System*, Systems Engineering Department, University of Pennsylvania, May 1998.
- Suman Mallik, *Supply Chain Coordination with Multiple Market Managers*, Operations and Information Management Department, The Wharton School, December 1998.
- Margaret H. Belknap, *A Gradient-Based Methodology for the Analysis of Stochastic Variational Inequalities*, Systems Engineering Department, University of Pennsylvania, December 2000.
- Baba Prasad, *Technology Choice in Financial Services: A Real-Options Approach*, Operations and Information Management Department, The Wharton School, exp. August 2002.
- Mei Xue, *Customer Efficiency: Concept and Its Impact on E-Business Management*, Operations and Information Management Department, The Wharton School, August 2002.

M.S. Supervision

- Frederick A. Mosley, *Equilibrium Model of a Competitive Urban Bus Market*, A.S.P., Graduate Group in Transportation, December 1986.
- Daniel Anninos, *Optimal Pacing of Trains on Single Track Rail Lines*, A.S.P., Graduate Group in Transportation, May 1987.
- Robert Underwood, *Optimal Design of Concrete Structures*, A.S.P., Graduate Group in Civil Engineering, May 1987.
- Krishnamohan Balachandran, *What Makes a Good Customer? Consumer Segmentation, Data Envelopment Analysis, and Classification in a Retail Banking Environment*, M.S. thesis, Operations and Information Management, May 1999.

Books, Monographs and Edited Volumes

1. P.T. Harker, ed., *Spatial Price Equilibrium: Advances in Theory, Computation and Application*, Lecture Notes in Economics and Mathematical Systems No. 249 (Springer-Verlag, Berlin, 1985).
2. P.T. Harker, ed., "The Analytic Hierarchy Process" special issue of *Socio-Economic Planning Sciences* 20(1986).
3. P.T. Harker, *Predicting Intercity Freight Flows* (VNU Science Press, Utrecht, The Netherlands, 1987).
4. B.L. Golden, E.A. Wasil and P.T. Harker, eds., *The Analytic Hierarchy Process: Applications and Studies*, (Springer-Verlag, Berlin, 1989).
5. P.T. Harker, *Lectures on the Computation of Equilibria* (Center for Operations Research and Econometrics, Universite Catholique de Louvain, Belgium, 1993).
6. P.T. Harker, ed., *The Service Quality and Productivity Challenge* (Kluwer Academic, Norwell, MA, 1995).
7. P.T. Harker, ed., Special issue of *Interfaces* on "Service-Sector Productivity-The MS/OR Challenge", V. 25, No. 3 (May-June 1995).
8. P.T. Harker and S.A. Zenios (eds.), Special issue of *Management Science* on "Performance of Financial Institutions", V. 45, No. 9 (September 1999).
9. P.T. Harker and S.A. Zenios (eds.), *Performance of Financial Institutions*, (Cambridge University Press, London, 2000).

Chapters in Books

1. T.L. Friesz and P.T. Harker, "Freight network equilibrium: a review of the state of the art", in: A.F. Daughety, ed., *Analytical Studies in Transportation Economics* (Cambridge University Press, 1985), 161-206.
2. P.T. Harker, "Issues and models for planning and regulating freight transport systems", in: L. Bianco and A. LaBella, eds., *Freight Transport Planning and Logistics* (Springer-Verlag Lecture Notes in Economics and Mathematical Systems No. 317, Berlin, 1989) 374-408.
3. P.T. Harker, "The art and science of decision making: the analytic hierarchy process", in: B.L. Golden, E.A. Wasil and P.T. Harker, eds., *The Analytic Hierarchy Process: Applications and Studies*, (Springer-Verlag, Berlin, 1989), 3-36.
4. P.T. Harker, "The service quality and productivity challenge," in P.T. Harker (ed.), *Service Quality and Productivity Challenge* (Kluwer Academic, Norwell, MA, 1995), 1-10.
5. P.T. Harker and L.W. Hunter, "Engineering products for customer value," in J.W. Cortuda and J.A. Woods (eds.), *The Quality Yearbook 1996* (New York, McGraw-Hill, 1996); reprinted from *Bank Management* March/April 1995.
6. F.X. Frei, P.T. Harker and L.W. Hunter, "Retail banking," in D.C. Mowrey (ed.), *U.S. Industry in 2000: Studies in Competitive Performance* (Washington, DC, National Academy Press, 1999), 179-214.
7. P.T. Harker, L.M. Hitt, and F.X. Frei, "How financial service firms decide on technology," in R.E. Litan and A.M. Santomero (eds.), *Brookings-Wharton Papers on Financial Services 1999*, (The Brookings Institution, Washington, DC, 1999) 93-146.
8. F. Frei and P.T. Harker, "Value creation and process management: evidence from retail banking," in E.L. Melnick, P.R. Nayyar, M.L. Pinedo, and S. Seshadri (eds.), *Creating Value in Financial Services: Strategies, Operations, and Technologies* (Kluwer Academic Publishers, Norwell, MA, 1999), 447-460.
9. P.T. Harker and S.A. Zenios, "What drives the performance of financial institutions?" in P.T. Harker and S.A. Zenios (eds.), *Performance of Financial Institutions*, (Cambridge University Press, London, 2000), 3-31.

10. F. Frei, P.T. Harker, and L.W. Hunter, "Inside the black box: what makes a bank efficient?" in P.T. Harker and S.A. Zenios (eds.), *Performance of Financial Institutions*, (Cambridge University Press, London, 2000), 259-311.
11. A. De Meyer, P.T. Harker, and G. Hawawini. "The globalization of business education," in H. Gatignon and J.R. Kimberly (eds.), *The INSEAD-Wharton Alliance on Globalizing: Strategies for Building Successful Global Businesses* (Cambridge University Press, London, 2004), 104-127.

Magazine Articles and Opinion Pieces

1. P.T. Harker, "Cheating: The New Epidemic," *Global Agenda: The Magazine of the World Economic Forum* (2005).
2. P.T. Harker, "Recalling Joseph Wharton's Vision for Business Schools," *AACSB International eNewsletter* Volume 5, Issue 3 (2006).
3. P.T. Harker, "Dean's Column: Patrick Harker of Wharton on Jon Huntsman," *Financial Times*, May 14, 2007.

Cases

1. O.Z. Aksin and P.T. Harker, "NationsBank reinvents the phone channel (A): the design decision," INSEAD, 1998.
2. O.Z. Aksin and P.T. Harker, "NationsBank reinvents the phone channel (B): the implementation," INSEAD, 1998.

Book and Software Reviews

1. *Spatial Economics: Potential, Density and Flow* by M. Beckmann and T. Puu--in *Geographical Analysis* **19** (1987), 185-186.
2. *Discrete Choice Models In Regional Science* by D.E. Pitfield, ed.--in *Journal of Regional Science* **26** (1987), 613-614.
3. *Multicriteria Optimization in Engineering and in the Sciences* by W.D. Stadtler (ed.)--in *Transportation Science* **23** (1989), 225-226.
4. *Criterion Software System*--in *OR/MS Today* **17** (October 1990), 28-29.
5. *Advances in Equilibrium Modeling, Analysis and Computation* by A. Nagurney (ed.), in *European Journal of Operational Research* **84** (1995), 499.

Refereed Publications

1. T.L. Friesz, R.L. Tobin, T.E. Smith and P.T. Harker, "A nonlinear complementarity formulation and solution procedure for the derived demand network equilibrium problem", *Journal of Regional Science* **23** (1983), 337-359.
2. T.L. Friesz and P.T. Harker, "Multicriteria spatial price equilibrium network design: theory and computational results", *Transportation Research* **17B**(1983), 411-426.
3. T.L. Friesz, R.L. Tobin and P.T. Harker, "Predictive intercity freight network models: the state of the art", *Transportation Research* **17A**(1983), 409-418.
4. T.L. Friesz, P.T. Harker and R.L. Tobin, "Alternative algorithms for the general spatial price equilibrium problem", *Journal of Regional Science* **24** (1984), 475-507.
5. P.T. Harker, "A variational inequality approach for the determination of oligopolistic market equilibrium", *Mathematical Programming* **30** (1984), 105-111.
6. P.T. Harker and T.L. Friesz, "Bounding the solution of the continuous equilibrium network design problem", *Proceedings of the Ninth International Symposium on Transportation and Traffic Theory* (1984), 233-252.
7. P.T. Harker, "A generalized spatial price equilibrium model", *Papers of the Regional Science Association* **54** (1985), 25-42.

8. P.T. Harker, "The state of the art in the predictive analysis of freight transportation systems", *Transport Reviews* **5** (1985), 143-164.
9. P.T. Harker and T.L. Friesz, "The use of equilibrium network models in logistics management: with application to the U.S. coal industry", *Transportation Research* **19B** (1985), 457-470.
10. P.T. Harker, "Existence of competitive equilibrium via Smith's nonlinear complementarity result", *Economics Letters* **19** (1985), 1-4.
11. T.L. Friesz and P.T. Harker, "Properties of the iterative optimization-equilibrium algorithm", *Civil Engineering Systems* **2** (1985), 142-154.
12. P.T. Harker, "The use of expert judgments in predicting interregional migration patterns: an analytic hierarchy process approach", *Geographical Analysis* **18** (1986), 62-80.
13. P.T. Harker and T.L. Friesz, "Prediction of intercity freight flows I: theory", *Transportation Research* **20B** (1986), 139-153.
14. P.T. Harker and T.L. Friesz, "Prediction of intercity freight flows II: mathematical formulations", *Transportation Research* **20B** (1986), 155-174.
15. P.T. Harker, "Alternative models of spatial competition", *Operations Research* **34** (1986), 410-425.
16. P.T. Harker, "A note on the existence of traffic equilibria", *Applied Mathematics and Computation* **18** (1986), 277-283.
17. P.T. Harker, "The spatial price equilibrium problem with path variables", *Socio-Economic Planning Sciences* **20** (1986), 299-310.
18. P.T. Harker, "Derivatives of the Perron root of a positive reciprocal matrix: with application to the analytic hierarchy process", *Applied Mathematics and Computation* **22** (1987), 217-232.
19. P.T. Harker, "Incomplete pairwise comparisons in the analytic hierarchy process", *Mathematical Modelling* **9** (1987), 837-848.
20. P.T. Harker, "The core of a spatial price equilibrium game", *Journal of Regional Science* **27** (1987), 369-389.
21. P.T. Harker, "Alternative modes of questioning in the analytic hierarchy process", *Mathematical Modelling* **9** (1987), 353-360.
22. P.T. Harker and L.G. Vargas, "Theory of ratio scale estimation: Saaty's analytic hierarchy process", *Management Science* **33** (1987), 1383-1403. Reply to a comment in *Management Science* **36** (1990), 269-273.
23. P.T. Harker and S.C. Choi, "Equilibrium in competitive urban mass transportation markets", *Proceedings of the Tenth International Symposium on Transportation and Traffic Theory* (1987), 417-436.
24. P.T. Harker, "Accelerating the convergence of the diagonalization and projection algorithms for finite-dimensional variational inequalities", *Mathematical Programming* **41** (1988), 29-59.
25. P.T. Harker, "Dispersed spatial price equilibrium", *Environment and Planning* **20A** (1988), 353-368.
26. P.T. Harker, "Multiple equilibrium behaviors on networks", *Transportation Science* **22** (1988), 39-46.
27. P.T. Harker, "Private market participation in urban mass transportation: application of computable equilibrium models for network competition", *Transportation Science* **22** (1988), 96-111.
28. P.T. Harker and J.S. Pang, "Existence of solutions to mathematical programs with equilibrium constraints", *Operations Research Letters* **7** (1988), 61-64.
29. P.T. Harker and J.S. Pang, "Finite-dimensional variational inequality and nonlinear complementarity problems: a survey of theory, algorithms and applications", *Mathematical Programming* **48** (1990), 161-220.

30. L. Goldsman and P.T. Harker, "A note on solving general equilibrium problems with variational inequality techniques," *Operations Research Letters* **9** (1990), 335-339.
31. I. Millet and P.T. Harker, "Globally effective questioning in the analytic hierarchy process," *European Journal of Operational Research* **48** (1990), 88-97.
32. P.T. Harker and J.S. Pang, "A damped-Newton method for the linear complementarity problem", in E.L. Allgower and K. Georg (eds.), *Computational Solution of Nonlinear Systems of Equations: AMS Lectures on Applied Mathematics* **26** (1990), 265-284.
33. S.C. Choi, W.S. DeSarbo and P.T. Harker, "Product positioning under price competition," *Management Science* **36** (1990), 175-199.
34. P.T. Harker and S.C. Choi, "A penalty function approach for mathematical programs with variational inequality constraints", *Information and Decision Technologies* **17** (1991), 41-50.
35. P.T. Harker and B. Xiao, "Perturbation results for the linear complementarity problem," *Applied Mathematics Letters* **2** (1989), 401-405.
36. B. Chen and P.T. Harker, "Two moments estimation of the delay on a single-track rail line with scheduled traffic", *Transportation Science* **24** (1990), 261-275.
37. D. Kraay, P.T. Harker and B. Chen, "Optimal pacing of trains in freight railroads: model formulation and solution", *Operations Research* **39** (1991), 82-99.
38. D. Jovanovic and P.T. Harker, "Tactical scheduling of rail operations: the SCAN-I decision support system", *Transportation Science* **25** (1991), 46-64.
39. P.T. Harker and B. Xiao, "Newton's methods for the nonlinear complementarity problem: a B-differentiable equation approach", *Mathematical Programming* **48B** (1990), 339-357.
40. P.T. Harker, "Generalized Nash games and quasivariational inequalities", *European Journal of Operational Research* **54** (1991), 81-94.
41. P.T. Harker, "The use of ATCS in scheduling and operating railroads: models, algorithms and applications," *Transportation Research Record* **1263** (1990), 101-110.
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3. P.T. Harker, "Models of imperfect spatial competition", *Modeling and Simulation: Proceedings of the 1984 Pittsburgh Conference on Modelling and Simulation* **15** (1984), 547-552.
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7. D. Jovanovic and P.T. Harker, "SCAN: a decision support system for railroad scheduling," in: R. Sharda (ed.), *Impact of Recent Computer Advances in Operations Research: Proceedings of the ORSA Computer Science Technical Section Special Conference* (North-Holland, Amsterdam, 1989), 347-360. Reprinted in *Proceedings of the 1989 IEEE/ASME Joint Railroad Conference* (IEEE, New York, 1989), 97-105.
8. P.T. Harker, "The use of satellite tracking in scheduling and operating railroads: models, algorithms and applications," *Proceedings of the Fifth World Conference on Transportation Research--Yokohama, Japan, 1989* (Western Periodicals, Ventura, CA, 1990), B299-B312.
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11. F. Frei and P. Harker, "Process efficiency in retail banking: methods and empirical results," *Proceedings of the Workshop on Quality Management in Services V* (Tilburg, The Netherlands, May 11-12, 1995).
12. P.T. Harker and L. Ungar, "A market-based approach to workflow automation," *NSF Workshop on Workflow and Process Automation in Information Systems: State-of-the-Art and Future Directions*, Athen, GA, May 1996.
13. V. Kumar, R. Bajcsy, W. Harwin, P. Harker, "Rapid design and prototyping of customized rehabilitation aids," *Communications of the ACM* **39** (1996), 55-61.
14. B. Prasad and P.T. Harker, "The technology payoff in retail banking: the role of the technical labor force," in D.C. Evanoff (ed.), *Technology: //www.policy.implications.for.the.future.of.financial.services/com, Proceedings of the 33rd Annual Conference on Bank Structure and Competition* (Federal Reserve Bank of Chicago, 1997), 86-103.
15. Bank Administration Institute, *Managing Technology Investment Decisions* (Chicago, IL: BAI, 1999).

Technical Reports and Working Papers

1. B. Xiao and P.T. Harker, "The stochastic linear complementarity problem," Working paper 88-05-04, Decision Sciences Department, The Wharton School, 1988.
2. D. Stefek and P.T. Harker, "Inexact restricted simplicial decomposition for large-scale multicommodity flow problems," Working Paper 89-02-01, Decision Sciences Department, The Wharton School, 1989.
3. A.B. Bailey and P.T. Harker, "Organizational structure in large service networks: the hazards of a back office strategy," Fishman-Davidson Discussion Paper No. 56, Fishman-Davidson Center, The Wharton School, 1990.
4. T. Kim and P.T. Harker, "Similarity of services and specialization in service operations," Fishman-Davidson Center Discussion Paper No. 52, Fishman-Davidson Center, The Wharton School, 1990.
5. P.T. Harker, "Computable equilibrium models for the analysis of service operations," Operations and Information Management Working Paper, The Wharton School, 1993.
6. P.K. Armstrong and P.T. Harker, "Design of incentive systems for service quality improvement," Systems Engineering Working Paper 94-23, University of Pennsylvania, 1995.
7. R. Qi and P.T. Harker, "Generalized spatial price equilibria with semicontinuous market structures," Systems Engineering Working Paper 95-08, University of Pennsylvania, 1995.
8. B. Prasad and P.T. Harker, "Examining the contribution of information technology toward productivity and profitability in U.S. retail banking," Working Paper, Wharton Financial Institutions Center, 1996.
9. R.A. Jose, P.T. Harker, and L.H. Ungar, "Coordinating locally constrained agents using augmented pricing," Working Paper 97-10-03, Department of Operations and Information Management, Wharton School.
10. B. Prasad and P.T. Harker, "Competition and software acquisition decisions in services: the case of retail banking," Working Paper, Wharton Financial Institutions Center, 1998.
11. L.W Hunter and P.T. Harker, "Designing the future of banking: lessons learned from the trenches," Working Paper, Wharton Financial Institutions Center, 1998.
12. B. Prasad and P.T. Harker, "Pricing online banking services amid network externalities," Working Paper, Wharton Financial Institutions Center, 1999.
13. M. Xue and P.T. Harker, "Overcoming the inherent dependency of DEA efficiency scores: a bootstrap approach," Working Paper, Wharton Financial Institutions Center, 1999.
14. S. Mallik and P.T. Harker "Contracting over multiple parameters: capacity allocation in semiconductor manufacturing," Working Paper, Fishman-Davidson Center, The Wharton School, 1999.
15. M.H. Belknap and P.T. Harker, "Beyond intelligent agents: introducing manager agents," Working Paper, Electronic Commerce Forum, The Wharton School, 1999.
16. M.H. Belknap, C.H. Chen and P.T. Harker, "A gradient-based method for analyzing stochastic variational inequalities with one uncertain parameter," Working Paper 00-03-13, Department of Operations and Information Management, The Wharton School, University of Pennsylvania, March 2000.
17. Mei Xue and Patrick T. Harker, "The self-service strategy: linking operations and marketing," Department of Operations and Information Management, Wharton School, January 2005.

Invited Seminars and Talks

In addition to numerous invited and contributed talks at professional meetings (ORSA/TIMS, Regional Science Association, American Mathematical Society Meetings, Mathematical Programming Society, SIAM, etc.) and at specialized conferences, the following invited seminars, tutorials and presentations have been given over the past several years:

1. "Prediction of intercity freight flows", Institute of Transportation Studies, University of California, September 1983 (Part I) and December 1983 (Part II).
2. "Past, present and future research directions in transportation economics: a comment", NSF Conference on Transportation Research, Evanston, IL, March 1985.
3. Panelist--"AHP and MAU, are their differences important?", ORSA/TIMS National Meeting, Atlanta, GA, November 1985.
4. "Equilibrium analysis via finite-dimensional variational inequalities", Department of Operations Research, Yale University, April 1986.
5. Tutorial on finite-dimensional variational inequalities, 8th Symposium on Mathematical Programming with Data Perturbations, Washington, DC, May 1986.
6. "Finite-dimensional variational and quasivariational inequalities: with application to equilibrium analysis and game theory", Department of Operations Research, AT&T Bell Laboratories, Holmdel, NJ, July 1986.
7. "Models of competition in telecommunications", Market Systems Analysis Department, AT&T Bell Laboratories, Murray Hill, NJ, February 1987.
8. "Finite-dimensional variational and quasivariational inequalities: algorithmic developments and applications to game theory", Department of Mathematical Sciences, The Johns Hopkins University, February 1987.
9. "Finite-dimensional variational and quasivariational inequalities: algorithmic developments and applications to game theory", Operations Research Seminar, Carnegie-Mellon University, March 1987.
10. "Finite-dimensional variational and quasivariational inequalities: algorithmic developments and applications to game theory", American Mathematical Society No. 834 Special Session on Computational Mathematics and Applications, Newark, NJ, April 1987.
11. Plenary talk--"Finite-dimensional variational and quasivariational inequalities: algorithmic developments and applications to socio-economic planning", International Conference on Mathematical Modeling, St. Louis, MO, August 1987.
12. "Finite-dimensional variational and quasivariational inequalities: algorithmic developments and applications to game theory", Department of Mathematical Sciences, University of Delaware, November 1987.
13. "The use of advanced technology in modern railroads", Department of Operations Research and Industrial Engineering, University of Michigan, November 1987.
14. "The use of advanced technology in modern railroads", Department of Civil Engineering, Carnegie-Mellon University, December 1987.
15. "The use of advanced technology in modern railroads", Katz Graduate School of Business, University of Pittsburgh, December 1987.
16. "The art and science of decision-making: the analytic hierarchy process", ORSA/TIMS Philadelphia Chapter Meeting, January 1988.
17. "The state-of-the-art in the analytic hierarchy process", Invited tutorial, ORSA/TIMS National Meeting, Washington, DC, April 1988.
18. "Recent results on finite-dimensional variational inequalities and nonlinear complementarity problems", AMS-SIAM Summer Seminar, Fort Collins, CO, July 1988.

19. "Two results in complementarity theory", Department of Combinatorics and Optimization, University of Waterloo, September 1988; Department of Civil Engineering and Operations Research, Princeton University, October 1988.
20. "Real-time and tactical scheduling of freight trains: the case of algorithms chasing technology", CP/NSERC Seminar Series, University of Waterloo, September 1988; Department of Industrial Engineering and Management Science, Northwestern University, October 1988; Decision Sciences-Civil Engineering Joint Seminar Series, RPI, November 1988; Department of Operations Research and the Graduate School of Business, Stanford University, January 1989.
21. "Solving finite-dimensional variational inequality and complementarity problems: survey and recent results," Department of Operations Research, Stanford University, February 1989; Rutgers Center for Operations Research, March 1989.
22. "The state-of-the-art in the analytic hierarchy process", Invited tutorial, ORSA/TIMS National Meeting, New York, NY, October 1989.
23. "Optimization: the world as a system of equations," AMS-MAA Joint National Meetings, Columbus, OH, August 1990.
24. Presiding officer, "Advanced technology in freight transportation: an intermodal perspective," 70th Annual Meeting of the Transportation Research Board, January 1991.
25. "Design and management of service operations: concepts and cases," Karl Eller School of Business, University of Arizona, February 1991; Graduate School of Business, Stanford University, March 1991; Faculty of Management, University of British Columbia, March 1991; Decision Sciences Department, R.P.I., March 1991.
26. "Path following methods for optimization and equilibrium problems: why stay interior?" Faculty of Management, University of British Columbia, March 1991.
27. "O.R./Management Science in the service industries: the great productivity challenge," Philadelphia Chapter of TIMS/ORSA, April 1991.
28. Panelist, Services Industry Sub-Group, National Advisory Commission on Work-Based Learning, Washington, DC, July 1991.
29. "America's Most Wanted: Technology That Works in Services," Operations Research Colloquium, Stanford University, January 1993.
30. "Services and Technology: Reengineering the Railroads," Transportation Systems Center, MIT, April 1993; Keynote Lecture, Australian Society for Operations Research, Adelaide, Australia, July 1993; Penn State O.R. Colloquium, September 1993; AT&T Bell Laboratories, March 1994; USAir Operations Research Group, March 1994.
31. "Computational Competitive Models: A Complementarity Approach," AT&T Bell Laboratories, January 1995; Penn State O.R. Colloquium, March 1995.
32. "Smooth Approximation Methods for Complementarity Problems," Center for Economic Research, Tilburg University, The Netherlands, May 1995.
33. "Productivity in Financial Services: A Process-Oriented View," N.Y.U. Stern School, March 1995; M.I.T. Operations Management Summer Camp, July 1995; MITRE Corporation, July 1995.
34. "Process and Technology Efficiency in Financial Services," Decision Sciences Department, R.P.I., October 1995; Operations Management Department, Columbia University, October 1995; Department of Industrial Engineering and Management Sciences, Northwestern University, November 1995; UCLA Anderson School of Management, February 1996; Owen Graduate School of Business, Vanderbilt University, April 1996.
35. "Software and delivery of commercial banking products," Software as a Tool of Competitive Advantage: A U.S. - Japan Comparison, Columbia University, April 1996.

36. "A market-based approach to workflow automation," NSF Workshop on Workflow and Process Automation in Information Systems: State-of-the-Art and Future Directions, Athen, GA, May 1996.
37. "Process Benchmarking Using AHP", Fourth International Symposium on the Analytic Hierarchy Process, Vancouver, Canada, July 1996.
38. Keynote Speaker, "Quality and Productivity in Financial Services: A Process-Oriented View of Banking Operations," Frontiers in Services (sponsored by the American Marketing Association and Vanderbilt University), October 4, 1996.
39. "Service Operations Management: An Agenda for Normative and Empirical Research," New Jersey INFORMS, January 1997; MIT Operations Research Center, March 1997; Invited tutorial, INFORMS National Meeting, San Diego, May 1997.
40. "High Performance Workplaces in Services: The Case of Retail Banking," Quality at the Turning Point Conference, Deming Center, Columbia University, September 1997.
41. "Integrated Service Delivery in Retail Banking," Service Management Group, Harvard Business School, October 1997.
42. "Inside the Black Box: What Makes a Bank Efficient?" Research Division, Federal Reserve Bank of Philadelphia, January 1998; Katz School of Business, University of Pittsburgh, February 1998; Laurent Picard Distinguished Lecturer, McGill University, Montreal Canada, March 1998.
43. Plenary Speaker, "Mathematical Programming in Services: Describing and Improving Operations," Applied Mathematical Programming and Modeling Conference, Limassol, Cyprus, March 1998.
44. "How financial firms decide on technology," Brooking-Wharton Papers on Financial Services, Washington DC, October 22-23, 1998; Bank Administration Institute's Retail Delivery Conference, Las Vegas, NV, December 1998; Kenan-Flagler Business School, University of North Carolina at Chapel Hill, February 1999; Bank Administration Institute's Transaction Processing Conference, Miami, FL, April 1999.
45. "Market-based operations," INSEAD, Fountainbleu, France, March 2000.
46. "From Customer to Co-Producer: Lessons for Higher Education," Wei Lun Distinguished Lecture, Chinese University of Hong Kong, January 2002.
47. "A Gradient-based Method for Analyzing Stochastic Variational Inequalities," Third Alan Goldman Lecture, Johns Hopkins University, February 2002.
48. "The Science and Art of Service Management: From Customer to Co-Producer," Keynote address, INFORMS Conference on OR/MS Practice, Cambridge, MA, April 2004.
49. "The Science and Art of Service Management: From Customer to Co-Producer", Keynote address, POMS Service Conference, Columbia University, December 2004.
50. "The Science and Art of Service Management: From Customer to Co-Producer," Omega Rho Distinguished Lecture, INFORMS Conference, Pittsburgh, PA 2006.

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