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Education:

Lehigh University, B.S., Engineering Physics, 1962 Princeton University, M.A., Economics, 1964 Princeton University, Ph.D., Economics, 1967

Professional Career:

Assistant Professor in Economics Department, Yale University, 1967-1971
Research Associate, National Bureau of Economic Research, 1971-1972
Associate Professor in Economics Department, Duke University, 1972-1976
Professor in Economics Department, Duke University, 1976-2009
Professor Emeritus in Economics Department, Duke University, 2009Research Fellow, International Institute of Management, Berlin, Germany, 1976
Visiting Scholar, Health Care Financing Administration, Office of Research,
Washington, D.C. 1979-1980
Director, Program in Pharmaceuticals and Health Economics, Duke
University, 1983-

Professional Organizations and Board Memberships:

Adjunct Scholar and Advisory Board Member for Health Policy Research, American Enterprise Institute for Public Policy Research Board of Scientific Advisors, American Council on Science and Health Associate Editor, The Quarterly Review of Economics and Finance Associate Editor, Journal of Research in Pharmaceutical Economics

Major Fields of Interest:

Industrial Organization Economics of Innovation Economics Government Regulation of Business Pharmaceutical Industry-Health



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Publications

Books and Monographs:

<u>Drug Regulation and Innovation: Empirical Evidence and Policy Options</u>, (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1976.

<u>The Impact of Regulation on Industrial Innovation</u> (with John Vernon) (National Academy of Sciences: Washington, D.C.), 1979.

The Regulation of Pharmaceuticals: Balancing the Benefits and Risks (with John Vernon) (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1983.

<u>Health Reform and Pharmaceutical Innovation</u> (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1994.

The Search for New Vaccines: The Effects of the Vaccines for Children Program, (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1997.

Articles:

"A Graph-Oriented Model for Research Management," (with Oscar Morgenstern and R. W. Shepherd), in M. C. Yovits, D. M. Gilford, E. Staveley, and H. D. Lerner, eds., Research Program Effectiveness, (Gordon and Breach: New York), 1966, pp. 187-216.

"The Determinants and Effects of Industrial Research and Development Expenditures," <u>Journal of Political Economy</u>, Vol. 76, No. 2, March/April, 1968, pp. 292-306; reprinted in K. S. Palda, ed., <u>Readings in Managerial Economics</u>, (Prentice-Hall), 1973; also reprinted in S. Yamey, ed., <u>Economics of Industrial Structure</u>: <u>Selected Readings</u>, (Penguin Modern Economics Series), 1973.

"Industrial Organization: The Role and Contribution of Econometrics," (with Dennis Mueller), <u>American Economic Review</u>, Vol. 60, No. 2, May 1970, pp. 100-104.

"Demand Shifting, Optimal Firm Growth, and Rule-of-Thumb Decision Making," <u>Quarterly Journal of Economics</u>, Vol. 84, May 1970, pp. 217-235.

"Non-Price Competition in the Cigarette Industry: A Comment," (with Dennis Mueller), <u>Antitrust Bulletin</u>, Vol. 40, Winter 1970, pp. 257-292.

"Imitative Advertising in the Cigarette Industry," (with Dennis C. Mueller), <u>The Journal of American and Foreign Antitrust and Trade Regulation</u>, Vol. 16, No. 2, Summer 1971, pp. 257-292.



"Determinants and Distributional Aspects of Enrollment in U.S. Higher Education," (with A. Corazzini and D. Dugan), <u>Journal of Human Resources</u>, Winter 1972, pp. 39-59.

"Managerial and Stockholder Welfare Models of Firm Expenditures," (with Dennis Mueller), Review of Economics and Statistics, Vol. 54, February 1972, pp. 9-24.

"Rivalry in Research and Development: An Empirical Study," (with Nevins D. Baxter), Journal of Industrial Economics, Vol. 21, No. 2, July 1973, pp. 209-235.

"Advertising and Resource Allocation: A Critique," in Salvatore F. Davita, ed., Advertising and the Public Interest, (American Marketing Association), 1974.

"Life Cycle Effects on Corporate Returns on Retentions," (with C. Dennis Mueller), Review of Economics and Statistics, Vol. 57, November 1975, pp. 400-409.

"Structural Effects of Regulation on Innovation in the Ethical Drug Industry," (with John Vernon), Chapter 10, in Robert T. Masson and P. David Qualls, eds., <u>Essays on Industrial Organization in Honor of Joe S. Bain</u>, (Ballinger Publishing Company: Cambridge), 1976, pp. 181-205.

"The Effects of Advertising on the Interindustry Distribution of Demand," in Occasional Papers of National Bureau of Economic Research, Explorations in Economic Research, Vol. 3, Winter 1976, pp. 21-75.

"The Effects of Regulatory Policy on the Incentives to Innovate: An International Comparative Analysis," (with John Vernon and Lacy Glenn Thomas), in Emery A. Link and Samuel Mitchell, eds., <u>Impact of Public Policy on Drug Innovation and Pricing</u>, (American University: Washington, D.C.), 1976, pp. 47-93.

"Consumer Protection Regulation in Ethical Drugs," (with John Vernon), <u>American</u> Economic Review, Vol. 67, February 1977, pp. 359-364.

"Estimating the Effects of Regulation on Innovation: An International Comparative Analysis of the Pharmaceutical Industry," (with John M. Vernon and Lacy Glenn Thomas), <u>Journal of Law and Economics</u>, Vol. 21, No. 1, April 1978, pp. 133-163.

"The Effects of Advertising on IntraIndustry Shifts on Demand," in Occasional Papers of National Bureau of Economic Research, <u>Explorations in Economic Research</u>, Vol. 4, No. 5, Fall 1978, pp. 675-701.

"Consumer Product Safety Regulation," (with John M. Vernon), <u>American Economic Review</u>, Vol. 68, May 1978, pp. 284-289.

"Industrial Research and Development, Intangible Capital Stocks, and Firm Profit Rates," (with Dennis Mueller), <u>Bell Journal of Economics</u>, Vol. 9, No. 2, Fall 1978, pp. 328-343.



"New Studies on Market Definition, Concentration, Theory of Supply, Entry and Promotion," (with John M. Vernon), in Robert I. Chien, ed., <u>Issues in Pharmaceutical Economics</u>, (Lexington Books: Lexington, Mass.), 1979, pp. 29-52.

"Regulation of the United States Pharmaceutical Industry: Current Problems and Policy Developments," in George Teeling-Smith, ed., <u>Medicines for the Year 2000</u>, (Office of Health Economics: London, England), 1979, pp. 57-74.

The Effects of Product Quality Regulation on Innovation in the U.S. Pharmaceutical Industry, Final Report for the National Science Foundation Grant PRA 75-19823 (National Technical Information Services, Washington, D.C.), 1979.

"The Impact of Regulation on Innovation," <u>Food Drug Cosmetic Law Journal</u>, Vol. 34, No. 10, October 1979, pp. 555-560.

"Substitution Laws and Innovation in the Pharmaceutical Industry," (with John Vernon), Law and Contemporary Problems, Winter/Spring Issue, 1979, pp. 43-66.

"Regulation and the International Diffusion of Pharmaceuticals," in Robert B. Helms, ed., <u>The International Supply of Medicines</u>, (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1980, pp. 5-36.

"The Determinants of R&D Expenditures," (with John Vernon), in Robert B. Helms, ed., <u>Drugs and Health</u>, (American Enterprise Institute for Public Policy Research: Washington, D.C.), 1981, pp. 3-20.

"Regulation and Industrial Innovation," in <u>Industrial Innovation and Public Policy Options: Background Papers for a Colloquium</u>, (National Academy Press: Washington, D.C.), 1981, pp. 65-81.

"Auto Safety Regulation: An Analysis of Market Failure," (with Richard J. Arnould), The Bell Journal of Economics, Vol. 12, No. 1, Spring 1981, pp. 27-48.

"Public Policy and Innovation: The Case of Pharmaceuticals," <u>Technovation</u>, Vol. 1, 1982, pp. 157-189.

"A Sensitivity Analysis of Expected Profitability of Pharmaceutical Research and Development," (with John Vernon), <u>Managerial and Decision Economics</u>, Vol. 3, No. 1, March 1982, pp. 36-40.

"Public Policy and Pharmaceutical Innovation," <u>Health Care Financing Review</u>, Vol. 4, No. 1, September 1982, pp. 75-87.

"An Evaluation of the Maximum Allowable Cost Program," (with Jean P. Gagnon), in <u>The Effectiveness of Medicines in Containing Health Care Costs</u>, Proceedings of a Symposium of the National Pharmaceutical Council, Washington, D.C., 1982, pp. 81-113.



"The Pharmaceutical Industry," (with John M. Vernon), in Richard R. Nelson, ed., <u>Government and Technical Progress - A Cross-Industry Analysis</u>, (Pergamon Press: New York), 1982, pp. 283-360.

"Automobile Safety Regulation: A Review of the Evidence," (with Richard J. Arnould), in Richard O. Zerbe, ed., <u>Research in Law and Economics</u>, Vol. 5, 1983, pp. 233-267.

"The Impact of Patent and Regulatory Policies on Drug Innovation," <u>Medical Marketing & Media</u>, Vol. 18, No. 10, October 1983, pp. 42-63.

"A Computer Simulation Model of Pharmaceutical Innovation," (with John Vernon), in Bjorn Lindgren, ed., <u>Pharmaceutical Economics</u>, (Swedish Institute for Health Economics and Liber Forlag: Lund, Sweden), 1984, pp. 159-175.

Studies on Drug Substitution, <u>Patent Policy and Innovation in the Pharmaceutical Industry</u>, Final report to the National Science Foundation available from the National Technical Information Services, Number PB-85-109700, Washington, D.C., 1985.

"Organizational Capital and the Choice between Specialization and Diversification," (with Michael Gort and Robert McGuckin), <u>Managerial and Decision Economics</u>, Vol. 6, No. 1, March 1985, pp. 2-10.

"Economic Aspects of Vaccine Innovation and Manufacturing," (with Lawrence De Brock), Chapter 4, in <u>Vaccine Supply and Innovation</u>, (National Academy Press: Washington, D.C.), 1985, pp. 45-64.

"Longer Patents for Lower Imitation Barriers: The 1984 Drug Act," (with John Vernon), <u>The American Economic Review</u>, Vol. 76, May 1986, pp. 195-198.

"Health Care Cost Containment and Pharmaceutical Innovation," in <u>Proceedings of the Conferences on Health Care and the Elderly</u>, (Washington, D.C.), 1986, pp. 25-28.

"Pioneers, Imitators, and Generics--A Simulation Model of Schumpeterian Competition," (with John Vernon), <u>The Quarterly Journal of Economics</u>, August 1987, pp. 491-525.

"The Health/Economic Benefits of Drug Therapy: Efficacy, Low Risk, Cost Effectiveness, Patient Information and Emancipation," <u>Swiss Pharma</u>, Vol. 9, No. 3a, 1987, pp. 29-31.

"Impact of Patent and Regulatory Policies on Drug Innovation," <u>Proceedings of the Second Annual Shearson Lehman Hutton Conference on Legal and Regulatory Issues Affecting Biotechnology and Health Care</u>, (Shearson Lehman Hutton, Inc.: New York), October 1988, pp. 5-16.

"Medicaid Patients' Access to New Drugs," <u>Health Affairs</u>, Winter 1988, pp. 102-114.



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