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Education

1970 B.A. University of Pennsylvania, Mathematics
1971 M.A. State University of New York at Stony Brook, Mathematics
1974 M.Phil. Yale University, Economics
1975 Ph.D. Yale University, Economics

Dissertation Title: *A Comparison of Price Controls and Quantity Controls Under Uncertainty*

Fields of Research Concentration

Applied Microeconomic Theory, Environmental and Resource Economics, Pollution Control, Issues of Public Policy, Probabilistic Long Term Projection Analysis, Climate Change, Decisions under Uncertainty and the Value of Information, Vulnerability to Climate Change and Climate Variability

Fellowships and Awards

Phi Beta Kappa, University of Pennsylvania
Yale University Fellowship
Dissertation received an evaluation of "Distinction"
Elected member of Connecticut Academy of Science and Engineering
Elected member-at-large of Sigma Xi

Experience

July 1985 - Present: Professor of Economics, Wesleyan
June 1994 – June 1999: Director of Research and Sponsored Programs, Wesleyan
July 1992 - June 1996: Director, Andrus Center for Public Affairs, Wesleyan University
July 1978 - June 1985: Associate Professor of Economics, Wesleyan University
July 1977 - July 1978: Assistant Professor of Economics, Wesleyan University
Aug. 1975 - Aug. 1977: Assistant Professor of Economics, SUNY Albany
Fall 1981 - Fall 1983: Visiting Associate Professor of Economics, Yale University
Fall 1987 - Fall 1989, Spring 1991 and Spring 1995: Visiting Professor of Economics, Yale University

Publications

Books and Monographs:

- 1) *A Comparison of Price Controls and Quantity Controls Under Uncertainty*, New York, Garland Publishing Co., Inc., 1979. (Published in a series of 24 Outstanding Dissertations in Economics)
- 2) *Exercises and Applications for Microeconomic Analysis* (1st, 2nd and 3rd Editions) New York, Norton and Company, 1983; 1986; 1993.
- 3) *Study Guide to Economics* (12th, 13th, & 14th Editions by Paul Samuelson and William Nordhaus), McGraw Hill, 1985; 1989; and 1992.
- 4) *Instructor's Manual to Economics* (12th, 13th, and 14th Editions by Samuelson & Nordhaus), McGraw Hill, 1985; 1989; and 1992.
- 5) *Instructor's Manual to Macroeconomics* (Hall and Taylor), Norton and Company, February 1986 and 1989.
- 6) *An Economic Methodology for Evaluating the Timing and Relative Efficacy of Alternative Responses to Climate Change*, Stockholm Environment Institute, November 1990.
- 7) *Economic Data and the Human Dimensions of Global Environmental Change: Creating a Data Support Process for an Evolving Long Term Research Program* (with Kathleen Segerson, University of Connecticut), Human Dimensions Program, International Social Science Council, UNESCO, Paris, France, December 1992.
- 8) Review of *Economic Value of Weather and Climate Forecasts* edited by Kats and Murphy (Cambridge University Press) for Eos, 1998.
- 9) Review of *The Environment and Emerging Development Issues* edited by Dasgupta and Maler (Oxford University Press) for The Journal of Asian Studies, 1998.
- 10) *Microeconomics* (10th edition, with Edwin Mansfield), Norton and Company, 2000.

Articles:

- 1) "Polluters' Profits and Political Response: Direct Controls versus Taxes--A Comment," *American Economic Review*, December 1976.
- 2) "Substitution and the Control of Pollution--A Comparison of Effluent Charges and Quantity Standards Under Uncertainty," *Journal of Environmental Economics and Management*, December 1976.
- 3) "Single-valued Control of an Intermediate Good Under Uncertainty--A Comparison of Prices and Quantities," *International Economic Review*, February 1977.
- 4) "Single-Valued Control of a Cartel Under Uncertainty--A Multifirm Comparison of Prices and Quantities," *Bell Journal of Economics*, Spring 1977.
- 5) "Comparisons of Price and Quantity Control, A Survey," *Journal of Comparative Economics*, September 1977.
- 6) "The Complementarity of Public and Private Capital and the Optimal Rate of Return to Government Investment," with Seiritsu Ogura, *Quarterly Journal of Economics*, November 1977.

- 7) "Toward a General Comparison of Price Controls and Quantity Controls Under Uncertainty," *Review of Economic Studies*, June 1978.
- 8) "The Optimal Linear Alternative to Price and Quantity Controls," with Gordon Karp, *Journal of Comparative Economics*, March 1979.
- 9) "Pollution Controls and the Distribution of Income to the Factors of Production: Some Comparative Statics in General Equilibrium," *Journal of Environmental Economics and Management*, September 1979.
- 10) "Distribution and the Structure of Incentives: A Comment", *Journal of Comparative Economics*, September 1979.
- 11) "Secondary Materials and International Trade--A Comment on the Domestic Market," *Journal of Environmental Economics and Management*, September 1979.
- 12) "Taxing Consumption to Finance Reduced Emissions: An Alternative Pollution Control," *Economic Letters*, 1979.
- 13) "Depreciation and the Conservation of Energy," *Economic Letters*, 1979.
- 14) "Current Publication Lags in Economics Journals," *Journal of Economic Literature*, September 1980.
- 15) "Managing a Sudden Supply Shortage--Some Policy Alternative When Information is Costly," *Resources and Energy*, March 1980.
- 16) "Should Sliding Controls be the Next Generation of Pollution Controls?", *Journal of Public Economics*, 1981.
- 17) "Regulation Under Uncertainty--An Intuitive Survey and Application to Fisheries," *Journal of Marine Economics*, September, 1984.
- 18) "Fines as Economic Incentives--An Alternative Variable Control," *International Review of Law and Economics*, June 1982.
- 19) "Markets and Regulation Under Uncertainty," *Economic Letters*, 9, 1982.
- 20) "Uncertainty and the Projection of Carbon Emissions," *Alternative Energy Sources V*, Elsevier Science Publishers, 1983 and 1989.
- 21) "Future Carbon Dioxide Emissions from Fossil Fuels," (with William Nordhaus) *Changing Climate: Report of the Carbon Dioxide Assessment Committee*, National Research Council, October 1983.
- 22) "Constant Elasticity of Substitution Production Functions with Three or More Inputs - An Approximation Procedure," *Economic Letters*, 15, 1984.
- 23) "Improving Tax Based Income Policies - Lessons for the Environmental Literature," *Public Finance Quarterly*, April, 1984.
- 24) "The Effects of Changes in Short Term Forecasts on Long Term Energy and Carbon Dioxide Projections," *Resources and Energy*, 6, 1984.
- 25) "Subjective Uncertainty and the Need for Consistency in Energy Forecasts," *Energy Journal*, May, 1984.

- 26) "Time, Space, Aggregation and Uncertainty: Sources of Disparity Among Forecasts." in *Models in the Decision Making Process: Planning Under Uncertainty*, (ed. A.S. Kydes), North Holland, 1985.
- 27) "Assessment of Greenhouse Futures and Risk" (with co-authors), World Meteorological Organization, Geneva, March 1986.
- 28) "Evaluating the Efficiency of Long Term Forecasts with Limited Information--Revisions in the IEW Poll Responses," *Resources and Energy*, 1986.
- 29) "Incorporating Current Prices Into Long-Term Energy Forecasts--A Maximum Likelihood, Adaptive Expectations Approach," *Resources and Energy*, 1987.
- 30) "Uncertainty and Disagreement Across the IEW Polls - Do the Ranges Match?" *OPEC Review*, Fall 1987.
- 31) "The Practical Advantages of Tax Over Regulatory Policies in the Control of Industrial Pollution" (with Paul MacAvoy), *Economics Letters*, February, 1988.
- 32) "Probabilistic Projections of CFC Consumption" (with William Nordhaus), in *Assessing the Risk of Trace Cases*, U.S. EPA, March 1988.
- 33) "Regulating the Monopolistic Polluter" (with Paul Burrows), *Souel Journal of Economics*, January 1988.
- 34) "Criteria for Selecting a CO2/Climate Change Region of Study" (with Joe Edmonds, et al.), *Proceedings of Air Pollution Control Association*, July 1989.
- 35) "Environmental Consequences" in New Energy Perspective, Electricite de France for the World Energy Conference, Montreal, September 1989.
- 36) "More on the Properties of a Tax Cum Subsidy Pollution Control Strategy," *Economic Letters*, June 1989.
- 37) "Consequences of Climate Change for the Human Environment" (with M. Scott, et al), Chapter 5, *National Energy Strategy*. U.S. DOE, February 1990 and Climate Research, 1990.
- 38) "The Cost of Not Holding Back the Sea - Economic Vulnerability" in Potential Effects of Global Climate Change on the United States (ed., Smith & Tirpak) *U.S. EPA Report to Congress*, 1989 and *Journal of Ocean and Shoreline Management*, 1991.
- 39) "Toward an Analysis of Policy, Timing, and the Value of Information in the Face of Uncertain Sea Level Rise", *Workshop Proceedings, Intergovernmental Panel on Climate Change - Response Strategies Working Group*, December 1989.
- 40) "Uncertainty, Global Climate and the Economic Value of Information" prepared for presentation at the 1989 meetings of the American Economic Association and the 1990 meetings of the American Association for the Advancement of Service, Policy Sciences, 1991.
- 41) "The Cost of Not Holding Back the Sea - Towards a National Sample of Economic Vulnerability," *Coastal Management*, 1991.

- 42) "Imbedding Dynamic Responses with Imperfect Information into Static Portraits of the Regional Impact of Climate Change" in *Global Change: Economic Issues in Agriculture, Forestry and Natural Resources*, U.S. Department of Agriculture, 1991.
- 43) "Greenhouse Effect and Sea Level Rise: Potential Loss of Land and the Cost of Holding Back the Sea" (with J. Titus, et al.), *Coastal Management*, 1991.
- 44) "Toward a General Criterion for Selecting 'Interesting' Greenhouse Scenarios," *Climate Research*, 1991.
- 45) "Toward a General Methodology with Which to Evaluate the Social and Economic Impact of Global Change," (with Thomas Malone, N.C. State), *Global Environmental Change*, June 1992.
- 46) "Sorting Out Facts and Uncertainties in Economic Response to the Physical Effects of Global Climate Change", *Proceedings of Conference on Assessing Climate Change for Risks*, Resources for the Future (Washington, 1992).
- 47) "Carbon Emissions Taxes: Their Comparative Advantage under Uncertainty," *Annual Review of Energy*, 1992.
- 48) "Equity and Efficiency in the Clinton Energy Tax Proposal - Some Early Thoughts from First Principles," *Energy Policy*, August 1993.
- 49) "Missing Carbon and the Economically Efficient Response to the Threat of Global Warming" (with Cheng Ong), *OPEC Review*, 1994.
- 50) "Modeling the Economic Drivers of Greenhouse Gas Emissions" (with Rodney Wallace), *Human Dimensions Quarterly*, Winter 1994.
- 51) "Incorporating Uncertainty and Nonlinearity into the Calculus of an Efficient Response to the Threat of Global Warming" (with Brendan Garvey), *International Journal of Global Energy Issues*, 1995.
- 52) "Assessing the Economic Cost of Greenhouse Induced Sea Level Rise: Methods and Applications in Support of a National Survey" (with James Neumann and Holly Ameden), *Journal of Environmental Economics and Management*, November 1995.
- 53) "Vulnerability of Agricultural Crops to Climate Change: A Practical Method of Indexing" (with David Schimmelpennig) in *Global Environmental Change and Agriculture: Assessing the Impacts*, Edward Elgar Publishing, 1999.
- 54) "IPCC Scenarios and the International Distribution of Income - Evidence from the Second Generation GCAM Model" (with Alexis Palmer), prepared for the IPCC Second Scientific Assessment (Chapter 3 of Working Group III) and included in Chapter 5 ("Economic Activity") of the *Global Climate Change and the Social Sciences - An International Assessment*, 1995.
- 55) "The Economic Cost of Greenhouse Induced Sea Level Rise in the United States", (with James Neumann, Patrick Marshall, and Holly Ameden), EPRI Research Report (comprehensive version) and *Climatic Change*, 1996.
- 56) "Near Term Mitigation Policy for Global Change Under Uncertainty - Minimizing the Expected Cost of Meeting Unknown Concentration Thresholds" (with Rodney Wallace), *Energy Modeling Assessment*, 1996.
- 57) "Planning for Sea-level Rise and Shore Protection under Climate Uncertainty" (with James Neumann for Resources for the Future), *Climatic Change*, 1997 and *Climate Change and Water Resources*

Planning Criteria, K. Frederick, D. Major and E Stakhiv (eds.), Kluwer Academic Publishers, Dordrecht, 1997.

- 58) "Exercises in Hedging Against Extreme Consequences of Global Change and the Expected Value of Information" *Global Environmental Change*, 1996.
- 59) "Strategies for Using Integrated Assessment Models to Inform Near-Term Abatement Policies for Greenhouse Gas Emissions", proceedings of the NATO Advanced Research Workshop on Integrated Assessment of Global Environmental Change, 1996.
- 60) "Coastal Impact and Adaptation Assessment" (with Stephen Leatherman) in R. Benioff, S. Guill and J. Lee (eds.), *Vulnerability and Adaptation Assessments - and International Handbook*, Version 1.1, Kluwer Academic Publishers, Dordrecht, 1996.
- 61) "First Principles and the Economic Comparison of Regulatory Alternatives in Global Change" in *Cost-Benefit Analysis of Climate Change: The Broader Perspective* (F.L. Toth, ed), Berhauser-Verlag, Basel, Switzerland (1999) and *The OPEC Review*, pp. 75-87, June 1997.
- 62) "Economic Activity" (with Robin Cantor) in *Human Choice and Climate Change*, Volume 3 (Chapter 1), Battelle Press, Washington, 1998.
- 63) "Using Integrated Assessment Models", Model Visualization and Assessment, SEDAC Website, May 1996.
- 64) "Climate Change Policies, the Distribution of Income, and U.S. Living Standards", *Climate Change Policy, Risk Prioritization and U.S. Economic Growth*, American Council for Capital Formation Center for Policy Research, 1997.
- 65) "The Economic Damage Induced by Sea Level Rise in the United States" (with James Neumann and Patrick Marshall), in R. Mendelsohn and J. Neumann (eds) *The Impact of Climate Change on the United States Economy*, (Chapter 7), Cambridge University Press, 1999.
- 66) "Uncertainty, Short Term Hedging and the Tolerable Windows Approach" presented at the Tokyo Modeling Forum on Integrated Global Environmental Assessment, March 14, 1997, Tokyo, Japan and *Global Environmental Change*, 1997.
- 67) "Fixing Global Carbon Emissions: Choosing the Best Target Year" (with Tricia Malinowski and Marielle Yohe), *Energy Policy*, 1998.
- 68) "Comprehending the Economic and Social Dimensions of Climate Change by Integrated Assessment" (with Hans Joachim Schellnhuber) presented at the Conference on the World Climate Research Programme, Geneva, August 27, 1997 and the *Proceedings*, 1998.
- 69) "Sea Level Change: The Expected Economic Cost of Protection or Abandonment in the United States (with Michael Schlesinger), *Climatic Change*, 1998.
- 70) "Risk and Uncertainties, Analysis and Evaluation: Lessons for Adaptation and Integration" (with Hadi Dowlatabadi) proceedings of the International Workshop on Adaptation to Climate Variability and Change, San Jose, Costa Rica, March 29-April 1, 1998 and *Mitigation and Adaptation Strategies for Global Change*, 2000.
- 71) "Meeting Concentration Targets in the Post-Kyoto World - Does Kyoto Further a Least Cost Strategy?" (with Mark Jacobsen), *Mitigation and Adaptation Strategies for Global Change*, 1999.

- 72) "Spanning 'Not Implausible' Futures to Assess Relative Vulnerability to Climate Change and Climate Variability"(with Mark Jacobsen and Taras Gapotchenko), *Global Environmental Change*, 1999 and presented at the Third Open Meeting of the International Human Dimension Programme in Kanagawa, Japan, June 24-26, 1999.
- 73) "The Tolerable Window Approach - Lessons and Limitations", *Climatic Change*, 1999.
- 74) "Assessing the Role of Adaptation in Evaluating Vulnerability to Climate Change", *Climatic Change*, 2000.
- 75) "Adaptation and the Guardrail Approach to Tolerable Climate Change" (with Ferenc Toth), *Climatic Change*, 2000.
- 76) "Economic Sustainability, Indicators and Climate Change" (with Richard Moss) in *Proceedings of the IPCC Expert Meeting on Development, Equity, and Sustainability*, Colombo, Sri Lanka, April 27-29, World Meteorological Organization and the Intergovernmental Panel on Climate Change, 1999.
- 77) "On Assessing the Application of Simplified, Parametric Representations of Impact, Adaptation and Mitigation Costs in Decision Analysis Models", *Proceedings of the IPCC Expert Meeting on Costing Issues*, Tokyo, Japan, June 28-July 1, 1999, TERI, New Dehli, India, 2000 and the *Pacific and Asian Journal of Energy*, 2000.
- 78) "Aggregation – Selected Comments on Strengths and Weaknesses with Application to Issues of Cost and Equity", *Proceedings of the IPCC Expert Meeting on Costing Issues*, Tokyo, Japan, June 28-July 1, 1999 (TERI, New Dehli) and the *Pacific and Asian Journal of Energy*, 2000.
- 79) "The Who-how of Adaptation: towards more realistic impact assessments" (with Hadi Dowlatabadi), *Global Environmental Change*, 2000 (also presented at OECD Meeting on Climate Change, Paris, France, June 15, 1999).
- 80) "Sea Level Rise and Global Climate Change: A Review of Impacts to the U.S. Coast" (with James Neumann, Robert Nicholls and Michelle Manion), Pew Center on Global Climate Change, March 2000.
- 81) "The Economics of Climate Change", in *International Encyclopedia of the Social and Behavioral Sciences*, Pergamon Press, Amsterdam, 2000.
- 82) "Integrated Assessment of Climate Change – the Next Generation of Questions" in *Climate Impact Research: Why, How and When?*, Berlin Brandenburg Academy of Sciences and the German Academy of Natural Scientists, Akademie Verlag Press, Berlin, 2000.
- 83) "The Hybrid Permit *cum* Price Ceiling Policy Proposal: Intuition from the Prices vs Quantities Literature", *OPEC Review*, December 2000.
- 84) "Mitigative Capacity – The Mirror Image of Adaptive Capacity on the Emissions Side", *Climatic Change*, May 2001.
- 85) "Constructing 'Not Implausible' Climate and Economic Scenarios for Egypt" (with Kenneth Strzepek, David Yates, Richard Tol, and Nicholas Mader), *Integrated Assessment*, forthcoming 2001.
- 86) "Segregation and the Provision of Spatially Defined Local Public Goods" (with Henry Wasserman), *The American Economist*, forthcoming, 2002.
- 87) "The Economics of an Efficient Reliance on Biomass, Carbon Capture, and Carbon Sequestration in a Kyoto-style Emissions Control Environment", *The OPEC Review*, 2001.

- 88) "Indicators for Social and Economic Coping Capacity – Moving Toward a Working Definition of Adaptive Capacity" (with Richard Tol), *Global Environmental Change*, forthcoming, 2002.
- 89) "Bringing Economic Analysis to Bear on Adaptation: The Egyptian Case Study" (with Kenneth Strzepek, Tammy Pau and Courtney Yohe), *Proceedings of the International Workshop on Enhancing the Capacity of Developing Countries to Adapt to Climate Change*, September 30 – October 2, 2001, forthcoming, 2002.

Other Professional Activities:

- 1) Member of the Council of Editors, *Journal of Environmental Economics and Management* (1987 - 1989).
- 2) Consultant to the Carbon Dioxide Assessment Committee of the National Research Council of the National Academy of Sciences (1982 - 1983).
- 3) Chairman, Governor's Commission on Connecticut's Future (1986 - 1988).
- 4) Invited participant at UNEP/WMO/ICSU Conference to Assess the Greenhouse Problem, Villach, Austria, October 1985.
- 5) Consultant to the U.S. EPA in preparation for an international convention and diplomatic agreement on chloroflourocarbon regulation.
- 6) Guest Investigator, Woods Hole Oceanographic Institution (Marine Policy Center), September 1988 through June 1991.
- 7) Member, Committee on the Preparation of Students from Selective Liberal Arts Programs for Graduate School in Economics (August 1989 -1994).
- 8) Member, Visiting Committee on Economics, Haverford & Bryn Mawr Colleges, March 1990.
- 9) Member, Connecticut Academy of Science and Engineering, elected 1990; member of the CASE Council, 1998 - present.
- 10) Participant, Energy Modeling Forum 12, Stanford University, 1990 - 1992; Energy Modeling Forum 14, 1994 -1997 and Energy Modeling Forum 16, 1998 -present.
- 11) Rapporteur, Task Group 12-Synthesis, Second World Climate Conference, Geneva, Switzerland, November 1990.
- 12) Coordinator, International Workshop on the Natural Resource and Economic Implications of Global Climate Change, Interlaken, Switzerland, November 1990.
- 13) Invited participant, 18th and 19th General Assemblies of the International Social Science Council (ISSC), and corresponding Scientific Symposium on the Human Dimensions of Global Environmental Change, Palma, Spain (November, 1990) and Paris, France (December, 1992); also invited participant in and organizer of the 3rd Scientific Symposium on the Human Dimensions of Global Environmental Change, Geneva, Switzerland, September 1995.
- 14) Invited participant, UNEP Workshops on the Costs of Limiting Fossil Fuel Carbon Emissions--Informal Consultation for UNEP General Secretary, January 1991 and April/May, 1991.

- 15) Working Group Chair, Economic Data for Analyzing the Human Dimensions of Climate Change--An International Inventory and Evaluation, ISSC, 1991 - 1992.
- 16) Member, Advisory Board, Adaptation in Response to Global Climate Change, United States Congress Office of Technology Assessment (OTA), 1992 - 1993.
- 17) Member, NSF Review Panel (Global Change Program), 1992-1994 and 1996
- 18) Member, Steering Committee and Executive Committee for the Human Dimensions of Global Environmental Change Research, International Social Science Council, 1993 - 1994.
- 19) Member, Scientific Advisory Committee, Consortium for International Earth Science Information Network (CIESIN), 1993 - 1994.
- 20) Member, User Working Group, Socio-Economic Data Archive Center (SEDAC), 1994 - 2001.
- 21) Member, Data Forum Steering Committee, National Research Council, National Academy of Science, June 1993 - October 1994.
- 22) Member, Exemplary Mechanisms of State Science-Based Policy Committee, Connecticut Academy of Science and Engineering for the Carnegie Commission, June 1993 - August 1994.
- 23) Principle Investigator, EPRI Damage Assessment Project, 1993 - 1996.
- 24) Member of the Editorial Board of *Human Dimensions Quarterly*, 1993 – 1996.
- 25) Working Group Chair, Energy Production and Consumption for the Human Dimensions Programme of the ISSC, 1993 - 1995.
- 26) Distinguished Environmental Policy Research Fellow, American Council for Capital Formation, Washington, DC, 1996-97.
- 27) Center Collaborator and Member of the Governing Board, Center for Integrated Study of the Human Dimensions of Global Change, Carnegie Mellon University, 1996-present.
- 28) Lead Author (with assorted collaborators) for Chapters 2 (Methods and Tools), 18 (Adapting to Climate Change in the Context of Sustainable Development and Equity) and 19 (Synthesis) for the *Third Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change* and Chapter 1 (Setting the Stage: Climate Change and Sustainable Development) for *Third Assessment Report of Working Group III of the Intergovernmental Panel on Climate Change*, 1998-present.
- 29) Editorial Board, *Climatic Change*, and *Integrated Assessment*, 1999 – present.