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BUSINESS ADDRESS

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WORK EXPERIENCE

Adjunct Professor of Economics, Department of Economics, University of California-Berkeley, 2002-present.
Visiting Professor of Economics, Department of Economics, University of California-Berkeley, 1993-2002.
Executive Director, Center for Research on Telecommunications Policy, Institute for Business Innovation, Haas Business School, University of California-Berkeley, 1995-present.
Consulting Professor, Public Policy Program, Stanford University, Spring 1993.
Senior Research Associate, California Energy Institute, University of California-Berkeley, 1993-94.
Senior Member of Technical Staff, Economics & Statistics Department, GTE Laboratories Incorporated, 1986-1992.
Assistant Professor of Economics, University of Rochester, 1981-1986.
Lecturer and Teaching Assistant, Department of Economics, University of California-Berkeley, 1978-81.
Research Assistant, University of California-Berkeley, 1975-80.
Research Assistant, Carnegie Council on Higher Education, Berkeley, CA, 1977-78.
Project Specialist, Institute for Research on Poverty, University of Wisconsin-Madison, Summer 1976.
Undergraduate Assistant, University of Wisconsin-Madison, 1971-1974.

EDUCATION

Ph.D. (Economics), University of California-Berkeley, 1983.
M.A. (Statistics), University of California-Berkeley, 1978.
B.A., University of Wisconsin-Madison, 1974.

HONORS/AWARDS

Lilly Post-Doctoral Teaching Fellowship, University of Rochester, 1982-83.
Sloan Foundation Research Assistantship, University of California-Berkeley, 1976-77.
Flood Fellowship, University of California-Berkeley, 1974-75.
Phi Beta Kappa, University of Wisconsin-Madison, 1974.

KEYNOTE ADDRESSES

- A Behavioral Approach to Telecoms Regulation*, CMT 3rd annual conference, Barcelona Spain, November 2010.
Merger in a Bidding Market, Competition Policy Forum, ZEW, Mannheim Germany, June 2010.
The Future of Voice, International Telecommunications Union, Geneva, Switzerland, January 2007.
Demand, Competition and Regulation of Fixed and Mobile Services: Lessons from the U.S. and Korean Experiences, KIET-KT International Seminar, Seoul Korea, August 2001

PROFESSIONAL ACTIVITIES

- Senior Policy Scholar, The Georgetown Center for Business and Public Policy, 2011-present.
Member, Advisory Editorial Board, Journal of Regulatory Economics, 1988-2002.
Member, Editorial Board, Information Economics & Policy, 1990-1996.
Member, Editorial Board, Telecommunications Policy, 2008-present.
Member, Board of Directors, *International Telecommunications Society*, 1987-2011.
Conference organizer, *Center for Research on Telecommunications Policy*, Berkeley, CA, June 1997, October 2000, October 2004 and April 2010.
Conference program organizer, *National Broadband Summit*, Washington DC, October 2001; *Center for Research on Telecommunications Policy*, Evanston, IL, May 1996; *Strategic Alliance Symposium*, Boulder, CO, January 1995; *International Telecommunications Society*, Cambridge, MA, July 1988 and Tokyo Japan, June 2010.
Session organizer, *Western Economic Association International Conference*, Lake Tahoe, June 1993; *International Telecommunications Society*, Cannes, June 1992, Berlin, September 2004, Tokyo, June 2010 ; *19th Telecommunications Policy Research Conference*, Solomon Island, MD, September 1991; *American Economic Association*, New York, December 1988.

Referee for professional journals:

<u>American Economic Review</u>	<u>Journal of Economic Literature</u>
<u>Berkeley Electronic Journals</u>	<u>Journal of Industrial Economics</u>
<u>Economic Inquiry</u>	<u>Journal of Law & Economics</u>
<u>Economic Journal</u>	<u>J. of Law, Economics & Organization</u>
<u>Economics Letters</u>	<u>J. of Policy Analysis & Management</u>
<u>IEEE Transactions on Networks</u>	<u>Journal of Public Economics</u>
<u>Information Economics & Policy</u>	<u>Journal of Regulatory Economics</u>
<u>International Economic Review</u>	<u>Telecommunications Policy</u>
<u>International J. of Industrial Organization</u>	<u>Telecommunications Systems</u>
<u>Information Economics & Policy</u>	<u>Transportation Science</u>
<u>J. of Economics & Management Strategy</u>	<u>Utilities Policy</u>
<u>Journal of Economic Literature</u>	<u>Zeitschrift Fur National Ekonomie</u>
<u>J. of Economic Behavior & Organization</u>	

- Reviewer, National Science Foundation, RAND Corporation, MacMillan Publishing, Prentice-Hall, MIT Press, Oxford University Press.
Member, *American Economic Association*, *International Telecommunications Society*, *American Bar Association*, *Industrial Organization Society*.

EXTRAMURAL ACTIVITIES

Advisor, Office of Policy, Planning and Analysis, U.S. Department of Energy, 1985-86.
Member of the California Public Utility Commission's Incremental Cost Task Force, 1988-89.
Member of the *National Science Foundation's* Information Infrastructure Forum, 1994.
Consultant to the Office of Technology Assessment, U. S. Congress, 1994.
Member, Deloitte & Touche, eBusiness Strategy Brain Trust, 2000-2002.
Principal, The Brattle Group, 2004-2008.
Senior Adviser, The Brattle Group, 2008-present.
Senior Consultant, Compass Lexecon, 2008-present.

JOURNAL ARTICLES

The Effect of Prices on Fixed and Mobile Telephone Penetration Using Price Subsidies as Natural Experiments (with Michael Ward), Information Economics & Policy, **22:1**, January 2010.

Competition for Exclusive Customers: Equilibrium and Welfare under One-Part and Two-Part Pricing (with James Reitzes), Canadian Journal of Economics, September 2008.

The Demographics of the Do-Not-Call Registry, IEEE Security & Privacy, December 2004.

Going Mobile: Substitution between Fixed and Mobile Access, Telecommunications Policy, **27** (2003), 457-476.

Open Access Rules and The Broadband Race, Michigan State University-Detroit College of Law Review, 2002.

Monopoly Pricing with Network Externalities, (with Luis Cabral and David Salant) International Journal of Industrial Organization, **17:2**, February 1999, 199-214.

Facilities Competition and Local Network Investment: Theory, Evidence and Policy Implications, Industrial and Corporate Change, **7:4**, December 1998.

Regulatory Pricing Rules to Neutralize Network Dominance, (with Nicholas Economides and Giuseppe Lopomo) Industrial and Corporate Change, **5:4**, December 1996, 1013-1028.

Microsoft Plays Hardball: Use of Nonlinear Pricing and Technical Incompatibility to Exclude Rivals in Operating Software, (with Kenneth Baseman and Frederick Warren-Boulton), Antitrust Bulletin, **XL:2**, Summer 1995, 265-315.

Economics of Intellectual Property Protection for Software: The Proper Role for Copyright, (with Kenneth Baseman and Frederick Warren-Boulton) StandardView, **2:2**, June 1995.

Current Copyright Protection Can Make Economic Sense, (with Kenneth Baseman and Frederick Warren-Boulton), The Computer Lawyer, **12:2**, February 1995.

Trigger Price Regulation (with David Salant), Rand Journal of Economics, **23:1**, Spring 1992, 29-51.

Crossing Dupuit's Bridge Again: a Trigger Policy for Efficient Investment in Infrastructure (with David Salant), Contemporary Policy Issues, **IX**, April 1991, 101-114.

Regulatory Risk, Investment, and Welfare, Review of Industrial Organization, **3:3**, May 1988, 75-99.

Second-best Pricing with Upstream Distortions, Economics Letters, June 1985.

BOOK CHAPTERS & CONFERENCE PROCEEDINGS

- Introduction to Special Issue on Wireless Innovation* (with John Mayo) in Information Economics & Policy, **22:1**, January 2010.
- Strategic Commitments and the Principle of Reciprocity in Interconnection Pricing*, (with Nicholas Economides and Giuseppe Lopomo), published in: The Economics of Digital Markets, edited by Gary Madden, 2008.
- Open Access Rules and Equilibrium Broadband Deployment*, Frontiers of Broadband, Electronic and Mobile Commerce, edited by Gary Madden and Russel Cooper, Physica-Verlag, 2004.
- Local Network Competition*, chapter in Handbook of Telecommunications Economics, Martin Cave, Sumit Majumdar and Ingo Vogelsang, editors, Elsevier Publishing, 2002.
- Local Telephone Service: A Complex Dance of Technology, Regulation and Competition*, (with Ingo Vogelsang) in Industry Studies, 2nd Edition, edited by Larry Duetsch, M. E. Sharpe, 1998.
- Exclusionary Behavior in the Market for Operating System Software: the Case of Microsoft*, (with Kenneth Baseman and Frederick Warren-Boulton), in Opening Networks to Competition: The Regulation and Pricing of Access, edited by David Gabel and David Weiman, Kluwer Academic, 1997, 221-238.
- Introduction to Special Issue on Telecommunications*, (with Michael Katz) in Industrial and Corporate Change, **6:4**, December 1997.
- Turning the Cables: Economic and Strategic Analysis of Cable Entry into Telecommunications*, in Globalism and Localism in Telecommunications, edited by Eli Noam, Elsevier Science, 1996.
- Promoting Capital Improvements by Public Utilities: a Supergame Approach*, (with David Salant), Economic Theory & International Trade: Essays in Honor of John Trout Rader III, W. Neufeind and R. Reizman (editors), Springer-Verlag, 1992, 445-461.
- Economics of Bypass in a Simple Model of the Telephone System*, Proceedings of the Fifteenth Annual Telecommunications Policy Research Conference, edited by Edward Zajak, ERIC Reports, 1987, 68-96.

BOOK REVIEWS

- Networks, Infrastructure and the New Task for Regulation*, (edited by Werner Sichel and Donald Alexander, University of Michigan Press, 1996), reviewed in Journal of Economic Literature, **XXXV**, September 1997, 801-803.
- Regulation and Markets* (by Daniel Spulber, MIT Press, 1989), reviewed in Journal of Regulatory Economics, December 1989, 1409-1412.

COMPLETED RESEARCH PAPERS

- Demand in a Portfolio-Choice Environment: The Evolution of Telecommunications Demand* (with Jeffrey Macher, John Mayo and Olga Ukhaneva), July 2012.
- Social and Private Learning with Information and Payoff Externalities: Laboratory Experiments* (with Julian Jamison and David Owens), September 2011.
- Merger in a Bidding Market: Quantifying the Unilateral Effects* (with Richard Gilbert), April 2010.
- Diffusion with Dueling Platforms: Technology Spillovers in the Cable-Telco Broadband Race* (with Armando Levy), June 2008.
- Input Quality Sabotage and the Welfare Consequences of Parity Rules* (with James Reitzes), October 2006.

COMPLETED RESEARCH PAPERS (Cont'd)

- Who Sign Up for the Do-Not-Call List?* (with Hal Varian and Fredrik Wallenberg), April 2004.
- Usage Substitution Between Fixed and Mobile Telephony in the U.S.* (with Michael Ward), April 2004.
- Demand, Competition and Regulation of Fixed and Mobile Services: Lessons from the U.S. and Korean Experiences*, December 2001.
- Competition's Effect on Investment in Digital Infrastructure*, May 2000.
- Interconnection and Foreclosure of Network Competition* (with Nicholas Economides), April 1996.
- Benefits and Pitfalls of Network Interconnection* (with Nicholas Economides), New York University Stern School Working Paper EC-92-31, November 1992.
- Straws in the Bottleneck: a Proposal for Efficient Provision of Essential Facilities*, (with Frederick Warren-Boulton and John Woodbury) June 1992.
- Technology, Regulation, and the Emergence of Competitive Access Providers*, October 1991.
- Competitive Entry into the Local Exchange: Survey of Strategic Models and Econometric Tests*, appeared as Rand Paper P-7644, May 1990.
- On the Stability of Efficient Networks: Integration vs. Fragmentation in Communications and Transportation*, July 1990.
- Efficiency and Sustainability of the Telephone Network with Potential Bypass*, September 1989.
- Dividing a Sunk Cost: a Bargaining Approach to Regulatory Treatment of Powerplant Cancellations*, July 1989.
- Lumpy Investment, Capital Recovery, and Rate Shock: Comparing Rate of Return Regulation with Price Caps*, GTE Laboratories Technical Note 879.3, November 1989.
- Credible Price Control*, GTE Laboratories Economics Working Paper 88-1, February 1988, revisions requested, Journal of Regulatory Economics.
- On Pricing with Lumpy Investment: Two Problems of Boiteux*, University of Rochester, Department of Economics Working Paper, November 1987.
- Long-term Regulatory Contracts*, University of Rochester, Department of Economics Working Paper, January 1986.

GOVERNMENT REPORTS

- The Evolving Structure of the U.S. Wireless Communications Industry*, prepared for Office of Technology Assessment, U.S. Congress, December 1994.
- A Primer on Rate Design with Imperfect Knowledge*, prepared for the Office of Policy, Planning, and Analysis, U. S. Department of Energy, July 1985.

MISCELLANEOUS CORPORATE & CONSULTING REPORTS

- The New Economics of the Cable Television Industry*, prepared for Arthur Andersen Economic Consulting, April 1993.
- Cable Entry into Telecommunications: Alternate Access Services*, GTE Laboratories Technical Correspondence TC-0188-08-92-419, September 1992.
- Deployment of Urban Fiber Rings by LECs and Caps: the Record to Date*, (with Frederick Kinzler and L. Keta Ruiz) GTE Labs Technical Correspondence TC-0189-08-92-419, August 1992.

MISCELLANEOUS CORPORATE & CONSULTING REPORTS (Cont'd)

GTE's Capital Investment Profile: an Empirical Assessment, (with L. Keta Ruiz) GTE Laboratories Technical Correspondence 0180-03-92-419, March 1992.

Deploying Telecommunications Technologies on Time: Challenges and Opportunities for Policymakers, GTE Labs Technical Correspondence TC-0164-09-91-419, Sept. 1991.

Are Two Regulators Better than One? Economics of Dual Regulation of Telecommunications, GTE Laboratories Technical Correspondence 0136-01-91-419, November 1990.

A Model of Entry by Alternative Local Carriers: I and II, GTE Laboratories Technical Correspondences 0132/0133-01-91-419, November 1990.

Consistent Pricing of Access to a New Network Service, GTE Laboratories Technical Note 879.6, October 1989.

SELECTED REGULATORY AND PUBLIC POLICY FILINGS

The Costs of the ITC Downstream Exclusion Order to the U.S. Economy, a report submitted to the U.S. Trade Representative, (with Daniel McFadden), July 2007.

Brief Amicus Curiae, U.S. Supreme Court in Lotus v. Borland, (with Joseph Farrell), December 1995.

Affidavit and Reply Affidavit, Motion of Bell Atlantic, BellSouth, NYNEX, and Southwestern Bell to Vacate the Modification of Final Judgment, Civil Action 82-0192, June 1994 and July 1995.

Comments and Reply Comments, *A Comparative Efficiency Approach to the FCC's Prime Time Access Rule*, (with Oliver Williamson) on Federal Communication Commission's Mass Media Docket 94-123, April and July 1995.

Comments submitted to New Zealand Commerce Department and The Treasury, *Finishing the Job of Telecommunications Reform in New Zealand*, November 1995.

SELECTED PRESENTATIONS

Demand in a Portfolio-Choice Environment, IIOC, Arlington VA, April 2012.

Social and Private Learning with Information and Payoff Externalities, EMTS, Berlin, June 2010.

Merger in a Bidding Market, IIOC, Vancouver Canada, May 2010.

The Effect of Prices on Fixed and Mobile Telephone Penetration Using Price Subsidies, Georgetown University conference on Wireless Innovation, April 2010.

Diffusion with Dueling Platforms: Technology Spillovers in the Cable-Telco Broadband Race, AEA/TPUG session, San Francisco, January 2009.

Input Quality Sabotage and the Welfare Consequences of Parity Rules, Telecommunications Policy Research Conference, October 2009.

A Two-Sided View of Net Neutrality: US and EU Competition Policy towards Discriminatory Conduct by Access Platforms, London Business School, November 2007; ITS biennial conference, Montreal, July 2008.

Mandatory Facility Sharing and Investment in Telecommunications Infrastructure, RITE Symposium, Tokyo Japan, June 2005; ZEW Workshop, Mannheim, Germany, December 2006.

Layered Regulation, New Millennium Research Council, Washington, June 2004; Stanford-Japan Center, Kyoto, Japan, April 2005.

SELECTED PRESENTATIONS (Cont'd)

- Who Sign Up for the Do-Not-Call List?* National Bureau of Economic Research, Cambridge, MA, May 2004.
- Open Access Rules and the Broadband Race, Beyond Microsoft conference, University of California at Berkeley, March, 2001.
- Do Wireless and Wireline Services Compete?* International Communications Forecasting Conference, Seattle, WA September 2000; TNS Telecoms conference, New Orleans, October 2000 and Las Vegas, October 2002.
- Competition's Effect on Investment in Digital Infrastructure*, CRTP conference; Telecommunications Policy Research Conference, September 1999; University of Arizona, May 2000; ITS Biennial Conference, Buenos Aires, July 2000; California Public Utility Commission, San Francisco, July 2000; Northwestern University, October 2000.
- Building U.S. Infrastructure for Ecommerce, The Digital Economy in International Perspective*, Washington, D.C., May 1999; Cyber Rendezvous, Jackson Hole, WY, October 1999.
- Economics of Network Interconnection*, Sogang University and Korean Telecom, Seoul, Korea, December 1998; University of the Andes, Bogota, Colombia, July 1997.
- Investment in Local Network Infrastructure under Deregulation*, CRTP, University of Michigan, June 1998; Fordham, NYC, October 1998; KDI and KISDI, Seoul, Korea, December 1998.
- Antitrust's Future in Local Exchange Markets: An Economist's View*, American Bar Association annual meetings, San Francisco, August 1997.
- Regulatory Pricing Rules and the New Telecom Act*, University of California, Berkeley, October 1996; California Public Utility Commission, May 1997; Federal Reserve Bank of Cleveland, July 1997; University of the Andes, Bogota, Colombia, July 1997.
- Symmetric Regulation of Deregulated Telecommunications Markets*, Consortium for Research on Telecommunications Policy, Northwestern University, May 1996.
- Interconnection and Foreclosure of Network Competition*, ITS Interconnection & Interoperability Symposium, Wellington, New Zealand, October 1995.
- Microsoft Plays Hardball: Use of Nonlinear Pricing and Technical Incompatibility to Exclude Rivals in Operating Software*, Western Economic Association, San Diego, July 1995; Stanford University, June 1996.
- Turning the Cables: Strategic Analysis of Cable Entry into Telecommunications*, Columbia University, NYC, December 1993; AEI Telecommunications Summit, Washington, July 1994; ITS Symposium, Boulder, January 1995; TPRC, Solomon Island, MD, October 1995.
- Intellectual Property Protection for the National Information Infrastructure: Getting the Rules Right from the Start*, NSF's Information Infrastructure Forum, Annenberg Foundation, Washington DC, July 1994.
- Monopoly Pricing with Network Externalities*, Berkeley, April 1994; AEA, Anaheim, January 1996.
- Benefits and Pitfalls of Network Interconnection*, Columbia University, December 1992; University of Illinois, March 1993; Western Economics Association, Lake Tahoe, June 1993.
- An Empirical Model of Innovative Entry and a Test of Strategic Deterrence: an Application to Local Access Markets*, 20th Telecommunications Policy Research Conference, Solomon Island, MD, September 1992; UC-Davis, May 1993.
- Straws in the Bottleneck: a Proposal for Efficient Network Interconnection*, International Telecommunications Society, Cannes, France, June 1992; Western Economics Association, June 1993.

SELECTED PRESENTATIONS (Cont'd)

Regulation and the Adoption of New Local Service Technologies, Boston University, May 1992; Wharton School, May 1992; Rutgers Conference on Regulation and Public Utility Regulation, San Diego, July 1991; EARIE, Ferrara, Italy, September 1991; American Enterprise Institute, October 1990; Southern Economic Association, New Orleans, November 1990.

Lumpy Investment, Capital Recovery, and Rate Shock: Comparing Rate of Return Regulation to Price Caps, Telecommunications Policy Research Conference, Airlie, VA, October 1990.

Competitive Entry into Communications Networks, NTT World Headquarters, Tokyo, July 1989.

On the Stability of Efficient Networks, ITS Conference, Cannes, France, June 1992; ORSA/TIMS conference, Denver, October 1988; Fifth World Congress on Transportation Research, Yokohama, Japan, July 1989.

Dividing a Sunk Cost: a Bargaining Approach to Abandoned Powerplants, American Economic Association, New York City, December 1988; Rutgers Public Utility Conference, Monterey, CA, July 1989.

COURSES TAUGHT

Intermediate Microeconomics (12 times)
Undergraduate Industrial Organization & Public Policy (16 times)
Undergraduate Industrial Organization Theory (2 times)
Undergraduate Regulation (3 times)
Undergraduate Senior Seminar (4 times)
Introduction to Econometrics (7 times)
Seminar in Telecommunications (5 times)
Graduate Industrial Organization (1 time)
Graduate Regulation & Antitrust (3 times)
Graduate Incentives and Information (4 times)

SELECTED CONSULTING CLIENTS

Amway Corp.	Pfizer, Inc.
Borland International, Inc.	Qualcomm, Inc.
BellSouth New Zealand	Samsung
BellSouth Corp. (AT&T)	SBC Communications (AT&T)
CTIA – The Wireless Association	Sun Microsystems, Inc
Deloitte, Touche, Tomatsu	Telecom Colombia
Deutsche Telekom AG	Telefonica, S.A.
DirectTV Inc.	Telstra Corp., Ltd.
EchoStar Satellite, LLC	U.S. Department of Justice
FEMSA Cerveza	Verizon Communications
Hewlett-Packard Corp.	Vodafone Group, PLC
Lucent Technologies	Walt Disney Co.
Novell Inc.	Wyeth Pharmaceuticals
Pacific Bell Telephone	

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