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"Project Independence Report: A Review of U.S. Energy Needs up to 1985," Bell Journal of Economics, Autumn 1975.

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- "Evaluating the Costs and Benefits of Appliance Efficiency Standards," with P. Joskow, MIT Energy Lab Working Paper, MIT-EL82005WP; American Economic Review, 72, 1982.
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"Labor Force Behavior of Older Men After Involuntary Job Loss," with L. Paquette, Report to Department of Health and Human Services, December 1985.

"Pollution and Work Days Lost," with D. Wise and B. Ostrow, NBER Working Paper, January 1984; Revised 1985.

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"Competition in the Information Market 1990", August 1990.

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Globalization, Technology and Competition, ed. S. Bradley, J. Hausman, R. Nolan, Harvard 1993.

"The Welfare Cost to the US Economy of Regulatory Restriction in Telecommunications," January 1995.

Economic Impact of Deregulating U.S. Communications Industries, The WEFA Group, Burlington, MA, February 1995.

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Dr. Tardiff received a B.S. with honors in Mathematics from the California Institute of Technology in Pasadena and a Ph.D. degree in Social Science from the University of California, Irvine, under a National Science Foundation Pre-doctoral Fellowship and an NSF Grant for Improving Dissertation Research in the Social Sciences.

Dr. Tardiff joined the faculties of the Department of Civil Engineering and the Division of Environmental Studies at the University of California, Davis. He taught undergraduate and graduate level courses in transportation and environmental policy analysis. His research included applications of econometric models of consumer choice to transportation planning problems. Dr. Tardiff's research was funded by the National Science Foundation, the Institute of Transportation Studies and the California Department of Transportation.

Prior to joining NERA, Dr. Tardiff's work included transportation, energy, public utility and telephone industry projects for the U.S. Departments of Transportation and Energy, the California Energy Commission, and several telephone and electric utilities.

Since joining NERA, he has evaluated pricing policies for increasingly competitive telecommunications markets, including appropriate mechanisms for pricing access services to competitors; studied actual and potential competition for services provided by telephone operating companies; analyzed the demand and revenue impacts of new telephone rate structures; developed and evaluated damage studies used in major telecommunications antitrust actions; analyzed the market potential for cellular radio; evaluated the investment and marketing programs of telephone companies; and developed a demand model for analyzing the market potential for alternative employee health care plans, including health maintenance organizations.

Dr. Tardiff has published extensively in the transportation literature. He has presented and published papers on the telecommunications industry. These papers address the issues of pricing and costing policies for emerging competition in telecommunications markets; evaluating and forecasting the impacts of telephone rate plans such as local measured service; analyzing the markets for new telecommunications products and services; and local competition and the bypass issue.

EDUCATION

UNIVERSITY OF CALIFORNIA, IRVINE
Ph.D., Social Sciences, 1974

CALIFORNIA INSTITUTE OF TECHNOLOGY
B.S., Mathematics, 1971

EMPLOYMENT

NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC.

1992 Vice President. Works on cases, mainly legal and regulatory, on issues of pricing policy, assessing demand for new and existing products and services, and economic damages. This work involves studies, often involving econometric demand analysis methods, for telecommunications, utilities and other clients. Specific areas have included: assessment of competition in the telecommunications industry; analysis of alternative approaches for regulating telephone utilities; evaluation of the benefits from telecommunication products and services; analyzing the demand for local services, toll, and carrier access; evaluation of the prudence of telephone company investments; damage studies for telecommunications antitrust cases; evaluation of methods for environmental damage assessment; and analysis of energy conservation /programs.

1984-1992 Senior Consultant

CHARLES RIVER ASSOCIATES, INC.--Boston, Massachusetts

1979-1984 Director of Marketing Research. Managed program to apply econometric customer demand models to marketing research problems in telecommunications, electric utilities, transportation and other industries.

Senior Research Associate. Performed studies on urban transportation, freight transportation, energy and telecommunications issues.

UNIVERSITY OF CALIFORNIA, DAVIS--Davis, California

1974-1979 Assistant Professor, Department of Civil Engineering and Division of Environmental Studies. Taught undergraduate and graduate course in transportation and environmental policy and quantitative research methods; conducted research on passenger transportation demand, (including econometric issues).

FELLOWSHIPS, GRANTS, AWARDS

First Place, Dissertation Contest of the Transportation Science
Section of the Operations Research Society of America.

NSF Research Initiation Grant (Engineering Division), 1976-1978.

NSF Grant for Improving Doctoral Dissertation Research in the Social Sciences,
1973-1974.

NSF Predoctoral Fellowship, 1972-1974.

Public Health Service Traineeship, 1971-1972.

AFFILIATIONS

American Economic Association
International Telecommunications Society

TESTIMONY

California Public Utilities Commission, on behalf of Pacific Bell, "Evaluation of MCI's Universal Service Funding Proposal," March 10, 1995.

California's Public Utilities Commission, on behalf of Pacific Bell, "Franchise Services and Universal Service," March 10, 1995 (with Richard D. Emmerson) .

Illinois Commerce Commission on behalf of GTE North: surrebuttal testimony on the benefits of intraMSA presubscription, September 30, 1994.

Illinois Commerce Commission on behalf of GTE North: rebuttal testimony on the benefits of intraMSA presubscription, September 16, 1994.

"Economic Evaluation of OIR/OII on Open Access and Network Architecture Development: Reply Comments," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, March 31, 1994 (with Richard D. Emmerson).

"Declaration of Timothy J. Tardiff on Pacific Bell's Productivity Under Price Caps," prepared for filing with the Federal Communications Commission, on behalf of Pacific Bell, February 28, 1994.

"Regulation of Mobile and Wireless Telecommunications: Economic Issues," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, February 25, 1994

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"Access to Intelligent Networks: Economic Issues," prepared for filing with the Federal Communications Commission, on behalf of Pacific Bell, December 1, 1993.

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"Performance Under Alternative Forms of Regulation in the U.S. Telecommunications Industry," prepared for filing with the Canadian Radio-television and Telecommunications Commission on behalf of AGT Limited, April 13, 1993. Timothy J. Tardiff and William E. Taylor, Study Directors.

"Pacific Bell's Performance Under the New Regulatory Framework: An Economic Evaluation of the First Three Years," prepared for filing with the California Public Utility Commission on behalf of Pacific Bell, April 8, 1993. William E. Taylor and Timothy J. Tardiff, Study Directors.

"Pricing Interconnection and the Local Exchange Carrier's Competitive Interstate Services," prepared for filing with the Federal Communications Commission, on behalf of Pacific Bell, February 19, 1993.

"The Treatment of FAS 106 Accounting Changes Under Price Cap Regulation: Reply Comments," prepared for filing with the Federal Communications Commission on behalf of Pacific Bell, July 1992. William E. Taylor and Timothy J. Tardiff, Study Directors.

"Costs and Benefits of IntraLATA Presubscription," prepared for filing with the State of New York Public Service Commission on behalf of New York Telephone, May 1, 1992. Timothy J. Tardiff and William E. Taylor, Study Directors.

"The New Regulatory Framework 1990-1992: An Economic Review," prepared for filing with the California Public Utility Commission on behalf of Pacific Bell, May 1, 1992. William E. Taylor and Timothy J. Tardiff, Study Directors.

"The Treatment of FAS 106 Accounting Changes Under Price Cap Regulation," prepared for filing with the Federal Communications Commission on behalf of Pacific Bell, April 15, 1992. William E. Taylor and Timothy J. Tardiff, Study Directors.

"The Treatment of FAS 106 Accounting Changes Under Pacific Bell's Price Regulation Plan," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, November 15, 1991. William E. Taylor and Timothy J. Tardiff, Study Directors.

"The Treatment of FAS 106 Accounting Changes Under Pacific Bell's Price Regulation Plan: Economic Analysis of the DRA Supplemental Testimony," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, January 21, 1992. William E. Taylor and Timothy J. Tardiff, Study Directors.

Timothy J. Tardiff

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Expert Witness on State Transportation Energy Forecasting, California Energy Commission, Sacramento, September 1980.

SELECTED CLIENT REPORTS

Quantifying the Handicaps of Unequal Access, (Confidential) Prepared for Japan Telecom, January 1994.

Overcoming Unequal Access: The International Experience, with S. Krom, (Confidential) Prepared for Japan Telecom, January 1994.

Market Potential For Cellular Radio And Other Personal Communications Products. (Confidential) Prepared for Pac Tel Corporation, July 1990.

Customer Demand for Local Telephone Services: Models and Applications. Prepared for South Central Bell Telephone Company, August 1987.

Evaluation Plans for Conservation and Load Management Programs. Prepared for New England Electric System, July 1987.

Telecommunications Competition for Large Business Customers in New York (Confidential). Prepared for NYNEX Corporation, June 1987.

"Estimation of Residential Conservation Service Program Electricity Savings," Prepared for Southern California Edison Company, July 1984.

The Demand for Local Telephone Service Upon the Introduction of Optional Local Measured Service. In part. Final report, prepared for Southern New England Telephone, July 1982.

Transit Strategies to Improve Air Quality in the Philadelphia Region. In part. Final report prepared for the Delaware Valley Regional Planning Commission, April 1982.

Estimation of Energy Impacts of State Transportation Improvement Program Projects. In part. Final report prepared for the California Energy Commission, January 1982.

Consumer Representation for Transportation Energy Conservation. In part. Final report prepared for the U.S. Department of Energy, July 1981.

Indicators of Supply and Demand for Transportation Fuels. In part. Prepared for the California Energy Commission, December 1980.

State of the Art in Research on Consumer Impacts of Fuel Economy Policies: Recent Findings and Recommendations for Further Research. In part. Prepared for the National Highway Traffic Safety Administration, January 1980.

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Tardiff, T.J., W.E. Taylor, and C.J. Zarkadas, "Periodic Review of Price Cap Plans: Economic Issues," presented at the Telecommunications Policy Research Conference, Solomons, Maryland, October 2, 1994.

Participant in AGT International Symposium on Local Interconnection Policy, Emerald Lake, British Columbia, Canada, May 27-28, 1994.

Tardiff, T.J., "Effects of Presubscription and Other Attributes on Long-Distance Carrier Choice," Presented at the 1994 National Telecommunications Forecasting Conference, Boston, Massachusetts, May 24, 1994.

Tardiff, T.J., "Access Charges and Toll Prices in the United States: An Economic Evaluation," Presented to representatives of Japanese Long-Distance Companies, New York, New York, May 16, 1994.

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Tardiff, T.J., "Interconnection and LEC Competitive Services: Pricing and Economic Efficiency," presented at the Telestrategies Conference: The Access Charge Revolution, Washington, D.C. May 18, 1993.

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Tardiff, T.J., "Price and Cost Standards for Increasingly Competitive Telecommunications Services," presented at the Ninth International Conference of the International Telecommunications Society, Sophia Antipolis, France, June 17, 1992.

Tardiff, T.J. "Modeling The Demand For New Products and Services." presented at the NTDS Forum, Santa Fe, New Mexico, September 27, 1991.

Tardiff, T.J. and C. Zarkadas, "Forecasting Tutorial," presented at the National Telecommunications Forecasting Conference, May 29, 1991.

Tardiff, T.J. and W.E. Taylor, "Pricing the Competitive Services of Regulated Utilities," National Economic Research Associates, Working Paper No. 7, May 1991.

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nonstructural safeguards, that would effectively negate as a practical matter the proliferation of interstate enhanced services.

II. THE COSTS OF STRUCTURAL SEPARATION FAR OUTWEIGH ANY POSSIBLE BENEFITS.

In determining whether to eliminate structural separation, the Commission must weigh the costs of structural separation against the benefits. There are two general types of "costs" imposed by retention of structural separation: (1) the public interest "costs" of smothering enhanced service development in general, to the detriment of consumers, and (2) the actual monetary costs to BOCs (and, therefore, to their customers) of attempting to offer enhanced services under the heavy harness of structural separation. In contrast, there are no demonstrated advantages of structural separation over nonstructural safeguards.

A. The Major Public Interest "Cost" Of Structural Separation Is Its Undeniable Smothering Effect Upon Enhanced Service Development.

During the years that the BOCs have been handcuffed by structural separation, existing ESPs have made few meaningful attempts to provide enhanced services to the small business or residence consumer markets. Instead, they have focused their attention on the mid-to-large business markets, where profit margins are such that a vendor does

not have to acquire very many customers to achieve an attractive return. These are the markets where investment can be targeted efficiently, due to relatively greater willingness-to-pay and concentrated business opportunities that are less expensive to seek out than most mass market-type business opportunities.

In the large business market, potential revenue levels are large enough, and profit margins wide enough, that an ESP need only acquire a handful of customers to recover investment and earn a good return. Conversely, in the consumer market, potential revenue levels are more uncertain, and profit margins much narrower, because small business and residence consumers operate on much smaller overall budgets than big business and have much lower overall willingness-to-pay thresholds. Where the cost of serving a given number of lines in a large business application is the same as in serving that number of lines in the consumer market, profit margins in the consumer market will tend to be much lower due to the lower overall willingness-to-pay of the consumer market. To recover investment and earn a good return in the consumer market, a vendor must be willing to assume the cost and risk of acquiring enormous numbers of customers. Existing ESPs have been largely unwilling or unable to assume such substantial costs and risks to address the consumer market.

One thing that can ease this cost and risk level considerably is economies of scope--economies that BOCs

would have if permitted into enhanced service markets on an integrated basis.⁷ In fact, since the BOCs have been permitted to offer specific enhanced services on an integrated basis pursuant to Computer III Comparably Efficient Interconnection (CEI) plans (beginning in 1987 and 1988), several BOCs have begun to accelerate dramatically the development of consumer enhanced services. For example, at the time of the Joint BOC Petition for Waiver for the CI-II rules,⁸ the BOCs were providing services for more than 160,000 customers. More recently, industry reports show that Bell Atlantic alone has signed up 100,000 subscribers for its Answer Call service.⁹

SWBT, for its part, has undertaken numerous enhanced service trials, both for mass market gateway and Voice Messaging Services (VMS). Without the benefits of structural integration, SWBT would not have been able to conduct these trials, a necessary early step in the assessment of any large, untried market. In addition, SWBT has already rolled out a business voice messaging service in all of its five states,¹⁰ plans to be involved with a mass

⁷SWBT demonstrates below that allowing BOCs and their customers to benefit from BOC economies of scope will not have an anticompetitive effect in enhanced service markets.

⁸See July 3, 1990 Joint Contingency Petition for Interim Waiver of the Computer II Rules.

⁹Telecom. Rep. 46 (Jan. 14, 1991).

¹⁰Arkansas, Kansas, Missouri, Oklahoma and Texas.

market consumer VMS service in at least one state in the near future, and is exploring similar possibilities in other states as well. The evidence is not subject to serious challenge: with BOC structural separation the consumer market languished; with BOC structural integration the consumer market has begun to come alive.

Moreover, BOC entry into enhanced services has benefited (not harmed) the market, through increased output and decreased prices. As cited in the BOC Reply Memorandum filed with the MFJ Court on January 15, 1991 in the information service remand proceeding, in the two years that the BOCs have provided videotex gateways, total subscribers to all videotex gateways have increased from 715,000 to 1.8 million and are continuing to multiply at a rate of 15-20% each year.¹¹ And, in the the two years of BOC participation the voice-mail equipment market has grown threefold; prices have dramatically declined; the number of voice mailboxes has grown from 5.3 million to 11.6 million; and the market for voice-mail services has increased by 40%, from \$452 million to \$635 million.¹²

¹¹BOC Reply Memorandum, Table A-11.

¹²Id., Table A-5. This is not to say that BOC structural integration will necessarily guarantee the proliferation of consumer enhanced services. The CAM rules have the effect of requiring that BOCs' enhanced service and other nonregulated activities bear the weight of disproportionately heavy cost loadings. When dealing with the normally very small willingness-to-pay levels of
(Footnote Continued)

At this point at least two things are certain: (1) although it may not be easy for the BOCs to move forward with consumer enhanced services under the current CAM rules, history has shown that significant progress would be dramatically more difficult--if not impossible--under a structural separation requirement; and (2) BOC integration has already begun to show promising acceleration of consumer enhanced services in most regions of the country.

Another public interest "cost" of structural separation is the possibly chilling effect it could have upon further development of fundamental infrastructure evolution, a very high Commission priority. Capital deployment becomes more probable as the range of revenue producing services enabled or provided by that investment broadens. Presenting BOCs with the opportunity to participate fully in the enhanced services market (unhindered by any added costs of establishing separate business entities) will encourage more rapid development and deployment of advanced technologies. If provided with full economic incentives to offer enhanced services, BOCs would be more likely to undertake the capital investment necessary to most efficiently deliver a wide variety of new services.

(Footnote Continued)

consumer markets, ensuring recovery of these high cost loadings requires pushing the price of the product right up against, and perhaps beyond, the upper levels of the market's willingness-to-pay. In these instances, the current CAM rules will not serve the public interest in aiding proliferation of enhanced services.