Postal Regulatory Commission
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BEFORE THE
POSTAL REGULATORY COMMISSION
WASHINGTON, DC

RATE ADJUSTMENT DUE TO EXTRAORDINARY OR EXCEPTIONAL CIRCUMSTANCES	:	Docket No. R2013-11R

INITIAL COMMENT OF THE
NATIONAL ASSOCIATION OF LETTER CARRIERS, AFL-CIO

Pursuant to the Commission's June 12, 2015 notice and order in the above case ("June 12 Order"), the National Association of Letter Carriers, AFL-CIO ("NALC") hereby submits this initial comment.

NALC is a labor organization that serves as the exclusive collective bargaining representative of the city letter carriers employed by the United States Postal Service ("USPS"). NALC's comment here draws on analysis provided to NALC by Dr. Michael Crew, CRRI Distinguished Professor of Regulatory Economics at the Rutgers University Business School. Dr. Crew is an expert in postal and regulatory economics and has provided testimony, advice and analysis to the Commission in a number of cases, and has also consulted on issues of regulatory economics for numerous private and public entities. His curriculum vitae is attached hereto as Exhibit A.

I. USPS HAS TAKEN THE APPROPRIATE APPROACH TO RE-CALCULATING, WITHOUT THE "COUNT ONCE" RULE, THE COMMISSION'S ESTIMATE OF VOLUME LOSS DUE TO THE GREAT RECESSION

In its June 12 Order, the Commission invited interested parties to comment "on the Postal Service's methodological approach for accounting for volume

losses due to the Great Recession in a cumulative manner." June 12 Order at 7. In its June 8, 2015 motion ("USPS Motion"), USPS explained how the removal of the "count once" rule from the Commission's analysis of mail volume losses caused by the Great Recession increased the estimated loss from approximately 25.2 billon to approximately 35 billion pieces. *See* USPS Motion 5-6. Dr. Crew has reviewed USPS's methodology for this calculation and has concluded that USPS's methodology is sound.

II. IN THIS REMAND PROCEEDING, THE COMMISSION SHOULD RECONSIDER ITS "NEW NORMAL" ANALYSIS, SINCE THAT ANALYSIS UNDERESTIMATES USPS'S LOSSES FROM THE GREAT RECESSION

In its June 5, 2015 opinion, the United States Court of Appeals for the District of Columbia indicated that the Commission was "free to consider" on remand USPS's argument that the Commission's "new normal" analysis underestimated USPS's losses due to the Great Recession. *See Alliance of Nonprofit Mailers, et al. v. Postal Regulatory Comm'n*, Case No. 14-1009 (D.C. Cir. June 5, 2015), slip op. 17 n.3. NALC urges the Commission to undertake such a reconsideration, since its "new normal" analysis underestimates USPS's losses from the Great Recession.

It is important for the Commission to take into account the effects of declining demand on a firm like USPS that operates with significant economies of scale. Scale economies like those of USPS imply everywhere decreasing average costs as volume increases. Until 2007, USPS generally operated in an environment where demand was growing, providing USPS with the automatic benefit of falling unit costs whether or not it made improvements in internal efficiency. Growing demand offered the prospect of constant or declining real prices.

However, since 2007, as demand has declined, the reverse has occurred: with USPS's scale economies, falling volume has, *ceteris paribus*, increased average

costs. Thus, even with all other factors constant, a "new normal" in this lower volume environment has to be inferior to the prior normal, just by virtue of the increase in unit costs arising from the effect of scale economies.

In a forthcoming study co-authored with Professor Timothy J. Brennan, Dr. Crew examines the effect of price cap regulation when demand declines. *See* Brennan, T.J. and Crew, M.A., "Price Cap Regulation and Declining Demand" in *The Future of the Postal Sector in a Digital World* (M.A. Crew and T.J. Brennan, eds. Springer Scientific, New York (forthcoming 2016)) (copy of most recent draft attached hereto as Exhibit B). The study provides an illustrative example of the effect of falling volume on USPS under the price cap regime, and, in particular, an estimate of the increases in real prices (adjusted for inflation) that would be needed just to compensate USPS for the increase in average costs resulting from nothing other than the impact of declining volume on USPS's scale economies.

The Brennan and Crew study assumes postal sector price elasticities in the range -0.3 to -0.4.[1] While the range for cost elasticity is somewhat more difficult to gauge and is based almost entirely on judgment, the study reasonably assumes an average cost elasticity of -0.3. With these assumed price and cost elasticities, the table below sets forth the price adjustments for 2007-2013 that would be needed to make up just for the increase in unit costs resulting from the effect of falling mail volume on USPS's scale economies:

[1] In the recent exigency rate case, USPS' implicit demand elasticities were close to -0.3.

Year	Change in demand	Price adjustment
2007	-0.47%	0.15%
2008	-4.25%	1.40%
2009	-12.81%	4.22%
2010	-3.39%	1.12%
2011	-1.75%	0.58%
2012	-4.76%	1.57%
2013	-1.25%	0.41%

The cumulative real price increase suggested by these figures over this period is 9.8%.[2] These figures are purely illustrative, in light of assumptions on the two elasticities. However, this illustration indicates that the potential price adjustment warranted by falling demand could be quite substantial and considerably in excess even of the exigent surcharge amount proposed to the Commission by USPS.

For these reasons, NALC urges the Commission to reconsider its "new normal" framework, to allow USPS to recoup more in exigent surcharges than the Commission's current framework allows.

June 24, 2015.

Respectfully submitted,

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[2] Under price cap regulation prices are already adjusted for inflation.

EXHIBIT A

CURRICULUM VITAE

MICHAEL ANTHONY CREW

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Marital Status: Married

Citizenship: United States of America

Schools and University:

Dudley Grammar School:	1953-1960, General Certificate
University of Birmingham:	1960-1963, B. Com. II (i)
University of Bradford:	1965-1972, Ph.D.

Present Position:

Professor II, (with tenure) Rutgers Business School – Newark and New Brunswick, Rutgers University, July 1, 1987-
CRRI Scholar Rutgers Business School – January 1, 2005- June 30, 2008
CRRI Professor of Regulatory Economics – July 1, 2008-

Faculty Appointments:

Visiting Professor of Economics, University of Texas at Arlington, January 14, 1984-May 31, 1984

Professor I (with tenure), Graduate School of Management, Rutgers University, July 1, 1980-June 30, 1987

Associate Professor of Business Administration (with tenure), Rutgers University, January 1, 1977-June 30, 1980

Visiting Professor of Economics, Wesleyan University, spring 1976

Visiting Faculty Member in Economics, Harvard University, summer 1975

Senior Lecturer in Economics, University of Strathclyde, 1974-1977

Associate Head of Department of Social Studies, Paisley College of Technology, 1972-1974

Lecturer in Economics, University of Southampton, 1971-1972

Lecturer in Economics, London Graduate School of Business Studies, 1970-1971

Lecturer in Economics, University of Kent at Canterbury, 1969-1970

Visiting Lecturer/Visiting Assistant Professor of Economics, Carnegie-Mellon University, 1968-1969

Assistant Lecturer/Lecturer in Management Studies, University of Bradford, 1965-1969

Assistant Lecturer in Business Economics, University of Strathclyde, 1964-1965

Administrative Appointments:

Chairman of the Department of Finance and Economics, School of Management, Rutgers University, July 1, 1994-June 30, 1996 (25 faculty; Ph.D., MBA, and undergraduate programs)

Chairman of Finance and Economics Area, Graduate School of Management, Rutgers University, August 1, 1988-September 30, 1991(20 faculty, Ph.D. and MBA programs)

Director of Center for Research in Regulated Industries, Rutgers Business School, Rutgers University, July 1, 1984- (Providing administrative direction, fund-raising, program development, publications, editorial duties, and research: funds raised are in excess of $500,000 per year)

Director of Business Research Center, Graduate School of Management, Rutgers University, June 1, 1977-June 30, 1984

Chairman of Economics, Paisley College of Technology, 1973-1974

Other Appointments:

Chairman of Appointments and Promotions committee, Rutgers Business School, Rutgers University, 2001–2002, 2005-2006.

Member of Editorial Board, *Utilities Policy*, 1990–1994

Editor and founder of *Journal of Regulatory Economics*, 1988–

Editor of Kluwer Series of books *Topics in Regulatory Economics and Policy*, 1986–

Member of Editorial Board, *Journal of Economics and Business*, 1980–1986

Member of Editorial Advisory Board, *Journal of Industrial Affairs*, 1976–1986

Advisor in Business Studies of the Mathematical Sciences and Applications Board, and a member of the Mathematics and Statistics Board and Panel of the Council for the National Academic Awards from December 1973 to March 1977

One of the founders of *Applied Economics* and Executive Editor, Joint Editor and Editor 1968–1972

Ph.D. Thesis:

"Peak Load Pricing and its Application," Unpublished, University of Bradford, 1971

Books:

Theory of the Firm, Longman, 1975; translated into Portuguese, *Teoria da Empresa*

Paying By Degrees, Institute of Economic Affairs, 1977 (with Alistair Young)

Public Utility Economics, Macmillan Press, St. Martin's Press, 1979 (with P.R. Kleindorfer)

Problems in Public Utility Economics and Regulation, (Ed.), Lexington Books, 1979

Issues in Public Utility Pricing and Regulation, (Ed.), Lexington Books, 1980

Regulatory Reform and Public Utilities, (Ed.), Lexington Books, 1982

Analyzing the Impact of Regulatory Change, (Ed.), Lexington Books, 1985

The Economics of Public Utility Regulation, Macmillan Press, M.I.T. Press, 1986 (with P.R. Kleindorfer)

Regulating Utilities in an Era of Deregulation, (Ed.), Macmillan Press, 1987

Deregulation and Diversification of Utilities, (Ed.), Kluwer Academic Publishers, 1989

Competition and the Regulation of Utilities, (Ed.), Kluwer Academic Publishers, 1991

Competition and Innovation in Postal Services, (Ed.), Kluwer Academic Publishers, 1991 (with P.R. Kleindorfer)

Economic Innovations in Public Utility Regulation, (Ed.), Kluwer Academic Publishers, 1992

The Economics of Postal Service, Kluwer Academic Publishers, 1992 (with P.R. Kleindorfer)

Regulation and the Evolving Nature of Postal and Delivery Services, (Ed.), Kluwer Academic Publishers, 1992 (with P.R. Kleindorfer)

Incentive Regulation for Public Utilities, (Ed.), Kluwer Academic Publishers, 1994

Commercialization of Postal and Delivery Services: National and International Perspectives, (Ed.), Kluwer Academic Publishers, 1994 (with P.R. Kleindorfer)

Pricing and Regulatory Innovations Under Increasing Competition, (Ed.), Kluwer Academic Publishers, 1996

Managing Change in the Postal and Delivery Industries, (Ed.), Kluwer Academic Publishers, 1997 (with P.R. Kleindorfer)

Regulation Under Increasing Competition, (Ed.), Kluwer Academic Publishers, 1999

Emerging Competition in the Postal and Delivery Sectors, (Ed.), Kluwer Academic Publishers, 1999 (with P.R. Kleindorfer)

Current Directions in Postal Reform, (Ed.), Kluwer Academic Publishers, 2000 (with P.R. Kleindorfer)

Expanding Competition in Regulated Industries, (Ed.), Kluwer Academic Publishers, 2000.

Future Directions in Postal Reform, (Ed.), Kluwer Academic Publishers, 2001 (with P.R. Kleindorfer).

Postal and Delivery Services: Pricing, Productivity, Regulation and Strategy, (Ed.), Kluwer Academic Publishers, 2002 (with P.R. Kleindorfer).

Postal and Delivery Services: Delivering on Competition, (Ed.), Kluwer Academic Publishers, 2002 (with P.R. Kleindorfer).

Markets, Pricing, and Deregulation of Utilities, (Ed.), Kluwer Academic Publishers, 2003 (with J.C. Schuh).

Competitive Transformation of the Postal and Delivery Sector, (Ed.), Kluwer Academic Publishers, 2003 (with P.R. Kleindorfer).

Obtaining the Best from Regulation and Competition, (Ed.), Kluwer Academic Publishers, 2004 (with M. Spiegel).

Regulatory and Economics Change in the Postal and Delivery Sector, (Ed.), Kluwer Academic Publishers, 2005 (with P.R. Kleindorfer).

Progress toward Liberalization of the Postal and Delivery Sector, (Ed.), Springer Science + Business Media, Inc., 2006 (with P.R. Kleindorfer).

International Handbook On Economic Regulation (Ed) Edward Elgar, 2006. (with D. Parker).

Liberalization of the Postal and Delivery Sector, (Ed.), Edward Elgar, 2006 (with P.R. Kleindorfer).

Competition and Regulation in the Postal and Delivery Sector, (Ed.), Edward Elgar, 2008 (with P.R. Kleindorfer).

Postal Reform, (Ed.), Edward Elgar, 2008 (with J.I. Campbell and P.R. Kleindorfer)

Economics of Privatization and Regulation, (Ed) 2008 (with David Parker)

Progress in the Competitive Agenda in the Postal and Delivery Sector, (Ed.), Edward Elgar, 2009 (with P.R. Kleindorfer).

Heightening Competition in the Postal and Delivery Sector (Ed), Edward Elgar, 2010 (with P.R. Kleindorfer)

Reinventing the Postal Sector in an Electronic Age (Ed), Edward Elgar, forthcoming 2011 with P.R. Kleindorfer)

Professional Papers:

"Pennine Electricity Board," Nelson, 1966; reprinted in Ralph Turvey, (Ed.), *Public Enterprise*, Penguin, 1969

"Capital Costs and the Peak Problem in Electricity Supply: Comment," Manchester School, May 1966

"Pricing for Efficiency in Electricity Supply," in *Essays in the Theory and Practice of Pricing*, Institute of Economic Affairs, 1967

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"Antitrust Policy: The Application of Rules," (with C.K. Rowley), *Moorgate and Wall Street*, Autumn 1971

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"Optimal Plant Mix and Peak Load Pricing," (with P.R. Kleindorfer), *Scottish Journal of Political Economy*, November 1975

"Peak Load Pricing with a Diverse Technology," (with P.R. Kleindorfer), *Bell Journal of Economics*, Spring 1976, reprinted in Ray Rees (Ed.) *The Economics of Public Utilities*, Edward Elgar, (forthcoming 2006)

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"Public Utility Regulation and Managerial Discretion," (with P.R. Kleindorfer), *Southern Economic Journal*, January 1979

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"Some Elementary Considerations of Reliability and Regulation," (with P.R. Kleindorfer), in M.A. Crew, (Ed.), *Problems in Public Utility Economics and Regulation*, 1979; translated as "Einige Grundlegende Uberlegungen fur Versorgungssicherheit bei offentlichen Unternehmnen" in C.B. Blankart and M. Faber, (Eds.), *Regulierung offentlicher Unternehmen*, Anton Hain, 1982

"Incentives for Efficiency in the Nationalized Industries: Beyond the 1978 White Paper," (with P.R. Kleindorfer and E.F. Sudit), *Journal of Industrial Affairs*, Autumn 1979

"Has the 1970 Act been fair to mailers? Commentary," in R. Sherman, (Ed.), *Perspectives on Postal Service Issues*, American Enterprise Institute, 1980

"Introduction to Issues in Public Utility Pricing and Regulation," in M.A. Crew, (Ed.), *Issues in Public Utility Pricing and Regulation*, 1980

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"Regulation and Diverse Technology in the Peak Load Problem," (with P.R. Kleindorfer), *Southern Economic Journal*, October 1981

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"A Cost Benefit Analysis of Local Measured Service," (with R.E. Dansby), in M.A. Crew, (Ed.), *Regulatory Reform and Public Utilities*, 1982

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"Opportunities for Regulation and Rate Design of Innovative Metering Technology in Water Utilities," (with D.L. Schlenger), in M.A. Crew, (Ed.), *Analyzing the Impact of Regulatory Change*, 1985

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"Deregulation as an Instrument of Industrial Policy," (with C.K. Rowley), *Journal of Institutional and Theoretical Economics*, March 1986; to be reprinted in Spanish in *Boletin de Informacion Comercial Espanola*

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"Competition, Diversification, and Disintegration in Regulated Utilities," in M.A. Crew, (Ed.), *Deregulation and Diversification of Utilities*, Kluwer Academic Publishers, 1989

"Feasibility of Deregulation: A Public Choice Analysis," (with C.K. Rowley), in M.A. Crew, (Ed.), *Deregulation and Diversification of Utilities*, Kluwer Academic Publishers, 1989

"Competition, Diversification and Disintegration in Electric Utilities," (with K.J. Crocker), in *Retrofit Opportunities for Energy Management and Cogeneration: Proceedings of the 11th World Energy Engineering Congress*, Association of Energy Engineers, 1989

"On the Efficiency of Law: A Public Choice Perspective," (with C. Twight), *Public Choice*, September 1990

"Peak-Load Pricing in Postal Services," (with P.R. Kleindorfer and M.A. Smith), *Economic Journal*, September 1990

"Diversification and Regulated Monopoly," (with K.J. Crocker), in M.A. Crew, (Ed.), *Competition and the Regulation of Utilities*, Kluwer Academic Publishers, 1991

"Information Economics and New Forms of Regulation," (with M.R. Frierman), in M.A. Crew, (Ed.), *Competition and the Regulation of Utilities*, Kluwer Academic Publishers, 1991

"Alternatives to Rate of Return Regulation Including Franchise Bidding as Deregulation," (with M. Zupan), in M.A. Crew, (Ed.), *Competition and the Regulation of Utilities*, Kluwer Academic Publishers, 1991

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"Incentive Regulation, Capital Recovery and Technological Change in Public Utilities," (with P.R. Kleindorfer), in M.A. Crew (Ed.), *Economic Innovations in Public Utility Regulation*, Kluwer Academic Publishers, 1992

"The Franchise Rebidding Problem and Public Utility Regulation," (with R. Harstad), in M.A. Crew (Ed.), *Economic Innovations in Public Utility Regulation*, Kluwer Academic Publishers, 1992

"Contracts for Independent Power Producers: Economic Analysis and Regulatory Implications," (with K.J. Crocker), in M.A. Crew (Ed.), *Economic Innovations in Public Utility Regulation*, Kluwer Academic Publishers, 1992

"Qualite et Differenciation des Prix dans les Services Postaux", *Les Cahiers de l'Institut de Recherche d'Etudes et de Prospective Postales*, Vol. 12, September 1992, pp. 132-145. (P. R. Kleindorfer)

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"Pricing Priority Service: Theory versus Utility Practice," (with C. Fernando) in M.A. Crew (Ed.), *Incentive Regulation for Public Utilities*, Kluwer Academic Publishers, 1994

"Pricing in Postal Service under Competitive Entry," (with P.R. Kleindorfer), in M.A. Crew and P.R. Kleindorfer (Ed.), *Commercialization of Postal and Delivery Services: National and International Perspectives*, Kluwer Academic Publishers, 1994

"Pricing, Entry, Service Quality and Innovation Under a "Commercialized" Postal Service," (with P.R. Kleindorfer), in *Governing the Postal Service*, American Enterprise Institute, 1994

"Lessons from Public Utility Regulation for the Economic Regulation of Health Care Markets: An Overview," (with T.A. Abbott) in T.A. Abbott (Ed.), *Health Care Policy and Regulation*, Kluwer Academic Publishers, 1994

"Postal Service in the Nineties," (with J.S. Boronico and P.R. Kleindorfer), in P. Harker (Ed.), *The Service Productivity and Quality Challenge*, Kluwer Academic Publishers, 1995

"The Theory of Peak-Load Pricing: A Survey," (with C.S. Fernando and P.R. Kleindorfer), *Journal of Regulatory Economics*, November 1995. Reprinted in Robert B. Ekelund, Jr. (ed). *The Foundations of Regulatory Economics. Edward Elgar, 1998.*

"Incentive Regulation in the United Kingdom and the United States: Some Lessons," (with P.R. Kleindorfer), *Journal of Regulatory Economics*, May 1996

"Competition in Postal Service: International Perspectives," in E.L. Hudgins (Ed.), *The Last Monopoly*, CATO Institute, Washington, DC, 1996.

"Price Caps and Revenue Caps: Incentives and Disincentives for Efficiency," (with P.R. Kleindorfer) in M.A. Crew (Ed.), *Pricing and Regulatory Innovations Under Increasing Competition,* Kluwer Academic Publishers, 1996.

"Utilities Under Competition: An Options-Based Market Approach," (with C. Fernando and P.R. Kleindorfer) in M.A. Crew (Ed.), *Pricing and Regulatory Innovations Under Increasing Competition,* Kluwer Academic Publishers, 1996.

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"Efficient Entry, Monopoly, and the Universal Service Obligation in Postal Service," (with P.R. Kleindorfer), *Journal of Regulatory Economics*, September 1998.

"Stranded Assets in Network Industries in Transition," (with P.R. Kleindorfer) in M.A. Crew (Ed.), *Regulation Under Increasing Competition,* Kluwer Academic Publishers, 1999.

"Regulatory Governance and Competitive Entry," (with P.R. Kleindorfer), in M.A. Crew and P.R. Kleindorfer (Ed.), *Regulation Under Increasing Competition,* Kluwer Academic Publishers, 1999.

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"Balancing Access and Universal Service Obligations" (with P.R. Kleindorfer) In *Postal and Delivery Services: Delivering on Competition*, edited by M.A. Crew and P.R. Kleindorfer, Kluwer Academic Publishers, 2002.

"Regulation Redux," (with P.R. Kleindorfer) in *Markets, Pricing, and Deregulation of Utilities,* edited by M.A. Crew and J.C. Schuh, Kluwer Academic Publishers, 2003.

"Postal Privatization: in General and for the United States Postal Service?" (with P.R, Kleindorfer) in *Handbook of Privatization,* edited by David Parker and David Saal , Edward Elgar, 2003.

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"Access and the USO under Full Market Opening" (with P.R. Kleindorfer) in *Heightening Competition in the Postal and Delivery Sector* (Ed), Edward Elgar, forthcoming 2010 with P.R. Kleindorfer)

Book Reviews:

"Optimal Pricing and Investment in Electricity Supply," (Review), *Applied Economics*, January 1970

"Introduction to Contemporary Microeconomics," (Review), *Applied Economics*, December 1970

"Economies of Scale," (Review), *Journal of Economic Literature*, December 1972

"Take-Overs: Their Relevance to the Theory of the Firm," (Review), *Journal of Economic Literature*, June 1973

"The Prediction of Profitability," (Review), *Journal of Economic Literature*, June 1973

"Microeconomics: The Theory of Economic Allocation," (Review), *Economic Journal*, December 1973

"The Service Industries: Strategy, Structure and Financial Performance," (Review), *Journal of Economic Literature*, December 1979

"Britain's Economic Performance," (Review), *Southern Economic Journal*, April 1982

"Public Enterprise Economics: Theory and Application," (Review), *Public Choice*, 1988

"`Natural Monopoly Regulation' and `The Regulation of Natural Monopoly'," (Review), *Journal of Regulatory Economics*, December 1989

Honors and Awards:

Recipient with Paul Kleindorfer, on behalf of the Center for Research in Regulated Industries, of the Hermes Award, 1992, presented by the European Express Organization, Munich, Germany, June 22, 1992

Recipient of the 2002 Distinguished Service Award, Public Utility Research Center, University of Florida, Gainesville, FL, February 21, 2002

Other Professional Activities:

Referee, including the following journals: *American Economic Review*, *Bell Journal of Economics*, *Economica*, *Economic Journal*, *Economic Inquiry*, *Journal of Economic Studies*, *Journal of Institutional and Theoretical Economics*, *Journal of Political Economy*, *Journal of Public Economics*, *Operations Research*, *Quarterly Journal of Economics*, *Quarterly Review of Economics and Business*, *Review of Economic Studies*, *Review of Economics and Statistics*, *Southern Economic Journal*, *Swedish Journal of Political Economy*, and *Zeitschrift fur Nationalokonomie*

Referee of proposals submitted to National Science Foundation

Discussant, International Symposium on Public Policy for Regulated Monopolies and Public Enterprise, Brussels, June 1979

Chairman of session on Public Utility Regulation, South Western Economic Association, Houston 1980

Discussant, Telecommunications Policy Conference, Annapolis, April 1980

Chairman of session, Econometric Society Meetings, Denver, September 1980

Director, Rutgers University Workshop on Advanced Public Utility Economics, 1980-81 (monthly meeting of sixteen professional economists engaged in research in regional utilities and regulatory bodies)

Chairman of session and discussant, Southern Economic Association, New Orleans, November 1981

Discussant, American Economic Association, New York, December 1982

Participant, Emory University Law and Economics Center's Legal Institute for Economists, Dartmouth College, June 1983

Presenter of Paper, "Transactions Costs of Rate of Return Regulation," Conference on New Institutional Economics, Metlach, West Germany, June 26-29, 1984

Presenter of Paper, "Competition, Diversification and Regulation of Telecommunications," New Jersey Bar Association Conference, New Brunswick, NJ, March 24, 1987

Discussant/Chair, Public Choice Society, Tucson, AZ, March 26-28, 1987

Presenter of Paper, "Capital Recovery and Productivity Problems Under Price Caps," Pacific Telecommunications Council, Honolulu, HI, January 14-20, 1989

Presenter of Paper, "Diversification and Regulated Monopoly," Current Issues Challenging the Regulatory Process, Santa Fe, NM, March 7-10, 1989

Presenter of Paper, "On the Efficiency of Law: A Public Choice Perspective," Public Choice Society, Orlando, FL, March 16-19, 1989

Discussant, Bellcore/Bell Canada Cost Forum, San Diego, CA, April 4-8, 1989

Presenter of Paper, "Peak-Load Pricing in Postal Services," Public Choice Society, Tucson, AZ, March 16-19, 1990

Director, Rutgers University Research Seminars in Public Utility Economics and Regulation, (28 one-day conferences held over the period May 1977 to May 2004)

Director, Rutgers University Advanced Workshop in Regulation and Competition, 1981–Present (three meetings per year of currently 70 professional economists)

Director, Rutgers University Annual Eastern Conference in Regulation and Competition, 1982–Present

Director, Rutgers University Annual Western Conference in Regulation and Competition, 1988–Present

Director, Rutgers University Workshops and Conferences on Postal Delivery Economics, 3 Workshops and 13 Conferences, 1990–Present

Testimony Before Congress:

Testimony before the House of Representatives Sub Committee on Postal Service on H.R. 22, "The Postal Reform Act," April 16, 1997

Testimony Before President's Commission:

Testimony before the President's Commission on the United States Postal Service, "Unique Attributes of the Postal Service Business Model: Prepared Statement to the President's Commission On The United States Postal Service," April 14, 2003

Consultancy:

American Telephone and Telegraph (local measured service, access, depreciation, testimony)

U.S. Department of Energy/Argonne National Laboratory/New Jersey Energy Research Institute (community energy planning)

City of Trenton (integrated community energy systems)

New Jersey Board of Public Utilities/Jersey Central Power and Light Company (strategic options for JCP&L arising out of the Three Mile Island accident)

Glitterex Inc. (pre-trial economic analysis for an antitrust case)

National Right to Work Legal Defense Foundation (agency shop in universities)

Stevens Institute of Technology (conference preparation)

Northwestern Bell (competitive pricing policies)

Hackensack Water Company (software development for regulated companies)

New York Telephone Company (capital recovery problems, executive education, price caps)

Manchester Township, N.J. (litigation support for host community benefit)

Niagara Mohawk Power Corporation (maximum demand rates)

United States Postal Service (preparation of testimony on marginal costs according to service level, research on service quality and marginal costs, incentive regulation, conference preparation)

New Jersey Bell Telephone (regulation of competitive and monopoly services)

Michigan Bell Telephone (regulation of competitive and monopoly services)

BellSouth Telecommunications (usage-based pricing)

Royal Mail, United Kingdom (pricing and entry, USO)

United States Department of State (peak-load pricing, conference preparation)

PSE&G (economic depreciation)

U.S. Energy Information Administration (electric system reliability)

Sithe Energies, Inc. (testimony on back-up charges and revenue caps)

Independent Power Producers of New York, Inc. (testimony on incentive regulation and back-up charges)

Washington Utilities and Transportation Commission (testimony on depreciation)

A.T. Kearney (LINX) (postal cost study of USPS)

Deutsche Post (price caps and USO)

Entergy (incentive regulation)

New Zealand Commerce Commission (incentive regulation)

Board of Airline Representatives of Australia (BARA) (airport fees)

Canada Post Corporation (USO, regulation, testimony)

Government of Canada (Testimony on USO)

Federal Trade Commission (Postal Service)

New Zealand Post (regulation)

Australian Competition and Consumer Commission (postal discounts)

European Commission (member, PriceWaterhouseCoopers team on the USO and full market opening of postal markets)

US Treasury (member, Grant Thornton team on costing for USPS competitive products)

Australia Post Corporation (Access)

Board Membership:

Energy Initiatives Inc., Morristown, New Jersey 1985-1988

EXHIBIT B

Price Cap Regulation and Declining Demand

Timothy J. Brennan and Michael A. Crew*

Draft, 6/17/15

Section 1: Introduction

Price Cap Regulation (PCR) originated in the late 70s in the US with a new regulatory scheme for Michigan Bell that replaced tradition cost-of-service regulation (COS). It gathered considerable momentum in the 80s, with its adaption for AT&T following the Divestiture of the Regional Bell Operating Companies (RBOCs) in 1984. PCR's momentum continued with the privatization of the utilities in the UK. All of the newly privatized utilities were subject to PCR, not only telecommunications, but also electricity, gas and water.

The foundations for the adoption of PCR derived from two reports to the British Government (Littlechild 1984 , and 1987). Stephen Littlechild held the view that cost-of-service was inefficient and that PCR apparently provided stronger incentives for efficiency. For example, COS, since revenue was a direct function of cost, provided minimal incentives for cost minimization. In addition, COS involved costs to regulated firms and regulators of making and evaluating requests to increase rates.

PCR provides flexibility to regulated firms in that it allows the firm's basket of prices to rise by some index reflecting inflation. Frequently, the Consumer Price Index (CPI) is employed. At its simplest the allowed percentage change in the firm's weighted price basket is the change in the CPI less X, where X represents the decline in real prices provided to consumers under PCR.[1] This is usually referred to as "CPI – X" regulation. The firm is compensated for inflation except for the pre-set deduction of X. PCR appears attractive to consumers in that the firm's prices increase by less than inflation. It is beneficial to the firm in that it does not have the expense of a rate hearing to obtain a price increase. In addition, it has some flexibility to extent that it can raise some prices greater than CPI - X if it raises others by less than CPI - X.[2] In addition, it provides incentives for efficient operation.

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[1] Nominally, X represents a sharing of benefits with consumers of the gains the regulated firm will get created by its ability to profit from increasing efficiency. As noted below, X may also represent sharing of profits the firm would achieve from economies of scale when demand increases. However, in practice X is set through political negotiation rather than the application of economic theory or evidence.

[2] Brennan (1989) shows that with multiple products, a cap of an appropriately weighted sum of prices of multiple regulated products converges to a set of prices that maximizes consumer welfare given the profits the regulated firm is able to achieve.

This paper examines the case where the regulated firm sells one product regulated under PCR. The regulated firm will maximize profits by taking the regulated price as given. In that sense, it becomes a price taker, just like a competitive firm. Consequently, the regulated firm notionally has the same incentive to cut costs as it would if it were operating in a competitive market. In contrast, under COS the firm's revenue is based directly on its costs. If the firm reduces its unit costs, its prices are reduced to the lower average costs. Where demand is growing and technology is advancing the regulated firm under COS can make greater than the allowed return. The firm therefore has an incentive to delay filling a rate case until costs rise above the previously allowed level. Despite the impact of regulatory lag, the COS firm has a considerably weakened incentive to minimize cost than the PCR firm.

The stronger incentives to minimize costs for the profit-maximizing PCR firm were a major benefit perceived by the proponents of PCR. Another benefit was that unlike a COS-regulated firm, a PCR firm did not gain by subsidizing competitive products from regulated products (Brennan, 1989; Braeutigam and Panzar, 1989). However, when PCR was applied to USPS under PAEA little or no attention was paid to the fact that USPS had no residual claimants, which are required for the efficiency benefits of PCR to apply. Similarly, the absence of residual claimants may mean that the organization's incentive to avoid cross subsidy of competitive products may be attenuated. Littlechild and others[3] also saw the limitations of PCR, including the likelihood that any efficiency gains would likely be short run, raising the question of whether PCR would be an effective regulatory scheme in the long run. The focus of this paper is on the problem of employing PCR when demand is decreasing, primarily in the postal sector.

PCR's widespread adoption occurred later in the postal sector than in other sectors. The last major postal operator (PO) to adopt PCR was the United States Postal Service (USPS). PCR was incorporated into law as he mode of regulation with the passing of the Postal Accountability and Enhancement Act of 2006 (PAEA) on December 20, 2006. The new regulatory process was administered by the Postal Regulatory Commission (PRC), the successor to the Postal Rate Commission. The Act was around a decade in the making and it has been widely criticized.

This paper will not address the multitude of problems of PAEA but will concentrate on the impact of PCR on USPS when demand is falling. PCR was intended to provide greater incentives for efficiency than COS and reduce the transactions costs of regulation with the intention that USPS would prosper as a result. In fact, the reverse has happened. Under PCR it has experienced severe financial problems, which were more serious than they would have been under the previous regime and these problems continue. Its problems arose because of the combined cyclical and secular decline of mail. PCR is flawed when faced with declining demand, making it unsuitable for industries with declining or sluggish growth in demand.

This paper examines PCR in the face of declining demand. Section 2 describes the effect of reductions in demand on USPS. Section 3 illustrates how falling demand reduces the ability to cover cost under PCR and what might be done about it. Section 4 presents the adjustment mechanism under PCR for declining demand, including a numerical example. Section 5 examines briefly the relevance of declining demand regulated industries. Section 6 is by way of summary and conclusions. The appendix provides formal derivations.

[3] See Armstrong and Sappington (2007) for a review of relevant research.

Section 2: The Implications of Declining Demand for USPS

In the case of USPS, the effect of increased unit costs and the loss of revenue on the reduction in output had serious financial implications. PAEA left it ill-equipped to address the problems it was facing. Under the previous regulatory regime it had a mechanism for addressing this problem, namely, a rate hearing. So, cutting costs was effectively the only viable option perceived by USPS. Reducing costs can be achieved in a number of ways including improved efficiency of operations and lowering service quality. However, increasing efficiency faces an up-hill fight against the scale economies as demand decrease.

Given that USPS has scale economies, and therefore the impact of PCR is severe, it needs to explore other avenues to avoid losses. However, the options available to USPS under the price cap instituted by PAEA were highly limited. Entering new lines of business was highly restricted. One option, which it exercised, was to take advantage of the growing parcel business. Regrettably, this growth has been insufficient to make up the shortfall resulting from the dramatic fall in letter volume. This has been for a number of reasons. Parcel delivery is a much smaller share of revenue than letters. In addition, USPS does not have the market power in the parcel market that it does in the letter market. Furthermore, scale economies are lower in parcels than in letters. Expansion in parcels' volume is likely to have less of an impact in reducing average costs than the loss in letter volume is going to have in increasing average costs. In addition, since USPS does not have the market power in parcels that it has in letters its margin is also likely to be lower. The gaping hole left in the letter mail volume decline was not going to be filled by increased parcel volume.

Given the limited options, USPS faced cutting costs by reducing service standards was management's principal option. USPS proposed eliminating Saturday delivery but without success. It was successful in reducing service quality. Mail now takes at least a day longer to deliver and overnight delivery locally has been almost eliminated. The service reductions that have been introduced have had the effect of making USPS products less valuable, which has contributed further to the reduction in volume. Service reduction is another area where PCR can be problematical. If the welfare-maximizing level service quality is higher than the profit-maximizing level the firm has an incentive to cut service standards.[4]

The measures taken by USPS were unsuccessful in becoming profitable or even breaking even since 2006. In addition, USPS filed an Exigent Rate Case before the PRC resulting in a temporary price increase in excess of the CPI. Table 1 summarizes the results for USPS since 2006. Every year since 2006 it has lost money. This is despite the growth in parcel traffic and the cost savings from reductions in the service quality.

[4] Sappington (2005) provides an analysis of this issue. PAEA showed some recognition of this issue in that it required USPS to seek an Advisory Opinion from the PRC when it sought to change service standards.

Fiscal Year	Net Income ($ billions)	Mail Volume	% Decline	Career Employees (thousands)
2006	0.9	213		696
2007	(5.1)	212	0.47	685
2008	(2.8)	203	4.25	663
2009	(3.8)	177	12.81	623
2010	(8.5)	171	3.39	584
2011	(5.1)	168	1.75	557
2012	(15.9)	160	4.76	528
2013	(5.0)	158	1.25	491

Table 1: USPS Financial and Operational Information, Fiscal Years 2006 through 2013

Source: General Accounting Office 2013

A different approach is needed and this the subject of what follows—the need to modify the price cap formula to adjust for changes in demand.

Section 3: The Declining Demand Problem Under PCR

PAEA was introduced at a time when the volume of mail peaked. It has declined dramatically every year since then, albeit at a decreasing rate recently. Declining demand has serious implications for the firm under PCR. Begin with Figure 1, which illustrates the baseline case in which a PCR firm is just covering cost, where P_{cap} is the regulated price under PCR, AC and MC are respectively marginal cost, and D_0 is demand. The price is set to just equal average cost, as it would be under COS regulation. This is a baseline to illustrate the solvency problem created by declining demand.

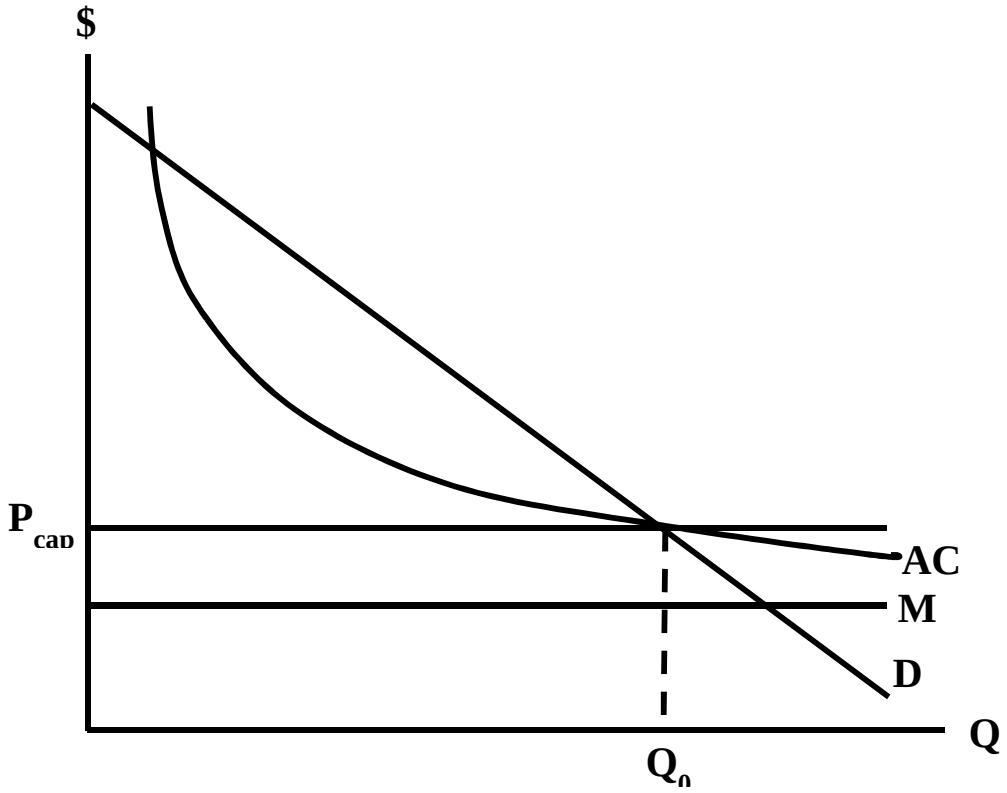

Figure 1: PCR with price exactly covering cost

Suppose the demand falls from D_0 to D_1, as illustrated in Figure 2. Average cost rises because of economies of scale, as output falls from Q_0 to Q_1. f price does not rise, the PCR regulated firm now is unable to cover its costs, purely as a result of the decline in demand. The loss is shown by the shaded rectangle above P_{cap}, up to Q_1.

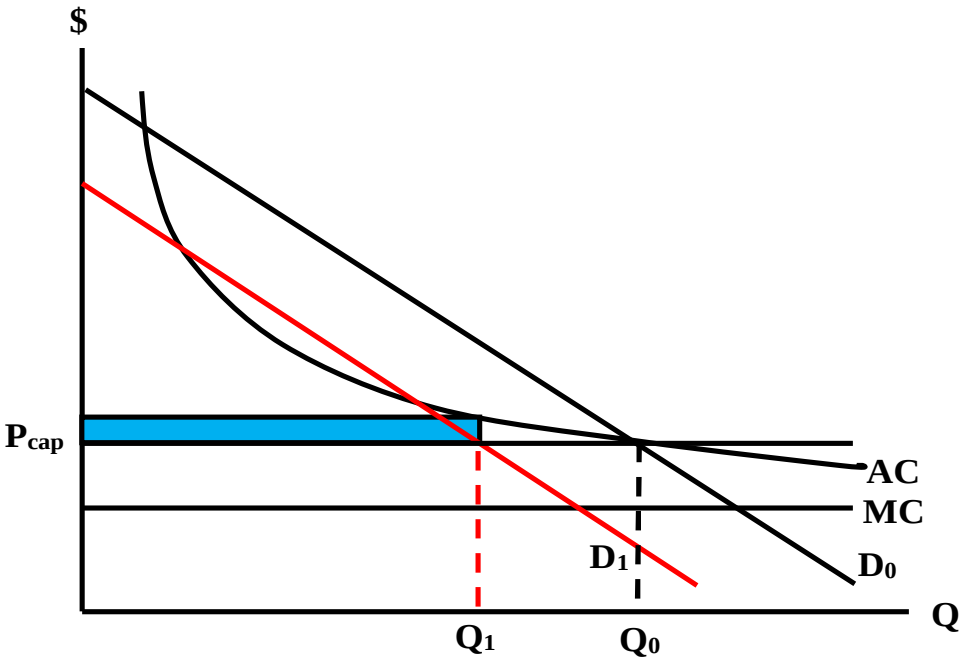

Figure 2: Losses to the PCR firm with declining demand

The size of the loss depends on the height of the rectangle that, as explained in the next section, depends on the elasticity of average cost. However, inspecting Figure 2 shows that were the regulator simply to increase price to by the height of this rectangle, demand would fall below Q_1, by an amount depending on the elasticity of demand. This, in turn, raises the required price. To restore the PCR firm's ability to cover costs, price has to rise to the point where the new demand curve intersects the average cost curve, as indicated by where the arrow is pointing in Figure 3.

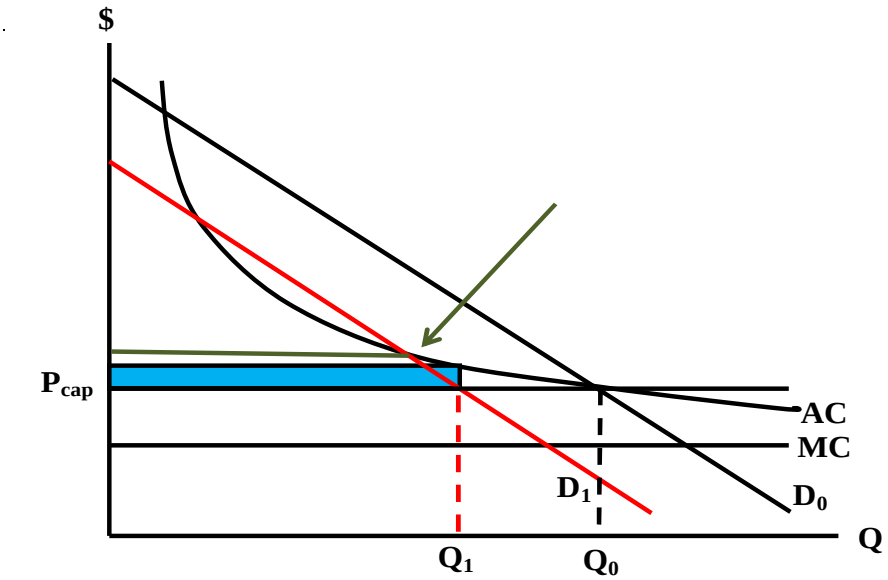

Figure 3: The price adjustment to restore the ability to cover cost

Section 4 describes the formula to adjust a price cap in order to restore the ability of the regulated firm to cover its costs in the face of declining demand.

Section 4: Price caps with changing demand

Revisiting the description in the introduction of PCR for a single product, the price cap formula can be written as:

$$\frac{\Delta P}{P} = \frac{\Delta CPI}{CPI} - X,$$

P is the price cap and ΔP is the change in the cap, so the left hand side is the percentage change in the price cap. The fraction on the right hand side is the inflation rate, and the last term is the X factor. An adjustment for changes in demand needs to be added to the formula. Three variables representing the change in demand, the resulting change in the average cost, and the elasticity of demand.

Change in demand. This is the percentage change in sales at the allowed price cap, assumed to be the price the regulated firm is charging. This percentage change in sales, Z, is assumed constant over the range of price between the current price cap and the price cap adjusted to reflect changes in demand. If Q is the quantity sold, the percentage change in sales defined as Z, as the percentage change in price above, is

$$Z = \frac{\Delta Q}{Q}$$

where ΔQ is the change in the change in sales. For declining demand, ΔQ and thus Z are both negative.

It is important that this change in sales is independent of actions taken by the regulated firm. If that firm were to be compensated by a price adjustment for every reduction in demand, it would be able to charge a higher price by taking actions to reduce demand, for example, reducing service quality. Similarly, a firm that undertook efforts to improve quality and thus increase demand would be penalized by a reduction in price. These would constitute perverse incentives to reduce product quality. Accordingly, it should be clear that any price adjustment be in response to only changes in demand outside the control of the regulated firm.

Average cost elasticity. While under PCR prices are not set by regulators to equal average cost—otherwise the firm loses its incentive to minimize its costs--prices need to be set with the expectation that the regulated firm will be able at least to cover average cost. The intent is to adjust price by a percentage. So, how much the percentage change in demand Z will change average cost, AC is require. The term for this is the elasticity of average cost, e_{AC}, defined as

$$e_{AC} = \frac{\Delta AC}{\Delta Q}\frac{Q}{AC} .$$

Multiplying this elasticity by the percentage change in demand will give the percentage change in average costs. Since regulation generally applies to firms with economies of scale that make them monopolies in the first place, average cost falls as output increases, so $e_{AC} < 0$.

One problem is that this elasticity may not be easy to measure. The appendix shows how to derive this elasticity from the elasticity of costs with respect to quantity, which could be estimated statistically. However, a simple way to understand and assess the magnitude of this elasticity is to calculate it from a familiar example. Suppose that the cost C(Q) of providing Q units of a particular service is given by

$$C(Q) = F + MQ,$$

where F is fixed cost and M is a constant marginal cost for each unit of the service delivered. Then

$$AC(Q) = C(Q)/Q = F/Q + M.$$

and

$$e_{AC} = \frac{-F}{F + MQ},$$

The elasticity of average cost is the negative of the ratio of fixed cost to total cost.[5] If variable costs MQ are low relative to fixed costs, this elasticity will be close to -1, its smallest value. In the extreme, if all of the costs are fixed (M = 0), the elasticity of average costs is -1; reducing quantity by a given percentage increases average cost by the same percentage. In the other direction, if fixed costs are low relative to variable cost, this elasticity will be close to zero—zero if fixed cost F equals 0. In this case price would not require adjusting for falling demand, because average cost would be M whether demand fell (or rose).

Elasticity of demand. It might seem that this is all that is needed, since the percentage change in demand times the elasticity of average cost with respect to output gives the percentage change in average cost, which should determine how much price would be adjusted. However, when price is adjusted, that too will have an effect on quantity sold (unless demand is perfectly inelastic), which will in turn affect how much average costs changes. This effect means that the percentage change in average cost will be the elasticity eAC times the sum of two percentage changes in quantity sold: Z, from general shift in demand, and this second effect induced by the adjustment itself.

The measure of this second effect on quantity sold is the percentage change in price $\Delta P/P$ times the elasticity of demand for the service, e_D. This means that the adjustment to $\Delta P/P$ is determined by an expression that also has $\Delta P/P$ as part of the adjustment itself. Specifically,

$$\frac{\Delta P}{P} = e_{AC}\left[Z + \frac{\Delta P}{P} e_D\right]$$

[5] Another expression shown in the appendix for e_{AC} is that for general cost functions, it equals MC/AC – 1, where MC is marginal cost. When MC is constant the expression in the text follows.

Solving this for the percentage change in price—a derivation is provided in the appendix—gives the expression to adjust for changes in demand Z:

$$\frac{\Delta P}{P} = Z\left[\frac{e_{AC}}{1-e_{AC}e_D}\right].$$

The PCR equation incorporating the adjustment is then

$$\frac{\Delta P}{P} = \frac{\Delta CPI}{CPI} - X + Z\left[\frac{e_{AC}}{1-e_{AC}e_D}\right].$$

Before getting to some illustrative examples, some general observations are in order. It may be useful to look at some extreme cases. To reiterate, if demand is perfectly inelastic (albeit at a lower level—a leftward shift of a vertical demand curve), e_D is zero. In that case, the denominator in the brackets is 1, and the adjustment is simply $Z[e_{AC}]$, in which one increases price by the increase in average cost brought about by the decline in demand. If e_{AC} is zero, the expression in the brackets is zero, and there would be no price adjustment, as average costs do not change and thus costs are covered without raising prices.

Typically scale economies are present in situations where PCR is applied. Scale economies, that is, falling average cost, will imply that e_{AC} is negative. Because the elasticity of demand is also negative, the product in the denominator above, $e_{AC}e_D$, is positive. If those elasticities are sufficiently small so their product is less than 1, the expression in the brackets is negative. When demand falls, that is, when Z is negative, the effect on price will be a negative number times the negative expression in the brackets, implying a positive price adjustment. This effect is expected. In most regulated sectors demand is inelastic, e_D having absolute value of less than one. The analysis above shows that e_{AC} is also less than one in absolute value when there are scale economies and positive variable costs. Consequently, their product will generally be less than one.[6] It is also worth observing that the effect is symmetric. If demand grows for reasons outside the control of the regulated firm, Z is positive, implying that prices could be adjusted downward, increasing consumer welfare while not affecting the PCR firm's ability to cover its costs.

The numerical example in Table 2 provides a sense of the impact of the adjustment. It shows the percentage adjustment to price from a fall in demand of 10%, for demand elasticities e_D between -.2 and -.6 and average cost elasticities e_{AC} between .1 and .5.

[6] If $e_{AC}e_D$ equals or exceeds one, the effect goes in reverse—falling demand that leads to higher average cost would imply that the firm cuts price. The appropriate economic interpretation of this perverse calculation is that if the elasticity of demand is sufficiently large, greater in absolute value than $1/e_{AC}$, then there is no price adjustment with positive sales by which the firm could cover its costs following a decline in demand. That is not a mathematical curiosity; it may be that any attempt to increase price would reduce demand by so much that the revenue collected would be less than the costs that remain. Under those conditions, the firm essentially lacks the market power necessary to cover its costs. Therefore, the adjustment factor will be most likely useful in settings where demand is inelastic at the regulated price before demand falls—as one would expect when firms are regulated—and that demand has not fallen so far as to change that.

Z = -.1		Elasticity of demand e_D				
		-.2	-.3	-.4	-.5	-.6
Elasticity of average cost e_{AC}	-.1	.010	.010	.010	.011	.011
	-.2	.021	.021	.022	.022	.023
	-.3	.032	.033	.034	.035	.037
	-.4	.043	.045	.048	.050	.053
	-.5	.056	.059	.063	.067	.071

Table 2: Price adjustments for a 10% fall in demand

Absent the correction from using the elasticity of demand, the numbers in the table would just equal the elasticity of average cost values on the left times the change in demand, -.1. For low values of the both demand and average cost elasticity, this is the case; when average cost elasticity is -.1, the adjustment factors are essentially just those. When both elasticities are large in absolute value, but less than unity, the size of the adjustment can be substantial. For the largest elasticities in the table, the price adjustment for a 10% reduction in demand would be to increase it by 7.1%; with no correction for the demand effect, it would be 5%.

For the current situation in the postal sector price elasticities in the range -0.3 to -0.4 seem reasonable.[7] The range for cost elasticity is somewhat more difficult to gauge and its choice is based almost entirely on judgment. Combining an average cost elasticity of -0.3 with a price elasticity of -.3, Table 3 shows the price adjustments for 2007-2013 implied from the changes in demand in Table 1.

Year	Change in demand	Price adjustment
2007	-0.47%	0.15%
2008	-4.25%	1.40%
2009	-12.81%	4.22%
2010	-3.39%	1.12%
2011	-1.75%	0.58%
2012	-4.76%	1.57%
2013	-1.25%	0.41%

Table 3: Price adjustments for falling demand, 2007-2013

The cumulative real[8] price increase suggested by these figures over this period is 9.8%. These figures are only illustrative, in light of assumptions regarding the relevant elasticities and the lack of adjustment for demand reductions driven by prices rather than outside factors. However, this illustration indicates that the potential adjustment under PCR due to falling demand could be quite substantial.

[7] In the recent Exigency Case, USPS' implicit demand elasticities were close to -0.3.

[8] Recall that under PCR prices should already be adjusted for inflation.

Section 5: Relevance across regulated sectors

While the motivation for this framework and its application is to the postal sector, it could have applications in other sectors where the regulated firms have seen declining demand, as summarized in Table 4.

Industry	Regulated provider	Disruptive technology, factors
Mail delivery	State postal operator, e.g., USPS	Internet delivery, on-line bill payment, e-government
Voice telephony	Landline telephone company	Mobile telephone service, digital voice-over-Internet protocol (VoIP)
Electricity	Local distribution utility	Distributed generation, energy efficiency mandates, emissions controls
Gas	Local distribution utility	Conservation, energy efficiency
Water	Local distribution utility	Conservation, drought

Table 4. Factors leading to declining demand in regulated sectors

Voice telephone service declined between 1992 and 2011, the percentage of households with landline telephone service falling from 94.7% in 1992 to 75% in 2011.[9] FCC data most recently for 2013 indicate that this trend has continued, with in connections provided by incumbent local telephone companies falling 16% from December 2011 to December 2013.[10] This decline is coincident with rapid growth in mobile telephony and telephone service provided by non-incumbent local carriers providing telephone service over the Internet rather than through traditional circuit-switched networks.

The decline in electricity service at this point is more prospective. Electricity demand growth has fallen dramatically last sixty years, from around 11% per year in the late 1950s to barely positive, .02%, between 2008 and 2013, with demand falling in some of those years.[11] Some of this was likely an anomaly due to the recession following the collapse of credit markets in the US in 2007, but the long term trend remains striking. Moreover, the U.S. utility industry is concerned that the trend is likely to get worse, with declining demand threatening the financial solvency of local electricity distributors (Kind, 2013). Part of this long-term decline in growth is the result of the decline in manufacturing and the more efficient use of electricity.

More recently, specific factors eliciting concern include on-site solar power and other technologies that "threaten the centralized utility model" and "energy efficiency and DSM [demand side manage-

[9] U.S. Census Bureau, "Extended Measures of Well-being: Living Conditions in the United States, 2011," Table 10, available at http://www.census.gov/hhes/well-being/publications/extended-11.html.

[10] Calculated from data in Federal Communications Commission, "Local Telephone Competition as of 2013," Table 1, p. 12, available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0219/DOC-329975A1.pdf.

[11] Calculated from data in Energy Information Administration, *Annual Energy Outlook 2014*, "Market Trends: Electricity Demand," available at http://www.eia.gov/forecasts/aeo/MT_electric.cfm#growth_elec.

ment] programs that also promote reduced utility revenues while causing the utility to incur implementation costs"(Kind, 2013 at 3). In the case of electricity, "decoupling" programs that attempt to guarantee local distribution utility revenues may protect utilities, and reduce their incentive to oppose public policies to promote efficiency programs that reduce electricity use (Brennan, 2010). The modification of PCR is one way to address the political or economic need to institute programs to increase prices when usage falls.

Gas distribution and water utilities face similar problems. In the case of gas and water per customer usage is being reduced by conservation programs. Water has strong scale economies and is subject to considerable fluctuations in usage as a result of restrictions imposed in time of drought (Crew and Kahlon, 2014). A further reform of gas, water and electricity would be to recover more of the fixed costs of distribution through monthly service charges. This would make distribution utilities less vulnerable to the effect of falling demand (Brennan, 2014 discusses rate reform in the case of electricity).

Section 6: Summary and Conclusion

Price cap regulation has significant advantages, in that it may induce regulated firms to operate efficiently and reduce the transactions costs of regulation. However, PCR can leave a regulated firm unable to cover costs when demand falls because with scale economies unit costs increase as output declines. An adjustment to the price cap formula, based on the elasticity of average cost with respect to output and the elasticity of demand, can restore solvency to a price-cap regulated firm. The elasticity of average cost—the percent by which average cost rises or falls as demand falls by a given percentage—can be expressed as a simple relationship between marginal and average cost. When marginal cost is constant, the elasticity of average cost is the negative of the ratio of fixed cost to total cost. Illustrative examples suggest that increasing the price cap based on this adjustment could have substantially mitigated the financial straits in which USPS found itself in recent years. The effect is symmetric, in that if demand is increasing, the same formula could be used to reduce prices, so consumers could share in the benefits of scale economies created by expanding supply.

This remains a work in progress. To apply it appropriately, authoritative estimates of the elasticity of demand and average cost. In practice there would be a number of complexities. For example, a separate price adjustment for each class of USPS products might be require as demand elasticities and perhaps scale economies differ across products. Applying the formula in this case may require relying on regulatory rules that determine the size of the fixed cost contributions from any particular product, as the basis for the cost recovery expected under PCR. It is important to remember that the formula assumes that the quality of service is constant, in part to prevent an inadvertent incentive to reduce demand by cutting quality in order to get a regulator to raise the cap; how PCR might be adjusted for service quality is a separate and complex question.

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Appendix

1. Equations for the change in average cost as output, the derivative of that change, and the elasticity of average cost with respect to output

Let C(Q) be the total cost of producing Q, with average cost AC(Q) = C(Q)/Q. The derivative of average cost with respect to Q is

$$AC' = \frac{dAC}{dQ} = \frac{QC'-C}{Q^2}.$$

Rewriting C' as MC, marginal cost, and dividing both the numerator and denominator by Q gives

$$AC' = \frac{dAC}{dQ} = \frac{MC-AC}{Q}.$$

For natural monopolies with scale economies throughout, this expression is negative, implying that MC < AC. The elasticity of average cost with respect to Q, e_{AC}, is then

$$e_{AC} = \frac{dAC}{dQ}\frac{Q}{AC} = \frac{MC\text{-}AC}{Q}\frac{Q}{AC} = \frac{MC}{AC} - 1 < 0.$$

Because MC/AC is non-negative but less than 1 for firms with scale economies, e_{AC} is negative, greater than or equal to -1.

The second derivative of average costs tells us of whether the effect of changing output on average cost and thus potentially solvency increases or decreases with scale. If that second derivative is positive (negative), the derivative of average cost falls (rises) in absolute value as scale increases. From the second expression above for AC',

$$AC'' = \frac{Q[MC' - AC'] - [MC\text{-}AC]}{Q^2}.$$

Because Q[AC'] = MC – AC,

$$AC'' = \frac{Q[MC'] - 2[MC\text{-}AC]}{Q^2} = \frac{MC'}{Q} - .\frac{2[MC\text{-}AC]}{Q^2}$$

The first term in the denominator on the right, MC', is

It may be useful to show these results for the setting

C(Q) = F + MQ.

In that case,

$$AC = \frac{F}{Q} + M,$$

$$AC' = \frac{MC\text{-}AC}{Q} = \frac{M - \frac{F}{Q} - M}{Q} = \frac{-F}{Q^2} < 0,$$

$$e_{AC} = \frac{MC}{AC} - 1 = \frac{M}{\frac{F}{Q} + M} - 1 = \frac{MQ}{F + MQ} - 1 = \frac{MQ\text{-}F\text{-}MQ}{F + MQ} = \frac{-F}{F + MQ} < 0,$$

And, because MC' = 0.

$$AC'' = -\frac{2[MC\text{-}AC]}{Q^2} = \frac{2F}{Q^3} > 0$$

because MC', the derivative of marginal cost with respect to output, is 0.

2. A general derivation of the price adjustment formula with changes in demand

It is shown below that if demand changes by a given percentage *Z*, the price *p* under a price cap should be adjusted in percentage terms (%Δ) by

$$\%\Delta p = Z\left[\frac{e_{AC}}{1-e_d e_{AC}}\right],$$

where $e_d \leq 0$ is the elasticity of demand and e_{AC} is the elasticity of average cost with respect to output. If the firm has scale economies, $e_{AC} < 0$.

To see why this holds, let demand be $kD(p)$, where p is price and k is the parameter reflecting a possible shift in the demand curve D. Z above will be the percentage change in k, that is, dk/k. The percentage change in price will be dp/p. To preserve the ability cover cost regardless of the value of k, price p has to be chosen to satisfy

$$pk[D(p)] = C(kD(p)), \tag{1}$$

where C is the total cost function. To fit into the price cap forumula, dp/p as a function of dk/k is required. To get this, first implicitly differentiate (1) to get

$$dp[kD] + dk[pD] + pkD'[dp] = C'D[dk] + C'kD'[dp] \tag{2}$$

Divide the left side of (2) by the left side of (1) and the right side of (2) by the right side of (1) to get:

$$\frac{dp}{p} + \frac{dk}{k} + \frac{D'dp}{D} = \frac{[C'D]dk}{C} + \frac{[C'kD']dp}{C}.$$

Multiply the last term on the left by p/p, the first term on the right by k/k, and the last term on the right by pD/pD, and get

$$\frac{dp}{p} + \frac{dk}{k} + \frac{D'p}{D}\left[\frac{dp}{p}\right] = \frac{C'kD}{C}\left[\frac{dk}{k}\right] + \frac{C'kD}{C}\left[\frac{D'p}{D}\right]\left[\frac{dp}{p}\right]. \tag{3}$$

Because the elasticity of demand $e_d = D'p/D$, (3) can be rewritten as

$$\frac{dp}{p} + \frac{dk}{k} + e_d\left[\frac{dp}{p}\right] = \frac{C'kD}{C}\left[\frac{dk}{k}\right] + \frac{C'kD}{C}e_d\left[\frac{dp}{p}\right]. \tag{4}$$

Multiplying and dividing the first expression on the right side of (3) and (4) by kD, because kD is output, $C'kD/C$, is MC/AC. However, it is more useful to invoke the following relationship derived above:

$$MC/AC = 1 + e_{AC},$$

Substituting (5) into (4) gives

$$\frac{dp}{p} + \frac{dk}{k} + e_d\left[\frac{dp}{p}\right] = [e_{AC}+1]\left[\frac{dk}{k}\right] + [e_{AC}+1]e_d\left[\frac{dp}{p}\right].$$

Multiplying out the terms on the right gives

$$\frac{dp}{p} + \frac{dk}{k} + e_d\left[\frac{dp}{p}\right] = \frac{dk}{k} + e_{AC}\left[\frac{dk}{k}\right] + e_d\left[\frac{dp}{p}\right] + e_{AC}e_d\left[\frac{dp}{p}\right].$$

Subtracting dk/k and $e_d[dp/p]$ from both sides of (7) gives

$$\frac{dp}{p} = e_{AC}\left[\frac{dk}{k}\right] + e_{AC}e_d\left[\frac{dp}{p}\right].$$

This gives

$$\frac{dp}{p}\left[1 - e_{AC}e_d\right] = e_{AC}\left[\frac{dk}{k}\right]$$

and

$$\frac{dp}{p} = \frac{dk}{k}\left[\frac{e_{AC}}{1 - e_{AC}e_d}\right],$$

which is the expression at the beginning of this section of the appendix, where dp/p is the percentage change in price and dk/k is the percentage change in demand, Z, in that expression.

If a regulated firm has scale economies, $e_{AC} < 0$. If demand falls, $dk/k < 0$. Thus, if demand falls where there are scale economies, the price cap should go up by the above expression to preserve the ability to cover costs under the original price cap regime. This can happen if the denominator on the right hand fraction in (9) is positive, that is

$$1 > e_{AC}e_D.$$

This is a reasonable assumption. If it is not true, when demand falls, if scale economies are sufficiently great and demand is sufficiently elastic, (10) implies that no price increase will be able to cover costs. The expression is symmetric. So, an increase in demand under scale economies would imply a fall in the price cap.