

**AGUSTIN J. ROS**  
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**Dr. Agustin J. Ros** is a Principal of the Brattle Group whose expertise is in public utility economics and antitrust in network industries—airlines, energy, postal, telecommunications and water—and is an Adjunct Professor at the International Business School at Brandeis University where he teaches a course on public utilities and antitrust economics. He has more than 20 years of consulting and agency experience and specializes in cost of service and performance-based ratemaking, competition and market power in network industries, damages, and econometric modelling. He teaches at the annual Edison Electric Institute (“EEI”) Advanced Rate Course in Madison, Wisconsin on embedded and marginal cost of service as well as efficient rate design principles and practices. At the EEI Electric Rate Course he has taught industry professionals all aspects of embedded cost of service including the theory and practice of functionalization, classification, allocation and rate design.

Dr. Ros worked at the Illinois Commerce Commission where he reviewed dozens of cost of service studies and advised the Chairman on all matters before the Commission. His consulting and research interest includes examining the workings of retail electricity competition and his econometric and statistical investigation of competition in retail and wholesale electricity markets in the U.S. was recently published in the *Energy Journal*. In addition, he has published his research in the *Journal of Regulatory Economics*, *Review of Industrial Organization*, *Review of Network Economics*, *Telecommunications Policy* and *Info*.

## AREAS OF EXPERTISE

- Cost of Service, Demand and Pricing in Network Industries
- Regulated Industry Policy and Restructuring
- Competition and Performance Based Ratemaking

## EDUCATION

Ph.D. Economics, University of Illinois-Urbana Champaign	1994
M.S. Economics, University of Illinois-Urbana Champaign	1991
B.A. Economics, Rutgers University-Newark	1989

## TEACHING POSITIONS

Brandeis University, International Business School, <i>Adjunct Professor</i>	2016–present
University of Anahuac, Mexico City, <i>Guest Lecturer</i>	2010
Northeastern University, <i>Adjunct Instructor</i>	2000

## AGUSTIN J. ROS

### EXPERT REPORTS, TESTIMONY AND AFFIDAVITS

Expert report on behalf of the Newfoundland and Labrador Board of Commissioners of Public Utilities: Review of Existing and Proposed Network Additions Policies for Newfoundland and Labrador Hydro, with Philip Hanser and Peal Donohoo-Vallet, November 19, 2019.

Expert report on behalf of Bragg Communications Inc. (c.o.b. Eastlink), Cogeco Communications Inc., Rogers Communications Canada Inc., Shaw Cablesystems G.P., and Videotron Ltd., Analysis of CRTC's Final Rates for Aggregated Wholesale High-Speed Access Services: Impact on Broadband Network Investment and Innovation, with Renée M. Duplantis, Dimitri Dimitropoulos and Ian Cass, November 13, 2019.

Direct Testimony on behalf of the Virginia Electric Power Company on cost allocation of utility scale solar projects, before the Virginia Corporation Commission, July 1, 2019.

Expert report on behalf of the Newfoundland and Labrador Board of Commissioners of Public Utilities: Embedded and Marginal Cost of Service Review, with Phil Hanser, T. Bruce Tschusida, Pearl Donohoo-Vallet, and Lynn Zang, May 3, 2019.

Expert report on behalf of Shaw Communications before the Canadian Legislative Review Panel of the Broadcasting and Telecommunications: Analysis of BDU Contributions, ISP Taxes and Regulations in the Canadian Broadcasting and Telecommunications Industries: Economic Efficiency, Investment and Innovation, with Coleman Bazelon and Renée Duplantis, January 11, 2019.

Expert opinion on behalf of CFE International LLC before the U.S. Citizenship and Immigration Services and Department of Homeland Security: An Overview of the Mexican Energy Markets and Reforms, October 25, 2018.

Expert report on behalf of Shaw Communications before the Canadian Competition Bureau: An Analysis of Broadband Services in Canada, Competition, Regulation and Investment with Coleman Bazelon and Renée Duplantis, August 30, 2018.

Affidavit on behalf of CFE International LLC before the Federal Energy Regulatory Commission: market-based rate authority application on vertical and horizontal market power issues in U.S. electricity markets, with Judy Chang, June 13, 2018.

Expert report on behalf of the Australian Competition and Consumer Commission (ACCC), before the ACCC: International experiences in retail electricity markets, with Toby Brown, Neil Lessem, Serena Hesmondhalgh, James D. Reitzes and Haruna Fujita, June 2018

**AGUSTIN J. ROS**

Expert report on behalf of Transportadora de Gas Natural de la Huasteca, S. de R.I. de C.V. before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the TGNH pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

Expert report on behalf of Infraestructura Marina del Golfo, before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the IMG pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

Expert report on behalf of GCI Communications before the Federal Communications Commission: rate of return, cost of service and cross-subsidy analysis of GCI's Satellite-Based Services, with William Zarakas and Nicolas E. Powers, May 2018.

Expert report on behalf of GCI Communications before the Federal Communications Commission, In the Matter of Connect America Fund and Universal Service Reform, WC Docket No. 10-90 and WT Docket No. 10-208A: analysis of the FCC's Rural Health Care Program Funding and Recipients, with William Zarakas, David Kwok, and M. Elaine Cunha, September 2017.

Expert report on behalf of Teléfonos de Mexico before the Mexican Telecommunications Authority: measurement of total factor productivity for Teléfonos de Mexico, July, 2014.

Expert report on behalf of Citibank, before the Honduran Competition Commission: expert report on the competitive effects of the FICHOSA – Citibank merger, April, 2014.

Expert report on behalf of America Móvil before the Mexican Competition Commission: correcting the OECD's erroneous assessment of competition in the Mexican telecommunications sector, May 2013. With Professor Jerry A. Hausman.

Expert report on behalf of Leyde and LACTHOSA before the Honduran Competition Commission: expert report on the competitive effects of a joint venture between Leyde and LACTHOSA in the Honduran dairy sector, April 2013.

Expert report on behalf of Lowe's Mexico before the Mexican Competition Commission: economic analysis on market definition, market power and monopolistic practices in the market for home improvement products sold through superstores, October 2012.

Expert report on behalf of Comcel before the Regulatory Commission of Communications in Colombia: expert report on economic analysis of Resolution CRC 3139 2011 regarding on-net and off-net pricing and termination rates, November 9, 2011.

Expert report on behalf of ESSOSA and Puma before the El Salvador Competition Commission: expert report on the competition implications of assets sales in El Salvador, (with Ramsey Shehadeh) October 5, 2011.

**AGUSTIN J. ROS**

Expert report on behalf of ESSOSA and Puma before the Honduran Commission for the Defense and Promotion of Competition: expert report on the competition implications of assets sales in Honduras, (with Ramsey Shehadeh) July 19, 2011.

Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 11-0046, surrebuttal testimony regarding market definition, market power and public interest considerations, filed April 22, 2011.

Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, update, reply and PBR review study, filed February 22, 2011.

Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, total factor productivity study, filed December 30, 2010.

Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 09-0310, rebuttal testimony regarding market definition, market power and public interest considerations, filed August 6, 2010.

Expert report before the Commission for the Supervision of Business Competition of the Republic of Indonesia on behalf of Singapore Telecommunications Limited and Singapore Telecom Mobile, "Competitive Assessment of the Indonesian Mobile Sector," (with William E. Taylor, Nigel Attenborough and Christian Dippon), filed October 15, 2007, rebuttal report filed January 11, 2008.

Expert report before the Ministry of Economic Affairs and Development on behalf of Cable and Wireless Barbados, "An Economic Assessment of Mandating Indirect Access in Barbados," (with Michael Khyefets and Loren Adler), November 14, 2007.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on economic efficiency considerations with respect to termination rates and the impact of capacity-based charges, (with Jose Maria Rodriguez), filed October 17, 2007.

Expert report before the Canadian Radio and Telecommunications Commission (Telecom Public Notice CRTC 2006-14) on behalf of Bell Aliant Regional Communications, "Telecommunications Competition in the US: An Assessment of Wholesale Regulation Policy," (with William E. Taylor), filed March 15, 2007.

Expert report before the New York Public Service Commission (Case 06-C-0897) on behalf of Verizon New York, "Report on Competition for Retail Business Services," (with William E. Taylor and Harold Ware), filed report August 31, 2006. Supplemental Report filed October 2, 2006.

AGUSTIN J. ROS

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, response to Digicel's economic analysis of Interconnections costs and rates, filed May 12, 2006 (with Timothy Tardiff).

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on interconnections costs in Trinidad and Tobago, filed May 4, 2006 (with Timothy Tardiff).

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on Benchmark Mobile Termination Rates, Evaluation of the .Econ Report, filed February 10, 2006 (with Timothy Tardiff).

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on OSIPTEL's imputation methodology, filed February 7, 2006 (with Jose Maria Rodriguez and Eduardo Prieto Kessler).

Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of Telcel, S.A., expert report measuring the cost Telcel incurs when providing interconnection services to operators, filed 22 June 2005.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSIPTEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru's total factor productivity for application in the 2004-2007 price cap regime (with José María Rodríguez Ovejero and Juan Hernández García), 21 June 2004.

Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on the Universal Service Obligation in The Bahamas," Comments filed 24 March 2004; Reply Comments filed 10 June 2004.

Expert report before the Canadian Radio-television and Telecommunications Commission on behalf of Aliant Telecom Inc., Bell Canada, MTS Communications Inc., Saskatchewan Telecommunications and Télébec, société en commandite, Public Notice 2003-10, "A Review of Rules and Regulations Governing Bundled Telecommunications Services." filed 12 March 2004, updated report filed 26 March 2004.

Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on Price Control of Bahamas Telecommunications Company," 19 September 2003.

Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of the Commission, "Telmex's 2003-2006 Price Cap Tariff Proposal," expert report in arbitration regarding the renewal of the price cap plan for Telmex (with William Taylor, Georgina Martinez, and Aniruddha Banerjee), 13 December 2002.

AGUSTIN J. ROS

Expert report before the Honorable Arbitration Tribunal of Fairness in Guatemala, Case No. CENAC-A-01-2002, final report in arbitration regarding call termination costs in fixed and wireless networks (with José María Rodríguez Ovejero, Laurent Bensacon, and Juan Hernández García), September 2002.

Expert report before the Federal Communications Commission on behalf of BellSouth Corporation Docket Nos. 01-338, 96-98, 98-47 Reply Declaration (with William Taylor, Aniruddha Banerjee, and Charles Zarkadas) regarding unbundling obligations of local exchange carriers. Filed 17 July 2002.

Expert report before the Federal Communications Commission on behalf of Verizon Communications, Docket Nos. 01-339, 01-337, 02-33, Statement of 43 Economists on the Proper Regulatory Treatment of Broadband Internet Access Service, 3 May 2002.

Expert report before the New Zealand Commerce Commission on behalf of Telecom New Zealand, “Review of CostQuests’ Associates Benchmarking Survey” (with William Taylor, Greg Houston, Tom Hird, Jaime D’Almeida, and Carol Osborne), May 2002.

Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, surrebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 16 July 2001.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSIPTEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru’s total factor productivity for application in the 2001-2003 price cap regime (with Timothy Tardiff, José María Rodríguez Ovejero, and Juan Hernández García), 22 June 2001.

Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, rebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 20 April 2001.

Expert report before the New Zealand Commerce Commission, on behalf of Telecom New Zealand, “Costs of Telecommunications Competition Policies,” final report exploring the indirect economic costs of changing competition policy to a more regulatory approach (with Harold Ware, Timothy Tardiff, and Nigel Attenborough), May 2000.

Testimony before the State of Illinois on behalf of GTE North Incorporated and GTE South Incorporated, Docket No. 98-0195, direct testimony regarding investigation into certain payphone issues as directed in Docket No. 97-0225, 21 December 1999.

Expert report before the Federal Communications Commission on behalf of US West, An Economic and Policy Analysis of Efficient Inter-Carrier Compensation Mechanisms for ISP-Bound Traffic, 12 November 1999.

## AGUSTIN J. ROS

Expert report before the Pennsylvania Public Utility Commission on behalf of Bell Atlantic Pennsylvania, Promised Fulfilled: Bell Atlantic-Pennsylvania's Infrastructure Development (with William Taylor, Charles Zarkadas, and Jaime D'Almeida), 15 January 1999.

Testimony before the State of Illinois on behalf of Illinois Gas Transmission Company, Docket No 98-0510, rebuttal testimony regarding certification of Illinois Gas Transmission Company as a Common Carrier by Pipeline and approval of rates and accounting, and for cancellation of the Certificate of Illini Carrier, LP, 11 January 1999.

Expert report before the Spanish Regulatory Commission on behalf of Telefónica, final report "Assessment of the methodology used by Telefónica in the calculation of the prices included in the interconnection reference offer and comparison with BT's interconnection prices" (with Nigel Attenborough, David Robinson, Yogesh Sharma, and José María Rodríguez Ovejero), October 1998.

Expert report before the Italian Regulatory Commission on behalf of Telecom Italia, final report "Volume Discounts: A Report for Telecom Italia" (with Nigel Attenborough, Andrea Coscelli, and Andrea Lofaro), October 1998.

Expert report before the Federal Communications Commission on behalf of Bell Atlantic, Docket Nos. 96-262, 94-1, 91-213, 96-263, "An Analysis of the Effects of Exchange Access Reform on Demand Stimulation" (with Charles Zarkadas), 27 April 1997.

### RECENT CONSULTING ENGAGEMENTS

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services. 2018.

Consulting work on behalf of a Canadian electricity provider: benchmarking analysis of generation utilities in transmission and regulatory practices with respect to generation procurement practices, distributed energy resources and customer-specific pricing practices, 2018.

Consulting work on behalf of a U.S. generation and transmission electricity cooperative: embedded and marginal cost of service studies to support rate reform initiative, 2018.

Consulting work on behalf of a major electricity distribution provider in the U.S.: develop a locational distribution marginal cost-based cost of service study to support the value of distributed energy resource proceedings, 2017 - 2018.

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail electricity providers in the U.S. and Canada: A regulatory assessment. November 2017.



## AGUSTIN J. ROS

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail natural gas providers in the U.S. and Canada: A regulatory assessment. November 2017.

Consulting work on behalf of the Cities of Garland, Mesquite, Plano, and Richardson appealing the decision by North Texas Municipal Water District affecting wholesale water rates, Texas PUC Docket No. 46662 and SOAH Docket No. 473-17-4964.WS: economic analysis of whether wholesale water rate charged by the District adversely affects the public interest and rate design issues.

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services. 2015 - 2016.

Consulting report for the Mexican National Center for the Control of Natural Gas: Electricity demand forecast for the National Mexican Electricity System for the period 2017-2030. December 2016. With Veronica Irastorza and Elvira Creel.

Consulting report for the Mexican Secretariat of Communications and Transport: “Econometric demand study of fixed and mobile broadband and telephony services and Pay-TV services using discrete choice analysis.” January 2016. With Kenneth Train and Douglas Umaña.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: recommended number of CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Recommended optimal portfolio mix for the CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Identification of relevant markets within the Mexican wholesale electricity markets. August 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy: Vesting contract criteria and methodology report. July 2015. With Hamish Fraser, Gene Meehan and Kurt Strunk.

### RECENT PRESENTATIONS

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “Residential Electricity Competition at a Crossroads,” January 2019.

Presentation before the EEI Electric Rates Advanced Course, “Introduction to Embedded Cost of Service,” with Phil Q Hanser, July 2018.



## AGUSTIN J. ROS

Presentation before the EEI Electric Rates Advanced Course, “Introduction to Marginal Cost of Service,” with Phil Q Hanser, July 2018.

Presentation before the Public Collaborative for the Puerto Rico Electricity System, “Introduction to Utility Regulation,” with Karl McDermott, July 19, 2018.

Presentations before the Public Collaborative for the Puerto Rico Electricity System, “Introduction to Electricity System Planning,” with Karl McDermott, July 19, 2018.

Presentation before the Public Collaborative for the Puerto Rico Electricity System, “Ownership Structure, Contracting Process and Wholesale Markets,” with Karl McDermott, July 19, 2018.

Presentation before Rutgers University Center for Research in Regulated Industries Eastern Conference: “Marginal cost of service: electricity distribution locational marginal costs, with Phillip Q Hanser and T. Bruce Tsuchida, June 8, 2018.

Presentation before the World Forum on Energy Regulation, Cancun Mexico: “Rate design helping facilitate change in electricity markets,” March 2018.

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “Utility of the future and cost of service: challenges and opportunities,” January 2018.

Presentation before Rutgers University’s Center for Research in Regulated Industries, 36<sup>th</sup> Annual Eastern Conference: “The evolving electricity distribution network – technological, competitive and regulatory implications.” May 2017.

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “Costing and pricing of electricity smart grid service offerings and competitive implications.” January 2017.

Presentation before Rutgers University’s Center for Research in Regulated Industries, 35<sup>th</sup> Annual Eastern Conference: “Determinants of total factor productivity in the U.S. electricity sector and the effects of performance-based regulation.” May 2016.

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “merger theory and practice in the U.S. electricity sector.” January 2016.

## PUBLICATIONS

“Economic framework for compensating distributed energy resources: Theory and practice.” (with Romkaew Broehm and Philip Hanser), *The Electricity Journal* 31(8): 14-22 (2018).

AGUSTIN J. ROS

“The future of the electric grid and its regulation: Some considerations,” *The Electricity Journal* 31(2): 18-25 (2018).

“An Econometric Assessment of Electricity Demand in the United States using Utility-Specific Panel Data and the Impact of Retail Competition on Prices.” *The Energy Journal* 38(4): 73-99 (2017).

“An Econometric Assessment of Telecommunications Prices and Consumer Surplus in Mexico using Panel Data.” (with Jerry A. Hausman), *Journal of Regulatory Economics*, vol. 43:284-304 (2013).

“Corrección de la Evaluación Errónea de la OCDE Acerca de la Competencia en el Sector de las telecomunicaciones en México.” (con Jerry Hausman), *El Trimestre Económico* (2013).

“The Impact of Asymmetric Mobile Regulation in Colombia.” (with Douglas Umana), *Info*, vol. 15 No. 3:54-65 (2013).

“Correcting the OECD’s Erroneous Assessment of Telecommunications Competition in Mexico.” (with Jerry A. Hausman), *CPI Antitrust Chronicle* June 2012.

“North American Performance-Based Regulation for the 21st Century.” (with Jeff D. Makhholm and Stephen Collins), *Electricity Journal* vol. 25, Issue 4, May 2012.

“The Determinants of Pricing in the Mexican Domestic Airline Sector: The Impact of Competition and Airport Congestion.” *Review of Industrial Organization* vol. 38:1 (2011), pp 43-60.

“Anticipating Merger Guidelines from Mexico’s Commission on Competition.” (with Elizabeth M. Bailey), *International Antitrust Bulletin* vol. 4, (2010).

“X-factor Updating and Total Factor Productivity Growth: The Case of Peruvian Telecommunications, 1996-2003.” (with Jeffrey I. Bernstein, Juan Hernandez and Jose Maria Rodriguez), *Journal of Regulatory Economics*, vol. 30:3 (2006), pp 316-342.

“Crecimiento de la demanda por servicios de comunicación móviles. Mitos y realidades (International Mobile Demand Growth: Myths and Reality)” (with Aniruddha Banerjee), *AHCIET Móvil* (September 2005).

“Concepto de costes básicos para la modelización entelecomunicaciones (Basic Economic Cost Concepts for Telecommunications Cost Modeling), *Perspectivas en Telecomunicaciones* (Perspectives in Telecommunications) (July 2005).

“Drivers of Demand Growth for Mobile Telecommunications Services: Evidence from International Panel Data.” (with Aniruddha Banerjee), in *Global Economy and Digital Society*, Elsevier (2004).

AGUSTIN J. ROS

“Patterns in Global Fixed and Mobile Telecommunications Development: A Cluster Analysis.” (with Aniruddha Banerjee), *Telecommunications Policy*, vol. 28 (2004), pp. 107-132.

“The Impact of the Regulatory Process and Price Cap Regulation in Latin American Telecommunications Markets.” *Review of Network Economics*, vol. 2 (2003), pp. 270-286.

“Does Employee Ownership Motivate Workers? Worker Effort, Shirking and Horizontal Monitoring in ESOP.” The Determinants of the Incidence and the Effects of Participatory Organizations, *Advances in the Economic Analysis of Participatory and Labor Management*, edited by Takao Kato and Jeffrey Pliskin, Elsevier Science, vol. 7 (2003).

“The Internet: Market Characteristics and Regulatory Conundrums.” (with Aniruddha Banerjee), *Forecasting the Internet: Understanding the Explosive Growth of Data Communications*, edited by David G. Loomis and Lester D. Taylor, Kluwer Academic Publishers (2002), pp. 187-216.

*Profits for All? The Costs and Benefits of Employee Ownership*, Nova Science Publishers, (2001).

“Are Residential Local Exchange Prices Too Low? Drivers to Competition in the Local Exchange Market and the Impact of Inefficient Prices.” (with Karl McDermott), in *Expanding Competition in Regulated Industries*, edited by Michael Crew, Kluwer Academic Publishers (2000), pp. 149-168.

“Telecommunications Privatization and Tariff Rebalancing: Evidence from Latin America.” (with Aniruddha Banerjee), *Telecommunications Policy*, vol. 24 (2000), 233-252.

“Utility Regulation in Latin America.” (with Leonardo Giacchino, Cesar Herrera, Siôn Jones, Phillip Maggs, and Kristina Sepety), *Privatisation International*, edited by Mark Baker, vol. 2 (2000).

“Essential Facilities, Economic Efficiency, and a Mandate to Share: A Policy Primer.” (with Karl McDermott, Kenneth Gordon, and William Taylor), Edison Electric Institute (January 2000).

“Does Ownership or Competition Matter? The Effects of Telecommunications Reform on Network Expansion and Efficiency.” *Journal of Regulatory Economics*, vol.15 (1999), pp. 65-92.

“Telecommunication Restructuring in Brazil: Issues and Options (A Report Based on the Proceedings of the U.S./Brazil Aspen Global Forum).” International Center for Public Administration and Policy Institute for Policy Research and Implementation, Graduate School of Public Affairs, University of Colorado at Denver (December 1997).

“When, Where and How? Implementing Effective Telecommunications Competition & Regulatory Policy.” *Journal of Project Finance* (Winter 1997).

AGUSTIN J. ROS

“Telecommunications in Brazil: Restructuring and Privatization” (et. al.), A Report Based on the Proceedings of the Brazil/U.S. Aspen Global Forum, International Center for Public Administration and Policy Institute for Policy Research and Implementation, Graduate School of Public Affairs, University of Colorado at Denver, August (1997).

“Another Look at What’s Driving Utility Stock Prices.” (with John L. Damagalski and Philip R. O’Connor), *Public Utilities Fortnightly* (January 1997).

"Regulatory Change and the Dismantling of the Bottleneck." Tenth NARUC Biennial Regulatory Information Proceedings (October 1996).

"Stranded Costs: Is the Market Paying Attention? A Look at Market-to-Book Ratios." (with John L. Damagalski and Philip R. O'Connor), *Public Utilities Fortnightly* (May 1996).

"The Gas Storage Market: What Does it Tell Us?" (with Ruth Kretschmer), *Public Utilities Fortnightly* (April 1996).

"Incentive Ratemaking in Illinois: The Transition to Competitive Markets" (with Terry S. Harvill), *Public Utilities Fortnightly* (July 1995).

## AJR-2: Summary of Recommendations

System	Variable	Unit	Marginal Cost Estimate*	Recommended Marginal Cost Estimate†	Recommendation
Primary	Plant Additions	(\$/MW) [1]	\$115,690		No change recommended
Secondary	Plant Additions	(\$/MW) [2]	\$82,116		No change recommended
Line Transformers	Plant Additions	(\$/MW) [3]	\$84,022		No change recommended
	Operations	(\$/MW) [4]	\$35,927	\$9,659	Five year average
Primary	Maintenance	(\$/MW) [5]	\$16,349	\$7,451	Five year average
	O&M Combined	(\$/MW) [6]	\$52,276	\$17,110	Five year average
	Operations	(\$/MW) [7]	\$3,410	\$3,516	Five year average
Secondary	Maintenance	(\$/MW) [8]	\$9,625	\$2,756	Five year average
	O&M Combined	(\$/MW) [9]	\$13,035	\$6,272	Five year average
	Operations	(\$/MW) [10]	\$1,458	\$689	Five year average
Line Transformers	Maintenance	(\$/MW) [11]	\$2,846	\$1,344	Five year average
	O&M Combined	(\$/MW) [12]	\$4,304	\$2,033	Five year average
Customer Related	O&M Expenses	(\$/customer) [13]	\$132.4	\$70.4	Five year average
Customer Related	Customer Accounts	(\$/customer) [14]	\$109.6	\$58.9	Five year average
	Admin & General	(\$/\$ of O&M) [15]	\$0.0373		No change recommended
Marginal Loading Factors	Admin & General	(\$/\$ of Util Plt) [16]	\$0.0353		No change recommended
	Materials and Supplies	(\$/\$ of Util Plt) [17]	\$0.0207		No change recommended
	General Plant	(\$/\$ of Util Plt) [18]	\$0.1016		No change recommended

Sources:

\*Marginal cost estimates are obtained from exhibits MFB-1, MFB-4, MFB-5 and MFB-6 provided in the direct testimony of Melissa F. Bartos.

† Own analysis.

Notes:

1. [1] - [12]: Recommended marginal cost estimates are calculated with respect to contemporaneous normalized peak demand.
2. [13] - [14]: Recommended marginal cost estimates are calculated with respect to contemporaneous number of total customers.
3. For the marginal cost estimate, the O&M combined expenses are a simple sum and are not obtained from the regression analysis:

$$[6] = [4] + [5]$$

$$[9] = [7] + [8]$$

$$[12] = [10] + [11]$$

### AJR-3: Operations and Maintenance Expenses - Plant and Customer-Related

System	Variable	Unit	Marginal Cost		Average Expenses (per unit)†				Projected Expenses (per unit)†		
			Estimate*		Entire Period		Past 5 Years		2019	2020	2021
			Coefficient**	Std. Error***	Mean	Std. Dev.	Mean	Std. Dev.			
Primary	Operations	(\$/MW) [1]	\$35,927	\$5,834	\$5,397	\$3,317	\$9,659	\$2,020	\$9,887	\$10,329	\$10,767
	Maintenance	(\$/MW) [2]	\$16,349	\$5,293	\$8,260	\$2,175	\$7,451	\$1,302	\$8,062	\$8,042	\$8,022
	O&M Combined	(\$/MW) [3]	\$52,276	\$7,877	\$13,657	\$3,429	\$17,110	\$1,224	\$17,949	\$18,371	\$18,790
Secondary	Operations	(\$/MW) [4]	\$3,410	\$1,609	\$1,726	\$1,480	\$3,516	\$979	\$3,711	\$3,921	\$4,129
	Maintenance	(\$/MW) [5]	\$9,625	\$2,207	\$3,177	\$986	\$2,756	\$550	\$3,105	\$3,097	\$3,089
	O&M Combined	(\$/MW) [6]	\$13,035	\$2,731	\$4,903	\$1,538	\$6,272	\$737	\$6,816	\$7,018	\$7,218
Line Transformers	Operations	(\$/MW) [7]	\$1,458	\$641	\$374	\$366	\$689	\$390	\$689	\$722	\$755
	Maintenance	(\$/MW) [8]	\$2,846	\$1,342	\$1,546	\$458	\$1,344	\$272	\$1,542	\$1,541	\$1,540
	O&M Combined	(\$/MW) [9]	\$4,304	\$1,487	\$1,920	\$455	\$2,033	\$350	\$2,231	\$2,263	\$2,295
Customer Related	O&M Expenses	(\$/customer) [10]	\$132.4	\$69.5	\$57.0	\$13.0	\$70.4	\$10.5	\$64.6	\$65.4	\$66.1
Customer Related	Customer Accounts	(\$/customer) [11]	\$109.6	\$33.1	\$48.1	\$10.4	\$58.9	\$9.6	\$55.9	\$56.8	\$57.7

Sources:

\* Marginal cost estimates are obtained from exhibits MFB-4 and MFB-5 provided in the direct testimony of Melissa F. Bartos.

\*\* Coefficient estimates from the regression analysis in exhibits MFB-4 and MFB-5.

\*\*\* Standard error of the regression coefficient.

† Own Analysis

Notes:

1. Projected expenses are calculated based on a simple forecast assuming a linear trend of historical values.

2. For the marginal cost estimate, the O&M combined expenses are a simple sum and are not obtained from the regression analysis:

$$[3] = [1] + [2]$$

$$[6] = [4] + [5]$$

$$[9] = [7] + [8]$$

## AJR-4: Marginal Distribution Plant-Related Costs: Primary System

### Dependent Variable: Primary Distribution Plant Additions 2018\$

Regression Variable		RationalDistributed Lag Model - OLS [1]	RationalDistributed Lag Model - FGLS [2]
Constant	[A]	-8,953,243 (0.140)	-8,951,116 (0.140)
Contemporaneous Normalized Peak	[B]	37,515 (0.324)	37,427 (0.326)
Primary Plant Additions - 1 Year Lag	[C]	0.442 (0.088)	0.444 (0.087)
Normalized Peak Demand - 1 Year Lag	[D]	49,048 (0.237)	49,050 (0.238)
Linear Trend	[E]	1,144,328* (0.043)	1,140,175* (0.043)
Marginal Investment Cost	[F]	155,130	155,535
Observations	[G]	16	16
R-Squared	[H]	0.995	0.996
Adj. R-Squared	[I]	0.994	0.994
RMSE	[J]	820,102	820,095
F-Statistic	[K]	1,036	1,042
Prob > F	[L]	0.000	0.000
Durbin Watson (Original)	[M]	1.975	1.975
Durbin Watson (Transformed)	[N]	-	1.967
Breusch Godfrey Test (Prob > chi2)	[O]	0.984	-
<b>F test to test joint significance of the normalized peak and its lagged term:</b>			
F-Statistic	[P]	3.05	3.05
Prob > F	[Q]	0.0884	0.0881

Source: Own Analysis

Notes:

p-values in parentheses

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

[F] = ([B] + [D]) / (1-[C])



## AJR-5: Marginal Operations & Maintenance Expenses: Primary System

<b>Dependent Variable: Primary Distribution Non-Customer O&amp;M Expenses 2018\$</b>			
Regression Variable		Geometric Distributed Lag Model - FGLS	Rational Distributed Lag Model - FGLS
		[1]	[2]
Constant	[A]	-1,637,649 (0.058)	-1,613,456 (0.074)
Contemporaneous Normalized Peak	[B]	13,998* (0.020)	14,216 (0.066)
Contemporaneous SAIFI	[C]	378,888** (0.007)	382,411** (0.003)
Primary Plant O&M - 1 Year Lag	[D]	0.147* (0.023)	0.148* (0.036)
Normalized Peak Demand - 1 Year Lag	[E]	-	-415 (0.937)
Dummy: 2005	[F]	-1,618,112*** (0.000)	-1,619,760*** (0.000)
Dummy: 2010	[G]	-1,101,464*** (0.000)	-1,099,090*** (0.000)
Dummy: 2014	[H]	675,178*** (0.000)	674,997*** (0.000)
Linear Trend	[I]	76,694*** (0.000)	77,071*** (0.001)
Marginal Investment Cost	[J]	16,410	16,198
Observations	[K]	17	17
R-Squared	[L]	0.996	0.996
Adj. R-Squared	[M]	0.992	0.991
RMSE	[N]	137,505	145,788
F-Statistic	[O]	526.9	380.3
Prob > F	[P]	0.000	0.000
Durbin Watson (Original)	[Q]	2.817	2.817
Durbin Watson (Transformed)	[R]	2.610	2.633
<b>F test to test joint significance of the normalized peak and its lagged term:</b>			
F-Statistic	[S]	-	3.91
Prob > F	[T]	-	0.0655

Source: Own Analysis

Notes:

p-values in parentheses

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

For model [1]: [J] = [B] / (1-[D])

For model [2]: [J] = ([B] + [E]) / (1-[D])

**AJR-6: Total Marginal Costs by Rate Class (\$000) - Recommended Estimates**

	Domestic D	Domestic-Opt. Peak D-10	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Total Company
Customer	\$9,480	\$149	\$105	\$486	\$2,337	\$0	\$280	\$6	\$12,844
Capacity	\$5,114	\$70	\$4,737	\$2,843	\$1,802	\$0	\$172	\$6	\$14,743
Lighting	\$0	\$0	\$0	\$0	\$0	\$609	\$0	\$0	\$609
<b>Total</b>	<b>\$14,595</b>	<b>\$219</b>	<b>\$4,842</b>	<b>\$3,329</b>	<b>\$4,139</b>	<b>\$609</b>	<b>\$452</b>	<b>\$12</b>	<b>\$28,196</b>
	51.76%	0.78%	17.17%	11.81%	14.68%	2.16%	1.60%	0.04%	100.00%

Source: Own Analysis

**AJR-6: Total Marginal Costs by Rate Class (\$000) - Original Estimates**

	Domestic D	Domestic-Opt. Peak D-10	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Total Company
Customer	\$13,596	\$209	\$145	\$674	\$3,215	\$0	\$397	\$8	\$18,246
Capacity	\$8,385	\$114	\$8,180	\$4,663	\$2,954	\$0	\$281	\$10	\$24,588
Lighting	\$0	\$0	\$0	\$0	\$0	\$609	\$0	\$0	\$609
<b>Total</b>	<b>\$21,981</b>	<b>\$323</b>	<b>\$8,326</b>	<b>\$5,338</b>	<b>\$6,169</b>	<b>\$609</b>	<b>\$679</b>	<b>\$18</b>	<b>\$43,443</b>
	50.60%	0.74%	19.16%	12.29%	14.20%	1.40%	1.56%	0.04%	100.00%

Source: Table 1 provided in the direct testimony of Melissa F. Bartos