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PRICE-LEVEL REGULATION AND ITS REFORM

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$$P_t = P_b \cdot (1 + \kappa)^t$$

$$P_t = P_b \cdot \prod_{i=b}^{t} (1 + \kappa_i)$$

Price-level, or "price-cap," regulation offers an alluring alternative to the traditional technique of monitoring a regulated firm's profits. This Article contrasts price-level regulation with conventional cost-of-service ratemaking and with Ramsey pricing. Price-level regulation stands as a market-based, incentive-driven "third way" between traditional regulation and complete deregulation. Although some jurisdictions have set price caps according to operating cost and rate-of-return calculations that clearly parallel those steps in conventional ratemaking, this Article will focus on price-level methodologies that combine an economy-wide measure of inflation with an x-factor reflecting total factor productivity within a regulated industry.

After addressing the simpler component of price-level regulation, the choice of an inflation index, this Article devotes detailed attention to the treatment of the x-factor by two federal ratemaking agencies, the Federal Energy Regulatory Commission (FERC) and the Federal Communications Commission (FCC). Closer examination of price cap methodologies adopted by FERC and the FCC suggests that price-level regulation based on inflation and an industry-specific X factor may be

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* Justin Smith Morrill Chair in Law, Michigan State University; Of Counsel, Technology Law Group of Washington, D.C. This Article extends earlier work of mine on price-level regulation. *See* Jim Chen, *The Nature of the Public Utility: Infrastructure, the Market, and the Law*, 98 NW. U. L. REV. 1617, 1668–79 (2004); Jim Chen, *The Price of Macroeconomic Imprecision: How Should the Law Measure Inflation?*, 54 HASTINGS L.J. 1375, 1434–42 (2003). This Article's legal and economic analysis, however, differs considerably. Needless to say, so does its conclusion. This Article's title pays allusive tribute to STEPHEN G. BREYER, REGULATION AND ITS REFORM (1982). I presented this Article at the George Mason University School of Law on December 17, 2014. Barbara Bean, Santanu Ganguli, Gil Grantmore, and Vivian Okere provided helpful comments. Christian Diego Alcocer Argüello and Matthew Downer supplied capable research assistance. Special thanks to Heather Elaine Worland Chen.

further streamlined. This Article concludes by describing how price-level regulation might be accomplished through the application of a single, industry-specific index of input costs.

I. INTRODUCTION

Conventional rate-of-return regulation richly deserves its derogatory reputation as "the most speculative undertaking . . . in the history of [Anglo-American] jurisprudence."[1] Rate regulation is a seemingly bootless quest to set prices according to competitive market conditions that do not exist and cannot emerge as long as a legal ratemaking apparatus remains in

1. West v. Chesapeake & Potomac Tel. Co., 295 U.S. 662, 689 (1935) (Stone, J., dissenting).

place.[2] In traditional public utility law, "the burden of intrusive regulatory procedures and the risk of capture seem unavoidable."[3] Many pitfalls plague the conventional technique of determining a rate-regulated firm's revenue requirement according to the sum of its prudently incurred operating costs and a reasonable rate of return on investment. Almost all of these ills can be traced to a fundamental informational asymmetry: relative to regulators, firm managers enjoy vastly superior access to information about the firm's true costs and opportunities for profit.[4]

Price-level, or "price-cap," regulation offers an alluring alternative to the traditional technique of monitoring a regulated firm's profits.[5] Part II of this Article contrasts price-level regulation with conventional cost-of-service ratemaking and with Ramsey pricing. Price-level regulation stands as a market-based, incentive-driven "third way" between traditional regulation and complete deregulation.[6]

Part III provides formal specifications of price-level regulation. Although some jurisdictions have set price caps according to operating cost and rate-of-return calculations that clearly parallel those steps in conventional ratemaking,[7] this Article will focus on methodologies that combine an economy-wide measure of inflation with an *x*-factor reflecting total factor productivity within a regulated industry.

Part IV addresses the simpler component of price-level regulation, the choice of an inflation index. Part V devotes detailed attention to the treatment of the *x*-factor by two federal ratemaking agencies, the Federal Energy Regulatory Commission (FERC) and the Federal Communications Commission (FCC). Although these agencies have never explicitly cooperated, closer examination of price cap methodologies adopted by

2. *See generally* Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 611–16 (1969).

3. JOSÉ A. GÓMEZ-IBÁÑEZ, REGULATING INFRASTRUCTURE: MONOPOLY, CONTRACTS, AND DISCRETION 243 (2003).

4. *See* Mark A. Jamison, *Regulation: Price Cap and Revenue Cap*, *in* 3 ENCYCLOPEDIA OF ENERGY ENGINEERING AND TECHNOLOGY 1245, 1247 (Barney L. Capehart ed., 2007).

5. For an overview of the technique, see JORDAN J. HILLMAN & RONALD R. BRAEUTIGAM, PRICE LEVEL REGULATION FOR DIVERSIFIED PUBLIC UTILITIES: AN ASSESSMENT (1989). For a sense of the controversy that the technique sparked upon its introduction to the United States, compare Richard J. Pierce, Jr., *Price Level Regulation Based on Inflation Is Not an Attractive Alternative to Profit Level Regulation*, 84 NW. U. L. REV. 665 (1990) with Jordan J. Hillman & Ronald R. Braeutigam, *The Potential Benefits and Problems of Price Level Regulation: A More Hopeful Perspective*, 84 NW. U. L. REV. 695 (1990).

6. *See* HILLMAN & BRAEUTIGAM, *supra* note 5, at 698.

7. *See, e.g.*, Bluefield Waterworks & Improvement Co. v. Pub. Serv. Comm'n, 262 U.S. 679, 693 (1923); Ass'n of Oil Pipe Lines v. FERC (*Oil Pipe Lines II*), 281 F.3d 239 (D.C. Cir. 2002).

FERC and the FCC suggests that price-level regulation based on inflation and an industry-specific X factor may be further streamlined. Part VI describes how price-level regulation might be accomplished through the application of a single, industry-specific index of input costs.

II. PRICE-LEVEL REGULATION IN RELATION TO CONVENTIONAL RATEMAKING AND RAMSEY PRICING

A. Curing Flaws in Conventional Ratemaking

Within the United States, a legal system accustomed to borrowing heavily from English common law,[8] price-level regulation is a decidedly recent and statute-based British import. British regulators devised the price-level strategy in the 1980s as a method for disciplining British Telecommunications after privatization.[9] In truth, the United States had already collected extensive experience with similar regulatory mechanisms. Maximum rates and price ceilings in American legal history are no younger than the Supreme Court's 1968 decision in the *Permian Basin Area Rate Cases*,[10] which upheld a price ceiling based on average-cost ratemaking. Other American antecedents include the full-avoided cost pricing rule that the Public Utility Regulatory Policy Act (PURPA) prescribed for cogenerators and small-power producers[11] and the "new gas" price ceilings imposed by the Natural Gas Policy Act (NGPA).[12] PURPA and the NGPA—both, coincidentally, enacted in 1978—intended their price ceilings to invite new entry.[13] That history is in harmony with the incentive-based motivation that underlies price-level regulation.

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8. For merely one example of the influence of English common law on American constitutional law, see Williams v. Florida, 399 U.S. 78, 86–90 (1970). With respect to the impact of common law on American statutes, see Sekhar v. United States, 133 S. Ct. 2720, 2724–25 (2013); Neder v. United States, 527 U.S. 1, 23 (1999). *See generally, e.g.*, LAWRENCE M. FRIEDMAN, A HISTORY OF AMERICAN LAW 4–5 (3d ed. 2005); 1 G. EDWARD WHITE, LAW IN AMERICAN HISTORY: FROM THE COLONIAL YEARS THROUGH THE CIVIL WAR 48–51 (2012); Herbert Pope, *The English Common Law in the United States*, 24 HARV. L. REV. 6, 6–7 (1910).

9. *See* MARK ARMSTRONG, SIMON COWAN & JOHN STUART VICKERS, REGULATORY REFORM: ECONOMIC ANALYSIS AND BRITISH EXPERIENCE 165–94 (1994); GÓMEZ-IBÁÑEZ, *supra* note 3, at 220–23; STEPHEN C. LITTLECHILD, REGULATION OF BRITISH TELECOMMUNICATIONS' PROFITABILITY (1983).

10. 390 U.S. 747 (1968).

11. *See generally* Am. Paper Inst. v. Am. Elec. Power Serv. Corp., 461 U.S. 402 (1983).

12. *See generally* Mobil Oil Expl. & Prod. S.E., Inc. v. United Distrib. Cos., 498 U.S. 211 (1991).

13. Natural Gas Policy Act of 1978, Pub. L. No. 95-621, 92 Stat. 3350; Public Utility Regulatory Policies Act of 1978, Pub. L. No. 95-617, 92 Stat 3117.

Price-level regulation marks a conscious departure from conventional cost-of-service ratemaking by emphasizing commodity or service prices rather than the revenue required to sustain a publicly franchised firm.[14] In lieu of traditional restraints on the regulated firm's profitability—which force regulators to review the prudency of the firm's operating costs, assess the value of its productive assets, determine an appropriate rate of return, and gauge the impact of taxes and depreciation, and allocate charges among distinct customer classes[15]—the price-level alternative entitles a regulated firm to conduct its business as it sees fit, provided that its prices remain below a certain level.[16]

These elements of conventional ratemaking are on full display in the simplest formulation of the regulated firm's revenue requirement[17]:

$$RR = r \cdot B + OC + T$$

where[18]:

RR	revenue requirement
r	rate of return
B	rate base (value of capital investments, net of depreciation)
OC	operating costs
T	taxes

Price-level regulation addresses at least four of the most severe defects in conventional, cost-of-service rate regulation.[19] First, perverse incentives arise from a profit-regulated firm's ability to pass operating costs through to ratepayers and to collect a return on all investment it can characterize as "prudent."[20] The celebrated Averch–Johnson hypothesis posits that firms guaranteed a "just and reasonable" rate of return will overinvest to the

14. Pierce, *supra* note 5, at 666.

15. Darin W. Kempke, *Regulated Utilities*, *in* 2 ACCOUNTANTS HANDBOOK: SPECIAL INDUSTRIES AND SPECIAL TOPICS, at 36-6 to 36-11 (D.R. Carmichael & Lynford Graham eds., 12th ed. 2012).

16. *Id.*

17. *See*, *e.g.*, Williston Basin Interstate Pipeline Co. v. FERC, 165 F.3d 54, 56–57 (D.C. Cir. 1999); RICHARD E. MATHENY, TAXATION OF PUBLIC UTILITIES § 2.04 (2014) ("The Ratemaking Process").

18. *Williston Basin*, 165 F.3d at 56–57.

19. *See* Nat'l Rural Telecom Ass'n v. FCC, 988 F.2d 174, 178 (D.C. Cir. 1993); Policy & Rules Concerning Rates for Dominant Carriers, 5 FCC Rcd. 6786, 6791, 6853 & n.450 (1990), *on reconsideration*, 6 FCC Rcd. 2637 (1991).

20. *See Oil Pipe Lines II*, 281 F.3d 239, 247 (D.C. Cir. 2002) (observing that the recovery of "all costs reasonably incurred in one period" gave "pipelines . . . perverse incentives to 'gold-plate' facilities"); *Nat'l Rural Telecom Ass'n*, 988 F.2d at 178.

extent that rate regulation shields them from the discipline of the marketplace.[21]

Second, the impossibility of extending a regulatory scheme to all business activities ostensibly within the reach of a natural monopolist[22] gives rise to that hoary practice of regulated firms, shifting money between regulated and unregulated lines of business.[23] Baxter's Law, named after the architect of the Bell breakup decree (William F. Baxter),[24] posits that a monopolist will "evade [rate] regulation by leveraging its market power from the [monopolized] platform market into adjacent and unregulated . . . markets."[25] Price-level regulation, in other words, blunts the motivation that dominant firms might otherwise have to use rents from imperfectly regulated lines of business to cross-subsidize their quest for greater power over unregulated markets.

A crucial corollary of this principle is regulatory reform of funding for universal service. Conventional ratemaking funds service to low-income and/or high-cost customers through implicit subsidies embedded within complex rate structures charging above-cost rates to those classes of customers who were presumed capable of financing universal service.[26] By

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21. *See* Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1052 (1962); Harold H. Wein, *Fair Rate of Return and Incentives–Some General Considerations*, *in* PERFORMANCE UNDER REGULATION 39 (Harry M. Trebing ed., 1968); Stanislaw H. Wellisz, *Regulation of Natural Gas Pipeline Companies: An Economic Analysis*, 71 J. POL. ECON. 30 (1963). *See generally* W. KIP VISCUSI, JOHN M. VERNON & JOSEPH E. HARRINGTON, ECONOMICS OF REGULATION AND ANTITRUST 387–91 (2d ed. 1995) (reviewing the literature addressing the Averch–Johnson hypothesis).

22. The impossibility of this task does not keep regulators from trying and trying again, and failing each time. *Compare, e.g.*, United States v. Sw. Cable Co., 392 U.S. 157 (1968), *with* ALBERT CAMUS, *The Myth of Sisyphus*, *in* THE PLAGUE, THE FALL, EXILE AND THE KINGDOM, AND SELECTED ESSAYS 589 (Stuart Gilbert, David Bellos & Justin O'Brien eds., 2004).

23. *See, e.g.*, Colo. Interstate Gas Co. v. FPC, 324 U.S. 581 (1945); Smith v. Ill. Bell Tel. Co., 282 U.S. 133 (1930); City of Houston v. Sw. Bell Tel. Co., 259 U.S. 318 (1922); Sw. Bell Corp. v. FCC, 896 F.2d 1378 (D.C. Cir. 1990).

24. *See* United States v. W. Elec. Co., 569 F. Supp. 1057 (D.D.C. 1983), *aff'd mem. sub nom.* California v. United States, 464 U.S. 1013 (1983); United States v. Am. Tel. & Tel. Co., 552 F. Supp. 131 (D.D.C. 1982), *aff'd mem. sub nom.* Maryland v. United States, 460 U.S. 1001 (1983), *terminated by* Telecommunications Act of 1996, Pub. L. No. 104-104, § 601(a)(1), 110 Stat. 56, 143–44, *reprinted in* 47 U.S.C. § 152 note (2012) (Applicability of Consent Decrees and Other Law).

25. Philip J. Weiser, *Toward a Next Generation Regulatory Strategy*, 35 LOY. U. CHI. L. REV. 41, 71–72 (2003); *see also* Paul L. Joskow & Roger G. Noll, *The Bell Doctrine: Applications in Telecommunications, Electricity, and Other Network Industries*, 51 STAN. L. REV. 1249, 1249–50 (1999).

26. *See generally* Jim Chen, *Subsidized Rural Telephony and the Public Interest: A Case Study in Cooperative Federalism and Its Pitfalls*, 2 J. TELECOMM. & HIGH TECH. L. 307, 318–

commanding that universal service support be made "explicit,"[27] the Telecommunications Act of 1996 effectively banned the funding of universal service through implicit cross-subsidies.[28]

In other words, cross-subsidization, whether achieved by dominant firms exploiting gaps within conventional regulation or indulged by regulators as part of their mission to ensure universal service, are incompatible with the contemporary commitments to open entry and competitive neutrality. Although price-level regulation does not directly provide an explicit, competitively neutral mechanism for funding universal service,[29] price caps are, at an absolute minimum, compatible with regulatory reforms designed to remove implicit cross-subsidies from filed tariffs and other expressions of conventional ratemaking.[30]

Third, conventional rate-of-return regulation is, not to put too fine a point on it, slow and expensive. As if to prove the regulatory command, "Thou Shalt Not Optimize in Piecemeal Fashion,"[31] the failure to complete the transition from rate-of-return regulation to its price-level equivalent leaves a firm free to "escape the burden of costs incurred in its unregulated *or* price cap business by shifting them to [a] rate-of-return affiliate, which can pass them on to ratepayers."[32] Allowing firms to choose between inflation-based and valuation-based methodologies injects "an exciting new twist" into rate regulation and "invites an enormous amount of gamesmanship."[33] Abortive conversion from conventional ratemaking also facilitates *official* misconduct, especially if regulators "arbitrarily switch back and forth between methodologies in a way which require[s] investors

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23 (2003).

27. 47 U.S.C. § 254(e) (2012).

28. *See, e.g.*, Comsat Corp. v. FCC, 250 F.3d 931, 938 (5th Cir. 2001); Alenco Commc'ns, Inc. v. FCC, 201 F.3d 608, 623 (5th Cir. 2000); Sw. Bell Tel. Co. v. FCC, 153 F.3d 523, 537–38 (8th Cir. 1998).

29. For judicial observations on that regulatory goal, see Qwest Corp. v. FCC, 258 F.3d 1191, 1196 (10th Cir. 2001); Tex. Office of Pub. Util. Counsel v. FCC, 183 F.3d 393, 418 (5th Cir. 1999).

30. *See* Nat'l Ass'n of State Util. Consumer Advocates v. FCC, 372 F.3d 454, 457–58, 461 (D.C. Cir. 2004).

31. Gregory S. Crespi, *Market Magic: Can the Invisible Hand Strangle Bigotry?*, 72 B.U. L. REV. 991, 1010–11 (1992); *see also* Mario J. Rizzo, *The Mirage of Efficiency*, 8 HOFSTRA L. REV. 641, 652 (1980) ("The general theory of second best demonstrates that if there are distortions from competitive equilibrium throughout the economy due to taxes or monopoly, for example, a change that can be viewed as value maximizing in one small sector may actually decrease value overall." (footnote omitted)). *See generally* R.G. Lipsey & Kelvin Lancaster, *The General Theory of Second Best*, 24 REV. ECON. STUD. 11 (1956).

32. Nat'l Rural Telecom Ass'n v. FCC, 988 F.2d 174, 180 (D.C. Cir. 1993).

33. Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1525 (D.C. Cir. 1984).

to bear the risk of bad investments at some times while denying them the benefit of good investments at others."[34]

Finally, price-level regulation promotes the efficient pricing of individual products offered by a regulated firm. Although "[t]he most basic idea in welfare economics and price theory is that it is efficient for a good to be produced and consumed if the marginal cost of production is less than the marginal benefit of consumption," virtually every question of regulatory rate design concerns circumstances in which "the fixed costs of production must be recovered through raising prices above marginal costs."[35] Prices in a regulated setting routinely exceed marginal cost because the firm otherwise "will not be able to cover its fixed costs if it sets prices equal to marginal cost."[36]

B. Ramsey Pricing

Despite these virtues, price-level regulation may not offer an ideal solution to the problem of optimal pricing. Outright deregulation, or at least its closest regulatory equivalent, may outperform both conventional ratemaking and its price-level alternative.[37] Nearly a century ago, economist Frank Ramsey proposed a pricing methodology that minimizes the social loss from setting prices above marginal cost.[38] When the government imposes taxes on goods, it can best minimize those taxes' distortion of consumption patterns (and therefore minimize the efficiency loss from such taxes) by levying taxes in inverse proportion to the elasticity of demand for each good. Later work, especially by Marcel Boiteux, extended Ramsey's insight from its original context in taxation to the allocation of fixed costs in utility ratemaking.[39]

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34. Duquesne Light Co. v. Barasch, 488 U.S. 299, 315 (1989). *But see* Verizon Commc'ns Inc. v. FCC, 535 U.S. 467, 526 (2002) (failing to identify any constitutionally significant "reliance interests" that would be "jeopardized by an intentional switch in ratesetting methodologies").

35. William P. Rogerson, *New Economic Perspectives on Telecommunications Regulation*, 67 U. CHI. L. REV. 1489, 1491 (2000).

36. *Id.*

37. *Cf.* Joseph D. Kearney & Thomas W. Merrill, *The Great Transformation of Regulated Industries Law*, 98 COLUM. L. REV. 1323, 1363 (1998) (describing the long-term trend of the law of regulated industries toward "complete detariffing, elimination of all entry restrictions, and outright abolition" of regulatory supervision).

38. *See* Frank P. Ramsey, *A Contribution to the Theory of Taxation*, 37 ECON. J. 47 (1927).

39. *See* Marcel Boiteux, *Sur la gestion des Monopoles Publics astreints à l'équilibre budgétaire*, 24 ECONOMETRICA 22 (1956), *translated in* Marcel Boiteux, *On the Management of Public Monopolies Subject to Budgetary Constraints*, 3 J. ECON. THEORY 219 (William J. Baumol & David F. Bradford trans., 1971). *See generally* ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 137–41 (photo. reprint 1988) (1st ed. 1970);

Ramsey pricing "in its pure form" often confounds regulators with insurmountable "difficulties in getting the data needed."[40] Price-level regulation overcomes this difficulty by effectively delegating cost allocation decisions to the regulated firm.[41] Armed with "an appropriate price cap scheme," a "regulator does not need to know demand elasticities to implement Ramsey prices," but rather "can induce the regulated firm itself to choose Ramsey prices."[42] Price-level regulation thus contains its own form of rate design. Common costs are assigned to customers whose demand for utility service is the most elastic:

> Ramsey pricing [is] designed for cases where marginal cost is below average cost. Where that is true, a regulated firm forced to sell at marginal cost cannot recoup its total costs. Under Ramsey pricing, the regulator allows firms to charge each user a premium over marginal cost in inverse proportion to the elasticity of the user's demand. Because the highest charges fall on the most inelastic demanders, the impact on total usage is minimized. Thus, . . . [Ramsey pricing] would reconcile the [regulated firm's] need for revenue to cover total costs with the least possible distortion of demand . . . .[43]

Ramsey pricing is easy to articulate as a regulatory norm but notoriously difficult to implement within political constraints on regulation.[44] Formally, the Lerner index measures a firm's market power according to the negative inverse of the price elasticity of demand faced by the firm.[45] Setting rates according to the inverse of the price elasticity of demand therefore gives legal effect to the regulated firm's market power. Market

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KENNETH E. TRAIN, OPTIMAL REGULATION: THE ECONOMIC THEORY OF NATURAL MONOPOLY 122–25 (1991).

40. Burlington N.R.R. Co. v. ICC, 985 F.2d 589, 596 (D.C. Cir. 1993); *see also* William B. Tye & Herman B. Leonard, *On the Problems of Applying Ramsey Pricing to the Railroad Industry with Uncertain Demand Elasticities*, 17 TRANSP. RES. 439 (1983).

41. *See* JEAN-JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS 66–67 (2000); Ingo Vogelsang & Jörg Finsinger, *Regulatory Adjustment Process for Optimal Pricing by Multiproduct Monopoly Firms*, 10 BELL J. ECON. 157 (1979).

42. Rogerson, *supra* note 35, at 1492.

43. *Burlington N.*, 985 F.2d at 596.

44. For a flavor of ongoing debates over Ramsey pricing, see Egbert Dierker, *The Optimality of Boiteux-Ramsey Pricing*, 59 ECONOMETRICA 99 (1991); Tae Hoon Oum & Michael W. Tretheway, *Ramsey Pricing in the Presence of Externality Costs*, 22 J. TRANSP. ECON. & POL'Y 307 (1988); William G. Shepherd, *Ramsey Pricing: Its Uses and Limits*, 2 UTILS. POL'Y 296 (1992).

45. *See* Abba P. Lerner, *The Concept of Monopoly and the Measurement of Monopoly Power*, 1 REV. ECON. STUD. 157 (1934).

power, after all, is the power to control prices.[46] In more colorful terms, setting rates according to Ramsey pricing prices utility services according to their value to the purchaser, and thereby allows the regulated firm to charge "all that the traffic will bear."[47]

The real world presence of inequality and the widely held political instinct against exacerbating unequal distributions of wealth in favor of the affluent hamper the complete implementation of Ramsey pricing. By allowing "the highest charges [to] fall on the most inelastic demanders," Ramsey pricing prescribes a harshly *regressive* approach to rate regulation.[48] The burden of high rates would fall most heavily on citizens who are least able and least likely to find alternatives to utility services priced according to Ramsey's approach. This criticism of Ramsey pricing finds a nearly exact parallel in defenses of progressive taxation.[49] At an extreme, Ramsey pricing may raise rates to such high levels as to create "the false illusion that a government agency is keeping watch over rates, . . . when it is in fact doing no such thing."[50]

In the fierce battle over its Total Element Long-Run Incremental Cost Rule (TELRIC),[51] the FCC rebuffed calls for Ramsey pricing of telephone network elements that incumbent local exchange carriers were required to

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46. *E.g.*, United States v. E.I. du Pont de Nemours & Co., 351 U.S. 377, 391 (1956); *accord* United States v. Grinnell Corp., 384 U.S. 563, 571 (1966); *see also* 47 C.F.R. § 61.3(q) (2016) (defining a "[d]ominant carrier" as one "found by the [Federal Communications] Commission to have market power (*i.e.*, power to control prices)").

47. *See, e.g.*, INTERSTATE COMMERCE COMM'N, PROPOSED ADVANCES IN FREIGHT RATES BY CARRIERS, ICC Docket No. 3500, U.S. Doc. 5910, S. Doc. No. 61-725, at 4072–74 (1911) (describing the railroads' proposed rule that would enable them to charge "all that the traffic will bear"); *cf. id.* at 4119 (acknowledging that pricing carriage at rates that "the traffic will bear" allows the railroad to extract the value of that service from the shipper). These hearings by the Interstate Commerce Commission represented merely one chapter in the United States government's decades-long assault on the trans-Missouri and trans-Illinois railroad trusts. *See generally* United States v. Trans-Mo. Freight Ass'n, 166 U.S. 290 (1897).

48. *Burlington N.*, 985 F.2d at 596.

49. *See, e.g.*, Donna M. Byrne, *Progressive Taxation Revisited*, 37 ARIZ. L. REV. 739, 770 (1995); Jim Chen, *Progressive Taxation: An Aesthetic and Moral Defense*, 50 U. LOUISVILLE L. REV. 659, 676–79 (2012); Richard A. Musgrave, *Clarifying Tax Reform*, 70 TAX NOTES 731, 733 (1996).

50. Texaco, Inc. v. FPC, 474 F.2d 416, 422 (D.C. Cir. 1972), *vacated on other grounds*, 417 U.S. 380 (1974); *accord* Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1510 (D.C. Cir. 1984).

51. *See generally* Jim Chen, *The Death of the Regulatory Compact: Adjusting Prices and Expectations in the Law of Regulated Industries*, 67 OHIO ST. L.J. 1265, 1292–95, 1305–13 (2006); Gregory L. Rosston & Roger G. Noll, *The Economics of the Supreme Court's Decision on Forward Looking Costs*, 1 REV. NETWORK ECON. 81 (2002); David E.M. Sappington, *On the Design of Input Prices: Can TELRIC Prices Ever Be Optimal?*, 18 INFO. ECON. & POL'Y 197 (2006).

sell to competitors on an unbundled basis, despite the endorsement of that practice by academic commentators[52] and at least one Supreme Court Justice.[53] A majority of the high court eventually concluded that Ramsey pricing's primary economic attraction "appears to be a drawback when [it is] used as a method of setting rates for the wholesale market in unbundled network elements."[54] Specifically, because entrants into local exchange markets were expected to exhibit "highest" demand for "the costly bottleneck elements, duplication of which is neither likely nor desired, high lease rates for these elements would be the rates most likely to deter market entry."[55]

Price-level regulation therefore stands between the economically flawed approach of conventional ratemaking and the politically fraught alternative of Ramsey pricing.[56] Its principal virtue lies in avoidance of conventional ratemaking's deepest pitfalls. At the same time, by imposing some ceiling, or "cap," on prices charged by a regulated firm, price-level regulation largely escapes the usual allegations leveled against Ramsey pricing, that setting prices inverse to elasticities of demand, even if technically achievable, abdicates control over prices to monopolists and enables them to charge all that the traffic will bear.[57]

Precisely how well price-level regulation navigates this third way depends on its specification and its application to actual markets. I now turn to this question.

III. SPECIFYING PRICE-LEVEL REGULATION

There are two strikingly distinct formulaic methods of specifying price-level regulation. I shall first dispense with the so-called forecast approach, if only to recognize the similarities between this method and the conventional ratemaking formula that price caps are purportedly designed to displace. I will then focus on the method that commands the lion's share

52. *See* J. Gregory Sidak & Daniel F. Spulber, *The Tragedy of the Telecommons: Government Pricing of Unbundled Network Elements Under the Telecommunications Act of 1996*, 97 COLUM. L. REV. 1081, 1109 (1997).

53. *See* AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 426–27 (1999) (Breyer, J., concurring in part and dissenting in part) (acknowledging that the "FCC disfavors Ramsey pricing, but" complaining that the agency "does not explain why a contrary judgment would conflict with" the Telecommunications Act of 1996 "or otherwise be arbitrary or unreasonable").

54. Verizon Commc'ns, Inc. v. FCC, 535 U.S. 467, 515 (2002).

55. *Id.* at 515–16.

56. *Compare, e.g.*, Williston Basin Interstate Pipeline Co. v. FERC, 165 F.3d 54, 56–57 (D.C. Cir. 1999), *with* Ramsey, *supra* note 38.

57. *See supra* note 47.

of this Article's attention: price-level regulation through the application of a general inflation index and an industry-specific measure of productivity.

A. The Forecast Approach

The forecast approach to price-level regulation proceeds in three steps.[58] First, the regulator determines the rate base for the initial year *t* of price-level regulation by reference to some base year:

$$B_{t-1} = B_i + \sum_{i=1}^{t-1}(C_i - D_i)$$

where:

B_i rate base in year *i*
C_i capital expenditures in year *i*
D_i depreciation in year *i*

Second, the regulator projects operating expenses and unit sales for each year under the price cap. Third and finally, the regulator calculates a weighted average cost of capital as the rate of return needed to finance the price-capped firm:

$$\sum_{j=t}^{n+t} \frac{P_j Q_j - OC_j - c_j + d_j - T_j}{(1+r)^j} = B_{t-1} - \frac{B_{n+t}}{(1+r)^n}$$

where:

n expected duration of the price cap
P_jQ_j projected revenue for year *j*
OC_j operating expenses for year *j*
T_j taxes for year j
R rate of return—i.e., the weighted average cost of debt and equity[59]

Despite its superficial complexity, the so-called forecast approach to price-level regulation is quite faithful to the traditional cost-of-service ratemaking formula for computing a regulated firm's revenue requirement:

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58. *See generally* RICHARD GREEN & MARTIN RODRÍGUEZ PARDINA, RESETTING PRICE CONTROLS FOR PRIVATIZED UTILITIES: A MANUAL FOR REGULATORS 77–80 (1999); Jamison, *supra* note 4, at 1247–48.

59. *See* GREEN & PARDINA, *supra* note 58, at 87–91 (describing different methods for computing the rate of return); *cf. Williston Basin*, 165 F.3d at 57, 60–63 (describing the use of discounted cash flow analysis to compute the cost of common equity as the most contentious part of computing the "weighted average . . . of the three elements comprising" a regulated firm's "capital structure: long-term debt, preferred stock, and common equity").

$RR = r \cdot B + OC + T$.[60] Indeed, the forecast method so closely tracks conventional ratemaking that it is better evaluated as a method for transitioning what had previously been a government-owned enterprise (such as British Telecommunications) to private ownership under regulatory supervision.[61] In the United States, which rarely encounters such transitions from outright public ownership to regulation of a newly privatized, shareholder-owned firm on a public utility model,[62] there may be no practically meaningful distinction between conventional ratemaking and the forecast approach to price-level regulation.

B. Inflation Minus x-Factor

In order to distinguish itself from conventional ratemaking's focus on firm-specific revenue, price-level regulation must begin with an economic baseline that is wholly independent of the firm's historic costs and revenues and likewise unconnected to regulatory forecasts of the rate of return needed to attract and retain private investment in the firm. What this Article will treat as true price-level regulation combines independent benchmarks of prices with industry-specific adjustments of a regulated firm's freedom to raise prices in a given time period.

The success of price-level regulation often hinges on the computation of its initial baseline.[63] To the extent that an initial price cap is based on old rates computed according to the historical cost of providing service, price-level regulation may not deliver significant gains *vis-à-vis* conventional

60. *See* GREEN & PARDINA, *supra* note 58.

61. *See, e.g.*, ARMSTRONG, COWAN & VICKERS, *supra* note 9, at 165–94.

62. Rate regulation in the United States does address publicly owned and quasi-public enterprises, *inter alia*, with respect to the United States Postal Service, *see*, *e.g.*, Nat'l Ass'n of Greeting Card Publishers v. U.S. Postal Serv., 462 U.S. 810 (1983) (assigning to the Postal Rate Commission the primary responsibility for setting postage rates under the Postal Reorganization Act, 39 U.S.C. § 3622(b) (1982)), and the Bonneville Power Administration, *see* 16 U.S.C. § 839e(a)(2) (1982) (setting rates within the Bonneville Power Administration so "that such rates . . . are sufficient to assure repayment of the Federal investment in the Federal Columbia River Power System over a reasonable number of years [and] . . . are based upon the Administrator's total system costs"); Alcoa, Inc. v. Bonneville Power Admin., 698 F.3d 774, 789 (9th Cir. 2012) (recognizing that the "BPA must set rates 'with a view to encouraging the widest possible diversified use of electric power at the lowest possible rates to consumers consistent with sound business principles,'" without being committed to "always charg[ing] the lowest possible rates" (quoting 16 U.S.C. § 838g(1) (2006); California Energy Comm'n v. Bonneville Power Admin., 909 F.2d 1298, 1307–08 (9th Cir. 1990))).

63. *See* Jeffrey I. Bernstein & David E.M. Sappington, *Setting the X Factor in Price-Cap Regulation Plans*, 16 J. REG. ECON. 5, 9 (1999); Peter Navarro, *The Simple Analytics of Performance-Based Ratemaking: A Guide for the PBR Regulator*, 13 YALE J. ON REG. 105, 128 (1996).

ratemaking.[64] Once an initial level has been set, an effective cap "require[s] annual adjustments to the [firm's] price cap indices for inflation and certain 'exogenous' changes outside the [firm's] control, coupled with a percentage offset for anticipated productivity gains."[65] The maximum allowable price thus varies according to two adjustments: (1) upward, generally, as prescribed by a gauge of general inflation, and (2) downward in anticipation of the extent to which "the [regulated] industry [will] experience[] faster productivity growth than the economy generally."[66]

The following formula describes price-level regulation in algebraic terms[67]:

$$P_t = P_b \cdot (1 + \pi - x - z)^t$$

where:

- P_b baseline price cap
- P_t price cap in year t after the onset of price-level regulation
- π inflation rate[68]
- x x-factor, sometimes called a "minimum productivity offset"[69]
- z a further adjustment for regulation-specific factors, sometimes called a "consumer productivity dividend"[70]

If we relax the assumption that a price cap would remain constant over a designated period before the agency adjusts its formula, we would do well to restate this formula in even more general terms, one that allows annual variation in all three parameters, π, x, and z:

$$P_t = P_b \cdot \prod_{i=b}^{t} (1 + \pi_i - x_i - z_i)$$

64. *See* Verizon Commc'ns, Inc. v. FCC, 535 U.S. 467, 486 (2002); U.S. Tel. Ass'n v. FCC (*USTA*), 188 F.3d 521, 524 (D.C. Cir. 1999); Alfred E. Kahn, Timothy J. Tardiff & Dennis L. Weisman, *The Telecommunications Act at Three Years: An Economic Evaluation of Its Implementation by the Federal Communications Commission*, 11 INFO. ECON. & POL'Y 319, 330–32 (1999); Daniel F. Spulber & Christopher S. Yoo, *Access to Networks: Economic and Constitutional Connections*, 88 CORNELL L. REV. 885, 910 (2003).

65. Bell Atl. Tel. Cos. v. FCC, 79 F.3d 1195, 1198 (D.C. Cir. 1996).

66. *Id.*

67. *See* Jeff D. Makholm, *Elusive Efficiency and the X-Factor in Incentive Regulation: The Törnqvist v. DEA/Malmquist Dispute*, *in* THE LINE IN THE SAND: THE SHIFTING BOUNDARY BETWEEN MARKETS AND REGULATION IN NETWORK INDUSTRIES 95, 97–98 (Sarah Voll & Mike King eds., 2007). *See generally id.* at 107–10 (providing a full mathematical derivation of the basic formula for price-level regulation).

68. By convention, economic literature designates inflation by the Greek letter π. In the context of this Article, π does not designate the transcendental number associated with the circumference of a circle or with trigonometric functions.

69. *See Bell Atl. Tel. Cos.*, 79 F.3d at 1198.

70. *Id.*

where i indicates an indexing variable and P_b indicates the baseline price cap.

The foregoing three-parameter approach to price-level regulation is evident in the rules of the Federal Communications Commission. The FCC defines "[p]rice cap regulation" as a "method of regulation of dominant carriers provided in [47 C.F.R.] §§ 61.41 through 61.49."[71] Dominant carriers are those "found by the Commission to have market power (*i.e.*, power to control prices)."[72] The FCC calculates a "Price Cap Index (PCI)," or an "index of prices applying to each basket of services of each carrier subject to price cap regulation,"[73] according to "the following formula":[74]

$$PCI_t = PCI_{t-1}[1 + w(GDPPI - X) + \frac{Z}{R}]$$

where:

> *GDP-PI* represents the "GDP Price Index," or the "estimate of the Chain-Type Price Index for Gross Domestic Product published by the United States Department of Commerce."[75]
>
> X represents the productivity adjustment known as the x-factor.[76]
>
> Z represents the "dollar effect of current regulatory changes when compared to the regulations in effect at the time the PCI was updated to PCI_{t-1}, measured at base period level of operations."[77]
>
> R represents "[b]ase period quantities for each rate element . . . multiplied by the price for each rate element . . . at the time the PCI was updated to PCI_{t-1}."[78]
>
> $w = R + Z$, all divided by R, with respect to the service baskets subject to these Price Cap Index adjustments.[79]

71. 47 C.F.R. § 61.3(ff) (2016).
72. *Id.* § 61.3(q).
73. *Id.* § 61.3(ee).
74. *Id.* § 61.45(b)(1)(i).
75. *Id.* § 61.3(r).
76. Special Access for Price Cap Local Exch. Carriers (*Special Access I*), 27 FCC Rcd. 10,557, 10,563 (2012).
77. 47 C.F.R. § 61.45(b)(1)(i).
78. *Id.*
79. *Id.*

Shorn of its elaborations, the FCC's Price Cap Index calculation takes the form of the full three-parameter formula for price-level regulation: $P_t = P_b \cdot (1 + \pi - x - z)^t$.[80] The FCC has characterized its PCI mechanism as serving three purposes, each corresponding to one of the parameters, π, x, and z:

> The PCI is designed to limit the prices LECs charge for service. The PCI has three basic components: (1) a measure of inflation, *i.e.*, the Gross Domestic Product (chain weighted) Price Index (GDP-PI); (2) a productivity factor or "X-Factor," which represents the amount by which LECs can be expected to outperform economy-wide productivity gains; and (3) adjustments to account for "exogenous" cost changes that are outside the LEC's control and not otherwise reflected in the PCI.[81]

Because exogenous costs are "'in general those costs that are triggered by administrative, legislative or judicial action beyond the control of the carriers,'" *z*-factor "adjustments for such changes presumably do not undermine the price caps' incentive structures."[82]

Other modifications of the basic price cap mechanism do reduce the effectiveness of price-level regulation in adjusting the incentives of capped firms. In specifying its price cap rules for dominant carriers, the FCC has codified its historic sensitivity to the potentially regressive redistributive effects of market-based regulation, which reach their peak under Ramsey pricing but are not altogether absent under price caps.[83] The FCC computes an "Actual Price Index (API)" based on "the level of aggregate rate element rates in [each] basket" of distinctly priced telephone company services.[84] The FCC further divides each price cap

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80. *See* sources cited *supra* note 67.

81. Special Access for Price Cap Local Exch. Carriers (*Special Access II*), 27 FCC Rcd. 16,318, 16,320 (2012) (footnotes omitted); *see also Special Access I*, 27 FCC Rcd. at 10,563.

82. Sw. Bell Tel. Co. v. FCC, 28 F.3d 165, 167 (D.C. Cir. 1994) (quoting Policy and Rules Concerning Rates for Dominant Carriers, 5 FCC Rcd. 6786, 6807 (1990), *modified on reconsideration*, 6 FCC Rcd. 2637 (1991), *further reconsideration dismissed*, 6 FCC Rcd. 7482 (1991)).

83. *See Special Access I*, 27 FCC Rcd. 10,557.

84. 47 C.F.R. § 61.3(b) (2016); *see also id.* § 61.46. Specifically,

> [a] price cap basket is a broad grouping of services, such as special access services. Prices for services within a basket are limited by the PCI for the basket, which limits the LEC's pricing flexibility and its incentives to shift costs. To ascertain compliance with the PCI, LEC rate levels within each basket are measured through the use of an Annual Price Index (API). The API is the weighted sum of the percentage change in LEC prices. The API weights the rate for each rate element in the basket based on the quantity of each element sold in a historical base year. The historical base year is

basket into service category bands and computes a "Service Band Index" based on "the level of aggregate rate element rates in [each] service category."[85]

Although the use of baskets and bands enables the FCC to calibrate price indexes according to the cost and demand characteristics of specific services,[86] these devices dilute the effectiveness of price-level regulation.[87] Baskets and bands partially restore regulatory oversight of costs and revenue on a firm-specific basis.[88] The greater the departure from the truly market-oriented aspects of price-level regulation, the lower the regulated firm's incentives to reduce costs and to innovate.[89] Regulatory directives ordering firms to share gains from price-level regulation with their customers have perhaps the most negative effect on these incentives.[90] Acknowledging that sharing mechanisms designed to capture the price-capped firm's profits for its customers' benefit do "severely blunt[] the efficiency incentives of price cap regulation" and reintroduce many of the distortions associated with conventional rate-of-return regulation, the FCC has eliminated sharing requirements in price-level regulation of local exchange carriers.[91]

Stripping away the *z*-factor and such artifices as baskets and bands returns price-level regulation to adjustments conducted "*solely* for reasons independent of the regulated firm's actual behavior, notably (1) an annual adjustment for general price inflation . . . and (2) an automatic annual downward adjustment for expected improvements in firm productivity."[92] Omission of the *z*-factor reduces price-level regulation to a simpler two-

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> the calendar year that immediately precedes the annual tariff filing on July 1. A price cap LEC's rates are in compliance with the cap for a basket if the API is less than or equal to the PCI.

Special Access for Price Cap LECs, 27 FCC Rcd. at 16,320 n.5 (citation omitted).

85. 47 C.F.R. § 61.3(*oo*); *see also id.* § 61.47.

86. *See* Nat'l Rural Telecom Ass'n v. FCC, 988 F.2d 174, 183 (D.C. Cir. 1993); 47 C.F.R. § 61.42.

87. *See generally* KEITH S. ROSENN, LAW AND INFLATION 21 (1982).

88. *Id.*

89. *See Nat'l Rural Telecom Ass'n*, 988 F.2d at 178.

90. The sharing mechanisms that the FCC imposed through its earliest price cap orders inspired numerous legal controversies. *See* Bell Atl. Tel. Cos. v. FCC, 79 F.3d 1195 (D.C. Cir. 1996); *Nat'l Rural Telecom Ass'n*, 988 F.2d at 180. By contrast, the D.C. Circuit has upheld a price-cap scheme for cable television operators that omitted any sharing mechanism. *See* Time Warner Entm't Co. v. FCC, 56 F.3d 151, 164–74 (D.C. Cir. 1995).

91. *See USTA*, 188 F.3d 521, 528 (D.C. Cir. 1999).

92. Sw. Bell Tel. Co. v. FCC, 28 F.3d 165, 167 (D.C. Cir. 1994) (emphasis added).

parameter specification, $P_t = P_b \cdot (1 + \pi - x)^t$.[93] Or in an even more general form that allows annual variations in inflation and total factor productivity:

$$P_t = P_b \cdot \prod_{i=b}^{t} (1 + \pi_i - x_i)$$

These specifications leave only two additional regulatory targets: the rate of inflation (π) and an x-factor reflecting gains in total factor productivity. Parts IV and V will address each of these factors in turn.

IV. CHOOSING THE INFLATION INDEX

As between the two primary tasks in price-level regulation, the choice of an inflation index is at once less burdensome and less important. Because inflation affects the national economy as a whole and is not confined to a single industry within the jurisdiction of a regulatory agency (let alone an individual firm subject to that agency's oversight), an agency such as FERC or the FCC must rely on extrinsic measures of price changes across the entire economy.[94]

By the same token, the choice of an inflation index is likely to command substantial attention, from capped firms as well as their regulators, because inflation represents the primary force in price-level regulation that drives prices *upward*.[95] Precisely because an "inflation index" represents a "factor[] outside of [entrepreneurial] control," a regulated firm should "have little incentive to shift costs from nonregulated activities to regulated ones because it would not be able to increase regulated rates to recapture those costs."[96]

The proper measurement of inflation nevertheless presents a nontrivial chore.[97] Despite the prominence of inflation in all legal subjects connected to economics,[98] regulators have demonstrated a

93. *See* sources cited *supra* note 67.

94. *See* Jim Chen, *The Price of Macroeconomic Imprecision: How Should the Law Measure Inflation?*, 54 HASTINGS L.J. 1365, 1403 (2003).

95. *Bell Atl. Tel. Cos.*, 79 F.3d at 1198.

96. California v. FCC, 39 F.3d 919, 926 (9th Cir. 1994).

97. *Cf.* ROSENN, *supra* note 87, at 21 ("There are billions of prices in modern economies, and there is no feasible method to monitor their constant movements.").

98. *See generally* James Ming Chen, *Indexing Inflation: The Impact of Methodology on Econometrics and Macroeconomic Policy*, 1 CENT. BANK J.L. & FIN. 3 (2014); Chen, *supra* note 94.

surprising reluctance to adopt a firm measure of inflation.[99] In judicial review of administrative discretion, an agency's failure to designate "an appropriate index," let alone the failure to explain "the proper relationship between the appropriate inflation rate and the lower limit of the zone of reasonableness" for regulated rates, is reversible error.[100]

To be sure, like any other form of "agency ratemaking, price cap regulation . . . 'involves policy determinations in which the agency is acknowledged to have expertise.'"[101] Moreover, "a reviewing court must generally be at its most deferential" when an agency "is making predictions, within its area of special expertise, at the frontiers of science."[102] But review of administrative decisions routinely requires judges to "acquire the learning pertinent to complex technical questions in such fields as economics, science, technology and psychology."[103] Judges "should not automatically succumb" to regulators' "acknowledged expertise . . . overwhelmed as it were by the utter 'scientificity'" of the ratemaking process.[104] "Restraint, yes, abdication, no."[105]

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99. *See* Chen, *supra* note 94, at 1405–07.

100. Ark. La. Gas Co. v. FERC, 654 F.2d 435, 443 (5th Cir. 1981); *see also* Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1524 nn.71–72 (D.C. Cir. 1984) (observing that FERC had failed to correlate changes in a rate base with inflation, whether measured by the CPI or by the IPD).

101. WorldCom, Inc. v. FCC, 238 F.3d 449, 458 (D.C. Cir. 2001) (quoting Time Warner Entm't Co. v. FCC, 56 F.3d 151, 163 (D.C. Cir. 1995)).

102. Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council, Inc., 462 U.S. 87, 103 (1983); *see also, e.g.*, Indus. Union Dep't v. Am. Petroleum Inst., 448 U.S. 607, 656 (1980) (plurality opinion); *id.* at 705–06 (Marshall, J., dissenting).

103. Ethyl Corp. v. EPA, 541 F.2d 1, 69 (D.C. Cir. 1976) (en banc) (Leventhal, J., concurring), *cert. denied*, 426 U.S. 941 (1976); *cf.* Kassel v. Consol. Freightways Corp., 450 U.S. 662, 670 (1981) (plurality opinion) (expressing a willingness to invalidate "marginally" effective and "substantially" obtrusive state laws despite state officials' claimed expertise over regulations designed "to promote the public health or safety"); Queensboro Farms Prods., Inc. v. Wickard, 137 F.2d 969, 975 (2d Cir. 1943) (describing agriculture as a field "so vast that fully to comprehend it would require an almost universal knowledge ranging from geology, biology, chemistry and medicine to the niceties of the legislative, judicial and administrative processes of government").

104. Essex Chem. Corp. v. Ruckelshaus, 486 F.2d 427, 434 (D.C. Cir. 1973); *cf.* Jackson v. Pollion, 733 F.3d 786, 787 (7th Cir. 2013) (Posner, J.) (identifying "a widespread, and increasingly troublesome, discomfort among lawyers and judges confronted by a scientific or other technological issue"); Edward K. Cheng, *Fighting Legal Innumeracy*, 17 GREEN BAG 2D 271, 276 (2014) (urging all "legal actors . . . to demand, without embarrassment, that quantitative researchers not only explain the conclusions of their studies, but also how and why the methods work").

105. *Ethyl Corp.*, 541 F.2d at 69 (Leventhal, J., concurring).

There are two obvious candidates for measuring inflation. First, the Bureau of Labor Statistics (BLS), a division of the Department of Labor, publishes the Consumer Price Index (CPI).[106] The CPI is not a true cost-of-living index, but rather an estimate based on a market basket of goods and services thought to represent average consumer spending.[107] The broadest version of CPI, the CPI for All Urban Consumers (CPI-U), reflects changes in the prices of all goods and services purchased for consumption by urban households.[108] Notably, even the BLS counsels against the use of CPI as "a reliable measure of inflationary and deflationary periods" because this gauge "includes volatile food and oil prices."[109] The BLS also recognizes the CPI's vulnerability "to sampling error since it is based on a sample of prices and not the complete average."[110]

The United States' second measure of inflation is the implicit price deflator that the Bureau of Economic Affairs (BEA), a division of the Department of Commerce, derives from its measurement of the Gross Domestic Product (GDP).[111] The implicit price deflator reflects the difference between the GDP's nominal measure of changes in the market value of goods, services, and structures produced by the entire United

106. *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, CPI DETAILED REPORT: DATA FOR JANUARY 2014, at 221 (2014), http://www.bls.gov/cpi/cpid1401.pdf [https://perma.cc/AV25-A9BG].

107. *See id.*

108. *See id.*

109. U.S. Bureau of Labor Statistics, *Consumer Price Index for All Urban Consumers: All Items Series*, FRED, https://fred.stlouisfed.org/data/CPIAUCSL.txt [https://perma.cc/Y2MJ-W5FP] (last updated June 6, 2016) (summarizing U.S. Bureau of Labor Statistics, *Consumer Price Index: Frequently Asked Questions (FAQs)*, U.S. DEP'T LAB., http://stats.bls.gov/cpi/cpifaq.htm#Question_13 [https://perma.cc/DX73-GW5C] (last modified Dec. 2, 2015)); *cf.* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, BLS HANDBOOK OF METHODS ch. 17, at 4 (June 2015) [hereinafter BLS HANDBOOK OF METHODS, CHAPTER 17], http://www.bls.gov/opub/hom/pdf/homch17.pdf [https://perma.cc/5QEN-GAK2] (observing that "many analysts" prefer the BLS's series for *All items less food and energy* as a more "useful" measure of "core inflation," since it includes "[f]ood and energy" as "two of the most volatile components of the CPI").

110. U.S. Bureau of Labor Statistics, *supra* note 109 (summarizing U.S. Bureau of Labor Statistics, *Consumer Price Index: Frequently Asked Questions (FAQs)*, U.S. DEP'T LAB., http://stats.bls.gov/cpi/cpifaq.htm#Question_21 [https://perma.cc/NES9-YEEZ] (last modified Dec. 2, 2015)); *cf.* BLS HANDBOOK OF METHODS, CHAPTER 17, *supra* note 109, at 6 ("The CPI is estimated for a sample of consumer purchases; it is not a complete measure of price change[, which requires that] all consumer transactions [be] covered.").

111. *See* BUREAU OF ECON. ANALYSIS, NIPA HANDBOOK: CONCEPTS AND METHODS OF THE U.S. NATIONAL INCOME AND PRODUCT ACCOUNTS, at 2-15 & 4-22 (2014), http://bea.gov/national/pdf/chapters1-4.pdf [https://perma.cc/CZ4Y-XBLT].

States economy and the computation of a "real" GDP that purports to account for the impact of inflation on nominal GDP.[112]

The closely related Gross National Product (GNP) "measures the market value of the goods, services, and structures produced by labor and property *supplied by U.S. residents*," including American investment abroad.[113] The GNP is therefore distinct from the GDP, which "cover[s] activities that take place *within the geographic borders of the United States*," including foreign investment in this country.[114] Accordingly, "GDP measures the market value of the goods, services, and structures produced within the nation's economy."[115] Although the United States officially switched from the GNP to the GDP as "the primary measure of U.S. production" in 1991,[116] the earliest implementations of price-level regulation by American regulators relied upon the GNP.[117] Vestiges of this history remain in the rules of the FCC.[118]

The deprecation of GNP in the United States' national income and product accounts reduces the selection of an inflation index to a binary choice between the CPI and the implicit price deflator of the GDP.[119] Legislative and administrative sources of law both favor the CPI (including CPI-U and all other variants) over the IPD as a measure of inflation by a rough ratio of ten to one.[120] In a rare flash of insight, Congress indexed natural gas price ceilings under the Natural Gas Policy Act of 1978 according to the IPD (plus a 0.2% premium),[121] evidently aware that the CPI systematically overstated inflation relative to the

112. *Id.*

113. *Id.* at 2-6 (emphasis added).

114. *Id.* (emphasis added).

115. *Id.*

116. *Id.* at 1-3 n.6, 2-4 n.29; *Gross Domestic Product as a Measure of U.S. Production*, 71 SURVEY CURRENT BUS., Aug. 1991, at 8, 8.

117. *E.g.*, Policy and Rules Concerning Rates for Dominant Carriers, 5 FCC Rcd. 6786, 6792–93 (1990), *modified on reconsideration*, 6 FCC Rcd. 2637 (1991), *further reconsideration dismissed*, 6 FCC Rcd. 7482 (1991); *accord* Sw. Bell Tel. Co. v. FCC, 28 F.3d 165, 167 (D.C. Cir. 1994).

118. *See* 47 C.F.R. § 61.3(s) (2016) (defining the "GNP Price Index" for purposes of rate regulation by the FCC); *id.* § 76.922(b)(2)(ii), (d)(2), (f)(4) (using the GNP Price Index to adjust rates for basic and cable programming service tiers, to make quarterly rate adjustments, and to account for external costs).

119. *See* Chen, *supra* note 94, 1402–09.

120. *See generally id.* at 1404–09.

121. *See* 15 U.S.C. §§ 3311(a), 3314(b)(1)(A)(ii) (1988), *repealed*, Pub. L. No. 101-60, § 2(b), 103 Stat. 158, 158 (1989); Mobil Oil Expl. & Producing S.E., Inc. v. United Distrib. Cos., 498 U.S. 211, 218, 221–22 (1991); Pub. Serv. Comm'n v. Mid-La. Gas Co., 463 U.S. 319, 333, 334–35 & n.13, 342 (1983).

IPD.[122] Because the GDP is derived from the most comprehensive survey of all transactions in the United States economy, and because the BEA has consistently applied a chain-type, annual-weighted methodology that the BLS has merely begun to explore on an experimental, legally nonbinding basis,[123] the implicit price deflator represents price-level regulation's unequivocally superior choice for measuring inflation across the entire economy.

In cases involving price-level regulation, the reviewing court should not hesitate to challenge a ratemaking agency's decision to use a firm- or industry-specific price index in lieu of the broadest available measure of price change in the economy at large. At least where conventional rate-of-return regulation still holds sway, the choice between the CPI and the IPD should be a simple one. In traditional rate regulation, the appropriate benchmark is the opportunity cost to the holder of a regulated firm's common stock of making that equity investment.[124] Insofar as utility investors anticipate nothing more and nothing less than being "better off by investing dollars in [the regulated firm's] securities than by buying real things at the time of investment,"[125] the appropriate inflation index for all traditional ratemaking applications is the broadest available: the price deflator implied by the BEA's computation of the Gross Domestic Product.

There is, admittedly, at least one judicial precedent that arguably counsels caution in applying GDP data to conventional ratemaking.[126] Closer examination of *Williston Basin Interstate Pipeline Co. v. FERC*,[127]

122. *See* H.R. REP. NO. 95-1752, at 72–74 (1978) (Conf. Rep.); Steven M. Spaeth, *The Deregulation of Transportation and Natural Gas Production in the United States and Its Relevance to the Soviet Union and Eastern Europe in the 1990's*, 12 U. BRIDGEPORT L. REV. 43, 79 n.310 (1991).

123. *See generally* JULIE M. WHITTAKER, CONG. RESEARCH SERV., RL 32293, THE CHAINED CONSUMER PRICE INDEX: WHAT IS IT AND WOULD IT BE APPROPRIATE FOR COST-OF-LIVING ADJUSTMENTS (2013); Chen, *supra* note 98, at 22–24 (prepublication offprint).

124. *See* Bluefield Waterworks & Improvement Co. v. Pub. Serv. Comm'n, 262 U.S. 679, 693 (1923) ("The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.").

125. Robert A. Webb, *Utility Rate Base Valuation in an Inflationary Economy*, 28 BAYLOR L. REV. 823, 847 (1976).

126. Williston Basin Interstate Pipeline Co. v. FERC, 165 F.3d 54, 63 (D.C. Cir. 1999).

127. *Id.* at 63–64.

however, confirms that decision's support for the use of a broad measure of economic growth in price-level regulation.[128]

In *Williston*, the D.C. Circuit reviewed a challenge to FERC's denial of a pipeline's request for a rate increase under conventional cost-of-service ratemaking.[129] A central point of dispute on review was FERC's consideration of long-term growth in pipeline earnings as a component of the return on common equity that Williston's shareholders were entitled to earn.[130] FERC rejected an "industry-specific approach to long-term growth estimates and adopted, as an alternative, 'the long-term growth rate of the economy as a whole, as measured by the gross domestic product.'"[131] In support of its embrace of GDP to support its evaluation of its discounted cash flow (DCF) forecast of pipeline revenues, the commissione reasoned:

> [A]s companies reach maturity, their growth rates approach that of the economy as a whole; [and] it is reasonable to predict that, in the long run, a regulated firm will grow at the rate of an average firm in the economy, because regulation will moderate profitability in good and bad economic periods.[132]

The D.C. Circuit upheld FERC's treatment of GDP data, at least to the extent that "the Commission expanded the scope of its long-term growth factor from the natural gas industry to the economy as a whole, as reflected in the GDP."[133] The court characterized FERC's "decision to adopt an economy-wide approach" as "a well-reasoned and supported outgrowth" of its "consideration [of] . . . the appropriate long-term growth factor to be used in the DCF analysis."[134] Expressing "little doubt that GDP is among the most commonly used and widely available measures of economy-wide growth," the court upheld "FERC's decision to expand the scope of its long-term analysis" to include GDP data.[135]

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128. *Id.* at 64.

129. *Id.* at 56.

130. *See id.* at 59–60; *cf. id.* at 57 (citing *NEPCO Mun. Rate Comm'n v. FERC*, 668 F.2d 1327, 1335 (D.C. Cir. 1981), *cert. denied*, 457 U.S. 1117 (1982), for the proposition that "[t]he cost of common equity is frequently . . . a point of contention in rate making"); United States v. FCC, 707 F.2d 610, 613 (D.C. Cir. 1983) (observing that a regulated utility's cost of equity almost invariably exceeds its cost of debt).

131. *Williston Basin*, 165 F.3d at 59 (quoting Williston Basin Interstate Pipeline Co. 79 FERC ¶ 61,311, at 62,387 (1997)).

132. *Id.* at 59–60.

133. *Id.* at 63.

134. *Id.* at 64.

135. *Id*.

The court did remand for further consideration, however, in light of FERC's failure to explain why it chose to introduce potentially contradictory "estimates of GDP created by different entities and based on different economic assumptions," all in response to a seemingly unrelated "specific concern over the suitability of industry-specific . . . data for use in the DCF model."[136]

The nugget of doubt in *Williston* therefore concerned the specific relationship between GDP and industry-specific data bearing on long-term forecasts of growth in natural gas pipelines (particularly with respect to disparities in pipeline revenues from selling gas as a commodity and from transporting gas).[137] Indeed, the ultimate goal in *Williston*, which after all concerned conventional ratemaking for the transportation of natural gas under section 4 of the Natural Gas Act,[138] was to determine a just and reasonable rate for a single pipeline.[139] That exercise typically accounts for inflation through conventional ratemaking's computation of the rate base.[140] By contrast, the entire point of choosing GDP as the measure of inflation in price-level regulation is to set an economy-wide baseline against which to evaluate growth of productivity within a specific regulated industry.[141] That is the work of the *x*-factor. This Article now turns to that subject.

V. DETERMINING THE *X*-FACTOR

A. The x-Factor as the Driver of Incentive-Based Regulation

The downward adjustment of a price cap via an *x*-factor is designed to achieve the primary goal of price-level regulation: "provid[ing] better incentives than rate-of-return regulation" by giving regulated firms "opportunity to earn greater profits if they succeed in reducing costs and becoming more efficient."[142] "The X-factor is aimed at capturing a portion of expected increases in . . . productivity, so that these

136. *Id*.

137. *See id.* at 59.

138. *See* 15 U.S.C. § 717c (2012); *Williston Basin*, 165 F.3d at 56.

139. *Williston Basin*, 165 F.3d at 56.

140. *See* Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1523–25 (D.C. Cir. 1984); *cf. id.* at 1516–17 & n.64 (identifying the inflation-laden trap of the "front-end load," whereby an untrended cost rate base, which does not increase with inflation, systematically declines over time as it depreciates, and prescribing a solution of "using a *trended*, inflation-sensitive original cost rate base").

141. *Williston Basin*, 165 F.3d at 63–64.

142. Bell Atl. Tel. Cos. v. FCC, 79 F.3d 1195, 1198 (D.C. Cir. 1999); *see also* Webb, *supra* note 125, at 847.

improvements, as under competition, will result in lower prices for consumers."[143] If properly computed, the *x*-factor "ensure[s] that price changes reflect changing costs the same way as in competitive markets," by aligning "[c]hanges in industry prices" with "changes in industry costs."[144]

The *x*-factor is what distinguishes the prices of inputs and changes in productivity within a regulated industry from parallel trends in the broader economy.[145] Because "changes in an individual firm's prices relative to its costs differ from an industry average" only to the extent that the firm's "productivity growth differs from the average productivity growth of its industry," the resulting "variation in profits" provides "the carrot or stick" by which price-level regulation, through imitation of "the competitive process[,] rewards efficiency gains."[146]

As a matter of administrative law, the *x*-factor must bear *some* relationship to a measure of productivity, lest the ratemaking agency "set the X-factor arbitrarily and capriciously."[147] To establish a rational basis for constraining the regulated firm to raise prices, regulators typically begin by deriving a "minimum productivity offset" from historical trends of long-term productivity growth in the regulated industry.[148] More precisely, this productivity offset "should be calculated as the sum of the difference in productivity growth and the difference in input price growth between the [regulated sector] and the economy as a whole."[149] This calculation assumes "that historic productivity increases will be matched in the future."[150]

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143. *USTA*, 188 F.3d 521, 524 (D.C. Cir. 1999); *see also* Tex. Office of Pub. Util. Counsel v. FCC, 265 F.3d 313, 319 (5th Cir. 2001); *In re* Policy & Rules Concerning Rates for Dominant Carriers, 3 FCC Rcd. 3195, 3394 (1988).

144. Makholm, *supra* note 67, at 96.

145. *See* JOHN VICKERS & GEORGE K. YARROW, PRIVATIZATION: AN ECONOMIC ANALYSIS 296 (1989); Robert Loube, *Price Cap Regulation: Problems and Solutions*, 71 LAND ECON. 286, 289–90 (1995); Ingo Vogelsang, *Optimal Price Regulation for Natural and Legal Monopolies*, 8 ECONOMÍA MEXICANA, NUEVA ÉPOCA 5, 10 (1999).

146. Makholm, *supra* note 67, at 96; *see also id.* at 97 (describing the *x*-factor as part of "a regulatory regime designed to limit monopoly utility prices . . . in a way that mimics the constraints that a competitive firm would face"); Jeffrey I. Bernstein & David E.M. Sappington, *How to Determine the* X *in* RPI-X *Regulation: A User's Guide*, 24 TELECOMMS. POL'Y 63, 64 (2001).

147. *Tex. Office of Pub. Util. Counsel*, 265 F.3d at 329.

148. *See* Bell Atl. Tel. Cos. v. FCC, 79 F.3d 1195, 1198 (D.C. Cir. 1996).

149. *USTA*, 188 F.3d 521, 524 (D.C. Cir. 1999) (citing *In re* Price Cap Performance Review for Local Exch. Carriers, 12 FCC Rcd. 16,642, 16,680 (1997)).

150. *Id.*

The *x*-factor is consciously designed to raise regulated firms' incentive to reduce cost and to pursue revenue-enhancing technological improvements.[151] The size of the *x*-factor, given its designation as the minimum productivity offset, hinges on the extent to which regulators believe that price-level regulation can spur efficiency gains through technological and managerial change. A higher minimum productivity offset represents a stronger commitment to technology forcing. Whatever its intended purpose, the *x*-factor carries great practical significance. In one 1999 case involving an FCC price cap, each 0.1% change in the *x*-factor "represent[ed] a $23 million change in the industry-wide access charge" collectible by local exchange carriers.[152]

Proper evaluation of the *x*-factor demands that this critical component of price-level regulation be distinguished from legal considerations that are *not* intended to affect the incentives of regulated firms. Special care must be taken to distinguish true *x*-factors—namely, those designed to track productivity gains within a regulated industry—from other regulatory concepts.

In at least one instance, the FCC has used the term "X-factor" to describe a price cap adjustment mechanism that bore no relationship to industry-wide productivity.[153] The FCC's "CALLS Order" adopted a separate pricing basket for special access services and purported to apply a distinct *x*-factor to the special access basket.[154] "Special access services encompass all services that do not use local switches," including "services that employ dedicated facilities that run directly between the end user and an interexchange carrier's (IXC) point of presence, where an IXC connects its network with the local exchange carrier's (LEC) network, or between two discrete end user locations."[155] More succinctly, "special access is a dedicated transmission link between two locations, most often provisioned via high-capacity circuits."[156]

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151. *See* Makholm, *supra* note 67, at 96 (describing how competition and its emulation through price-level regulation "punishes firms that are slow to innovate, to reduce costs, or to respond to consumer demands").

152. *USTA,* 188 F.3d at 524.

153. *See* Federal-State Joint Bd. on Universal Serv., 15 FCC Rcd. 12,962, 12,974–75 (2000), *aff'd in part and rev'd in part sub nom.* Tex. Office of Pub. Util. Counsel v. FCC, 265 F.3d 313 (5th Cir. 2001), *cert. denied*, 535 U.S. 986 (2002).

154. *See id.* 12,974–75, 13,033–34.

155. *Special Access II*, 27 FCC Rcd. 16,318, 16,319 n.1 (2012).

156. AT&T Inc. & BellSouth Corp., 22 F.C.C.R. 5662, 5677 (2007).

> Special access services—services that provide dedicated, high-quality data connections—are a vital input to our broadband economy. Mobile providers use these connections to link cell towers to wireline backbone networks. Banks, credit

Unlike the *x*-factor adopted by the FCC in other contexts, the purported *x*-factor adopted by the CALLS Order was "not a productivity factor."[157] "Rather, it represented 'a transitional mechanism . . . to lower rates for a specified period of time for special access."[158] Of course, even if a price cap adjustment is decoupled from any specific measure of productivity, the agency must still "provide a rational explanation of how it derived the precise percentage," lest the agency be given "free reign [*sic*] to set" this adjustment "arbitrarily and capriciously."[159]

The computation of the *x*-factor must likewise be distinguished from adjustments that are more appropriately characterized as *z*-factor considerations. To complement downward adjustment of rates by the *x*-factor, regulators sometimes compute a "consumer productivity dividend" reflecting the "greater productivity gains" realized solely by virtue of the transition from rate-of-return regulation to the incentive-laden system of price-level regulation.[160] Unlike the minimum productivity offset, which reflects legal confidence that price-level regulation will spur positive behavioral changes by the regulated *firm*,[161] the consumer productivity dividend embodies the expectation that moving from profit-level to price-level regulation will deliver consumer benefits based solely on improvement in the regulatory process itself.[162] The consumer productivity dividend thus represents gains expected from behavioral changes by *regulators*.[163]

> card, technology and insurance companies . . . use special access links to communicate among their branch offices. . . . [T]hese services remain a $12–18 billion market annually.

Special Access I, 27 FCC Rcd. 10,557, 10,641 (2012) (statement of Chairman Genachowski).

157. *Special Access I*, 27 FCC Rcd. at 10,564.

158. *Id.*; *accord Special Access II*, 27 FCC Rcd. at 16,321.

159. Tex. Office of Pub. Util. Counsel v. FCC, 265 F.3d 313, 329 (5th Cir. 2001), *cert. denied*, 535 U.S. 986 (2002). "Free reign" is a common but embarrassing solecism for "free rein." *See* THE AMERICAN HERITAGE GUIDE TO CONTEMPORARY USAGE AND STYLE 193 (2005) ("Since giving free rein . . . is . . . granting control and power to another, it is not surprising that [this] expression[] ha[s] been reanalyzed as free reign . . . , when the metaphor evokes the power that a monarch has . . . . But the expression[] remain[s] properly free rein . . . ."); *Free Rein*, OXFORD ENGLISH DICTIONARY, http://www.oed.com/view/Entry/270005?redirectedFrom=free+rein#eid [https://perma.cc/8EZS-8VC4] (defining "free rein" as "a rein held loosely to allow a horse free motion; the freedom that this gives a horse"); Catherine Soanes, *Rein or Reign?*, OXFORDWORDS BLOG (Mar. 26, 2012), http://blog.oxforddictionaries.com/2012/03/rein-or-reign [https://perma.cc/WXE2-P5RE] (tracing confusion over these words to the decline of the horse in everyday life).

160. Bell Atl. Tel. Cos. v. FCC, 79 F.3d 1195, 1198 (D.C. Cir. 1996).

161. *Id.*

162. *Id.* at 1204.

163. *Id.* at 1201.

Any regulatory treatment of consumer productivity should be regarded as an element of the *z*-factor and therefore distinguished from evaluation of the *x*-factor. As time goes by and economic damage from rate-of-return regulation recedes ever further in legal and managerial memory, the idea that price-level regulation per se improves consumer welfare becomes less tenable. Regulators who continue to include a consumer productivity dividend must explain its retention.[164]

B. Three Pipelines and a Phone Call

The foregoing theoretical analysis must survive the vexatious task of implementing price-level regulation in practice. To evaluate how federal agencies and their reviewing courts have discharged this task, including the pivotal computation of a productivity-based *x*-factor, I will examine the final decade of FERC's longstanding struggle to establish price ceilings for oil pipelines. The D.C. Circuit's *Oil Pipe Lines* trilogy,[165] especially seen in light of an intervening decision by that court on a seemingly unrelated price cap set by the FCC, offers tantalizing hints on the possible streamlining of price-level regulation. The *Oil Pipe Lines* trilogy and *United States Telephone Ass'n* provide legal support for reducing price-level regulation from a two-step process (involving the selection of an inflation index and the setting of an *x*-factor) into a single step stressing solely the average level of input costs borne by a regulated industry.

1. *Oil Pipe Lines I*

In passing the Hepburn Act of 1906, Congress subjected oil pipelines to rate regulation.[166] In four orders adopted during the early 1940s,[167] the Interstate Commerce Commission (ICC) adopted the "fair value" standard of *Smyth v. Ames*,[168] albeit "without discussion, or even explicit recognition, of alternative bases" for regulation.[169] Despite the Supreme

164. *See USTA*, 188 F.3d 521, 527 (D.C. Cir. 1999).

165. Flying J Inc. v. FERC, 363 F.3d 495 (D.C. Cir. 2004); *Oil Pipe Lines II*, 281 F.3d 239 (D.C. Cir. 2002); *USTA*, 188 F.3d 521 (D.C. Cir. 1999); Ass'n of Oil Pipe Lines v. FERC (*Oil Pipe Lines I*), 83 F.3d 1424 (D.C. Cir. 1996).

166. Pub. L. No. 59-337, 34 Stat. 584.

167. Reduced Pipe Line Rates & Gathering Charges, 272 I.C.C. 375 (1948); Minnelusa Oil Corp., 258 I.C.C. 41 (1944); Petroleum Rail Shippers' Ass'n v. Alton & So. R.R., 243 I.C.C. 589 (1941); Reduced Pipe Line Rates & Gathering Charges, 243 I.C.C. 115 (1940).

168. 169 U.S. 466 (1898); *see id.* at 546–47 (requiring the rate base to reflect the "fair value" of utility property dedicated to public service).

169. Farmers Union Cent. Exch. v. FERC, 584 F.2d 408, 413 (D.C. Cir. 1978), *cert. denied*, 439 U.S. 995 (1978).

Court's 1944 overruling of *Smyth* in *Hope Natural Gas*,[170] the ICC never updated its ratemaking methodology for oil pipelines.[171]

Upon the transfer of ratemaking authority from the ICC to FERC in 1977[172] and a petition for review of a contested ICC rate order,[173] the D.C. Circuit found "little to rely on in constructing a theory of oil pipeline ratemaking."[174] Taking special pains to identify "important economic transformations" as well as "the significant changes in the relevant legal environment since the ICC's 1940's decisions,"[175] especially the rise of an "inflationary economy wherein [regulatory] valuation typically exceeds investment by a substantial amount,"[176] the D.C. Circuit remanded the case to FERC so that the newly empowered agency could determine its own ratemaking methodology free of the ICC's discredited precedent.[177]

On remand, however, FERC set price ceilings so high that, even by the agency's admission, they would "seldom [be] reached in actual practice" and would allow oil pipelines to achieve "creamy returns."[178] Holding that FERC's proposed methodology would flunk even the most generously framed interpretation of the responsibility to set "just and reasonable" rates,[179] the D.C. Circuit vacated FERC's rate order by stating: "FERC set rate ceilings which, if reached in practice, would admittedly be egregiously extortionate and then failed to demonstrate that market forces could be relied upon to keep prices at reasonable levels throughout the oil pipeline industry."[180] The *Oil Pipe Lines* trilogy took place against this backdrop.

The Energy Policy Act of 1992[181] directed FERC to adopt streamlined procedures for setting oil pipeline rates.[182] To comply with this mandate, FERC adopted rates approved in the 1992 Act as a baseline for price-level regulation and set caps for future rate increases according to an

170. *See* Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591, 601 (1944).

171. *Farmers Union*, 584 F.2d at 414.

172. *See* Department of Energy Organization Act, Pub. L. No. 95-91, § 402(b), 91 Stat. 565, 584 (1977), *recodified as amended at* 49 U.S.C. § 60502 (2012).

173. *See* Williams Bros. Pipe Line Co., 355 I.C.C. 479 (1976).

174. *Farmers Union*, 584 F.2d at 413.

175. *Id.* at 414.

176. *Id.* at 415.

177. *See id.* at 422.

178. Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1509 (D.C. Cir. 1984).

179. *Id.* at 1510.

180. *Id.*

181. Pub. L. No. 102-486, 106 Stat. 2776.

182. *See id.* §§ 1801–04, 106 Stat. at 3010–12, *codified at* 42 U.S.C. § 7172 note (2012) (Oil Pipeline Regulatory Reform).

inflation index.[183] This set the stage in 1996 for the first of two D.C. Circuit cases styled *Ass'n of Oil Pipe Lines v. FERC* (*Oil Pipe Lines I*).[184] The court of appeals characterized FERC's "indexed ratemaking methodology" as one that would "enable pipelines to recover costs by . . . rais[ing] rates at the same pace as they are predicted to experience cost increases."[185]

"Of central importance to the Commission's scheme [was] its choice of index."[186] *Oil Pipe Lines I* asked whether FERC's oil pipeline rates should have hinged on a narrow producer price index or, alternatively, on a broader measure of prices throughout the economy of the United States.[187] The pipeline industry proposed the implicit price deflator derived from the gross domestic product, which the D.C. Circuit (correctly) described as "a macroeconomic indicator of overall inflation in the economy."[188]

FERC countered with what it called "PPI – 1%," the producer price index minus one percent.[189] FERC derived this index from "a macroeconomic measure of inflation" by using "a fixed-weight index of commodity prices taken at the producer level" to track "price changes for commodities that will not undergo further processing."[190] Although FERC staff originally characterized the adoption of "an index one percent lower than the PPI as 'an offset for productivity,'" the D.C. Circuit ultimately upheld the lowered index as "the most likely formula to keep rates at their real value."[191] "[E]mpirical evidence in the record," said the reviewing court, "demonstrates that the application of the PPI – 1% to the total pipeline rate . . . was a better historical measure of pipelines' cost experience" than other alternatives before FERC.[192] The ratemaking dispute in *Oil Pipe Lines I* thus centered on the choice between a narrower producer price index and the broader implicit price deflator.[193]

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183. *See* Order No. 561, Revisions to Oil Pipeline Regulations Pursuant to the Energy Policy Act of 1992, 58 Fed. Reg. 58,753 (Nov. 4, 1993), *on reh'g sub nom.* Order No. 561-A, 59 Fed. Reg. 40,243 (Aug. 8, 1994).

184. 83 F.3d 1424 (D.C. Cir. 1996).

185. *Id.* at 1430.

186. *Id.*

187. *See id.* at 1430 n.9; 1430 n.10.

188. *Id.* at 1430 & n.10.

189. *Id.* at 1430.

190. *Id.* at 1430 & n.9.

191. *Id.* at 1435.

192. *Id.* at 1436.

193. *See id.* at 1430 nn.9–10.

The commission rejected the implicit price deflator principally because of its breadth.[194] The "GDP-IPD index," it alleged, "directly reflects rapid inflation in consumer services, such as health care," which oil pipelines buy "only indirectly, if at all."[195] Moreover, because the implicit price deflator "reflects changes in the composition of the GDP at large," FERC complained that this index "is upwardly biased due to the growing size of inflationary sectors of the economy," especially health care.[196] The D.C. Circuit agreed.[197] According to the court, the IPD's fatal flaw lay in the "fact that the [index] reflects changes in the relative weights of different sectors of the economy," which renders that index "less accurate for cost changes within a single industry."[198]

The court also took pains to distinguish FERC's embrace of a PPI-based index from the commission's earlier deployment of a broader implicit price deflator in *Buckeye Pipe Line Co.*[199] *Buckeye* had approved an experimental program under which a pipeline would be relieved of regulatory supervision of rates in markets where it lacked market power, as long as prices charged did "not exceed[] the change in the GNP deflator" since the rate was last increased, "plus two percent."[200] In other words, *Buckeye* upheld the use of a GNP deflator + 2% price cap. If we treat the GNP deflator as a measure of inflation, as the BEA did before 1991, *Buckeye* may be read as adopting an *x*-factor of minus 2%. Confining *Buckeye* to the circumstances of "a pipeline without market power," the D.C. Circuit declined to allow that decision to impugn FERC's "different purpose[s]" in adopting "the indexing rate cap" at issue in *Oil Pipe Lines I*.[201]

There is reason to believe that *Oil Pipe Lines I* misconstrued the meaning of *Buckeye*. By endorsing a pricing experiment in *Buckeye*, FERC moved toward deregulation before the passage of the Energy Policy Act of 1992.[202] In the oil pipeline and wholesale electricity markets, FERC had begun to relax conventional rate-of-return regulation

194. *See id.* at 1434.

195. *Id.*

196. *Id.*

197. *Id.* at 1435.

198. *Id.*

199. 53 FERC ¶ 61,473 (1990), *on reh'g*, 55 FERC ¶ 61,084 (1991).

200. 55 FERC ¶ 61,084. *Buckeye* and *Oil Pipe Lines I* took place on either side of the United States' decision to switch from Gross National Product to Gross Domestic Product as its primary measure of national production. *See generally supra* Part IV and text accompanying notes 114–18.

201. *Oil Pipe Lines I*, 83 F.3d at 1436.

202. 53 FERC ¶ 61,473 (1990), *on reh'g*, 55 FERC ¶ 61,084, 61,255 (1991).

whenever a regulated firm could demonstrate the absence of market power.[203] By 1990, in the bulk electricity market, FERC had already taken the more aggressive step of permitting purely market-based prices.[204] After the passage of the 1992 Act, FERC gradually adopted market-based sales as a general policy in its regulation of wholesale electricity markets.[205] The presence of a price cap of any sort in *Buckeye* suggests that FERC's reform of oil pipeline regulation was conservative relative to the agency's revision of its approach to the electricity market.

Strictly as a matter of ratepayer protection, it is easy to understand why the D.C. Circuit endorsed PPI – 1%.[206] FERC chose an index that would keep a tighter rein on oil pipeline rates.[207] The Producer Price Index appears to rise more slowly than either the IPD or the Consumer Price Index for All Urban Consumers (CPI-U), two broader indexes that are alleged to be "upwardly biased due to the growing size of inflationary sectors of the economy."[208] A quick look at price index reports compiled by the Department of Commerce's Bureau of Economic Analysis and the Department of Labor's BLS provides some hints supporting *Oil Pipe Lines I*'s decision to affirm FERC's PPI – 1% methodology.

Average annual change in any index may be computed according to the following formula:

$$\bar{x} = \sqrt[t-b]{\frac{x_t}{x_b}} - 1 = \left(\frac{x_t}{x_b}\right)^{\frac{1}{t=b}} - 1$$

where x represents the index value and subscripts t and b indicate, respectively, the target and base years.[209] From 1984 to 1996, the dozen years between *Farmers Union II* and *Oil Pipe Lines I* in which the D.C. Circuit gave FERC a second chance to devise a ratemaking methodology for oil pipelines, general inflation outpaced the Producer Price Index-Finished Goods (the baseline in FERC's PPI – 1% price cap) by almost exactly 0.75% per year, 2.738% to 1.986%[210]:

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203. *Oil Pipe Lines I*, 83 F.3d at 1431.

204. *See* Pub. Serv. Co. of Ind., Inc., 51 FERC ¶ 61,367 (1990).

205. *See* La. Energy & Power Auth. v. FERC, 141 F.3d 364 (D.C. Cir. 1998).

206. *See Oil Pipe Lines I*, 83 F.3d 1424.

207. *Id.* at 1434.

208. *Id.*

209. *See* Chen, *supra* note 98, at 10.

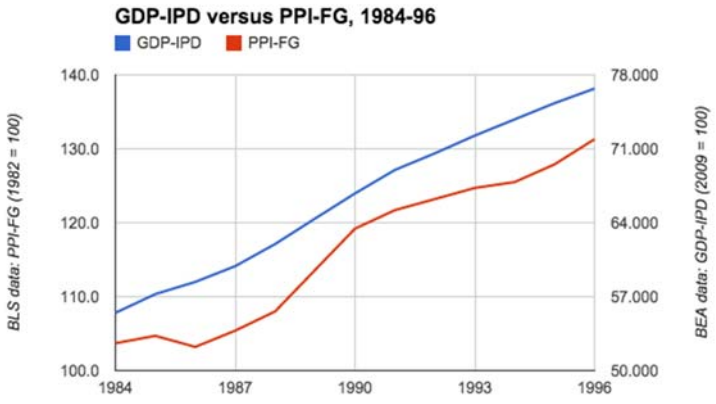
210. All data analyzed in this paragraph and Table 1 are readily available online from government sources. The Bureau of Economic Analysis, http://www.bea.gov, reports the implicit price deflator of the gross domestic product as part of its tables on National Income

Table 1: Comparing the Implicit Price Deflator with the Producer Price Index, 1984–1996

Year	GDP-IPD	PPI-FG
1984	55.466	103.7
1985	57.240	104.7
1986	58.395	103.2
1987	59.885	105.4
1988	61.982	108.0
1989	64.392	113.6
1990	66.773	119.2
1991	68.996	121.7
1992	70.569	123.2
1993	72.248	124.7
1994	73.785	125.5
1995	75.324	127.9
1996	76.699	131.3
Average Growth	**2.738%**	**1.986%**

A graphical presentation of this information shows how the slope of the blue line, representing the implicit price deflator from 1984 to 1996, rose more steeply than the red line, which represents the PPI-Finished Goods index over the same period:

Graph 1: GPD-IPD Versus PPI-Finished Goods, 1984–1996



GDP-IPD versus PPI-Finished Goods, 1984 to 1996

and Product Accounts. The Bureau of Labor Statistics, http://www.bls.gov, reports the Consumer Price Index and Producer Price Index.

But the law does not allow regulators to shove rates downward simply because they can. "[T]he principle that 'lower is better,'" when presented as "an argument that seems to have no end and little connection to any stated purpose," provides no basis for affirming a ratemaking decision.[211] If regulators can be required (as they are) to justify any particular *x*-factor as an "appropriate rate reduction measure,"[212] then reviewing courts can and should demand no less rationality in the choice of an inflation index.

2. Zwischenzug: United States Telephone Association

Three years after *Oil Pipe Lines I*, the D.C. Circuit more directly confronted issues of indexing and *x*-factor computation, albeit in the context of telephone rate regulation.[213] In *United States Telephone Ass'n v. FCC* (*USTA*),[214] the D.C. Circuit reviewed a price cap that the FCC had imposed on local exchange companies (LECs).[215] The FCC computed the *x*-factor "as the sum of the difference in productivity growth and the difference in input price growth between the LECs and the economy as a whole."[216] The FCC expected the *x*-factor to "provide a reliable measure of the extent to which changes in the LECs' unit costs have been less than the change in level of inflation."[217]

The D.C. Circuit translated the FCC's approach into mathematical terms: "X = U – L, where U is the 'change in level of inflation,' and L is the change in the LECs' unit costs."[218] Unit costs, whether realized within a regulated firm or in the economy at large, change according to two factors: changes in productivity and changes in input prices.[219] Therefore, L is readily conceptualized through the equation, "L = Δ% LEC input price – Δ% LEC productivity."[220] Treating "'change[s] in unit costs in the economy as a whole'" as changes attributable to inflation yields a similar expression for U: "U = Δ% U.S. input price - Δ% U.S. productivity."[221] "Substituting these values into the equation X = U – L, using 'TFP' for

211. *Oil Pipe Lines II*, 281 F.3d 239, 244 (D.C. Cir. 2002).

212. Tex. Office of Pub. Util. Counsel v. FCC, 265 F.3d 313, 329 (5th Cir. 2001), *cert. denied*, 535 U.S. 986 (2002).

213. 188 F.3d 521 (D.C. Cir. 1999).

214. *Id.*

215. *Id.*

216. *Id.* at 524.

217. *Id.* at 524 n.1.

218. *Id.* at 524–25 n.1. (citation omitted).

219. *See id.* at 525 n.1.

220. *Id.*

221. *Id*.

productivity, and performing a little algebraic manipulation"[222] of these definitions of U and L yields two alternative ways of stating the X-factor:

$$X = (\Delta\%\ \text{LEC productivity} - \Delta\%\ \text{U.S. productivity}) + (\Delta\%\ \text{U.S. input prices} - \Delta\%\ \text{LEC input prices})$$

$$X = (\Delta\%\ \text{LEC productivity} - \Delta\%\ \text{LEC input prices}) - (\Delta\%\ \text{U.S. productivity} - \Delta\%\ \text{U.S. input prices})$$[223]

Each of these equations calculates the *x*-factor according to some relationship between industry-specific and economy-wide factors. The first equation defines *x* as the *sum* of (1) the difference between industry-specific and economy-wide *productivity* and (2) the difference between economy-wide and industry-specific *input prices*.[224] The second formula, which the D.C. Circuit thought "more readily conceptualized,"[225] defines *x* as the extent by which industry-specific growth in productivity, relative to growth in input prices, exceeds the extent to which economy-wide growth outpaces economy-wide growth in input prices.[226]

But the court's most provocative suggestion, by far, arose in its consideration of the *x*-factor in light of the price cap's simultaneous consideration of inflation.[227] Insofar as the FCC "also increase[d] the cap" at issue in *USTA* "by general price inflation," the combination of an inflation-adjusted price cap and a productivity-sensitive *x*-factor effectively "increase[d] the cap by the LECs' estimated change in unit costs."[228] Once a downwardly oriented *x*-factor is combined with a generally upward adjustment for inflation, the approximate "net effect of these adjustments is . . . to increase the cap by the LECs' estimated cost in unit costs."[229] As the D.C. Circuit concluded in *USTA*, "[i]t is somewhat as if the overall adjustment ('A') were . . . $A = U - X = U - (U - L) = L$."[230] Substituting the previous definition for *L* and combining it with our original algebraic definition of price-level regulation[231] allows us

222. *Id*.
223. *See id.* at 524–25.
224. *Id.*
225. *Id.* at 525.
226. *Id*. at 524.
227. *Id.* at 525 n.1.
228. *Id.*
229. *Id.*
230. *Id.*
231. *See supra* text following note 67.

to state the overall task of price-level regulation in extremely simple terms:

$$P_1 = P_b \cdot (1 + \Delta\% \text{ utility input prices} - \Delta\% \text{ utility productivity})$$

Or more generally:

$$P_t = P_b \cdot (1 + \Delta\% \text{ utility input prices} - \Delta\% \text{ utility productivity})^t$$

And most simply of all:

$$P_t = P_b \cdot (1 + L)^t$$

To recast this final equation with a variable that does not reek of local exchange companies and telecommunications law, I have taken refuge in the Greek language. The obvious English letter, *i*, is fraught with mathematical and economic meanings (respectively, the imaginary square root of –1 and a variable that either counts items in a sequence or representings the rate of interest). The Greek words *ενέργεια* (literally, *energy*)[232] and *είσοδος* (*entrance*)[233] are often used to express the economic notion of *input*.[234] The letter epsilon, *ε*, has the unfortunate distinction of designating errors or residuals in many mathematical specifications and may not be ideally suited for indicating growth in a regulated industry's input costs. The most common Greek words designating *industry*, *βιομηχανία* and *κλάδου*,[235] seem more promising. Interestingly, both of these words are evocative of life. English is filled with loanwords incorporating the Greek root *bio-*, and the word *clade* designates a group of living organisms characterized by some set of traits presumably inherited from a common ancestor. Since beta, a measurement of covariance in mathematical finance,[236] will actually make an appearance in this Article, I will settle for kappa, the first letter of *κλάδου*.

Therefore, once again:

$$P_t = P_b \cdot (1 + \kappa)^t$$

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232. *Energy*, THE CLASSIC GREEK DICTIONARY: GREEK-ENGLISH AND ENGLISH-GREEK (George Ricker Berry ed., 16th prtg. 1962) [hereinafter THE CLASSIC GREEK DICTIONARY].

233. *Entrance*, THE CLASSIC GREEK DICTIONARY, *supra* note 232.

234. *See, e.g.*, *Translate Input to Greek*, BABYLON, http://translation.babylon.com/english/to-greek/input/ [https://perma.cc/ETL2-RBYU] (last visited June 18, 2016).

235. *βιομηχανία*, from the Greek *βιο* ("life") and *μηχανία* ("machine"), *Life* & *Machine*, THE CLASSIC GREEK DICTIONARY, *supra* note 232; *κλάδου* (lit. "branch"), *Branch*, THE CLASSIC GREEK DICTIONARY, *supra* note 232.

236. *See, e.g.*, *infra* Part VI.B.

where κ represents the rate of change in input prices paid by a regulated industry. Even more generally, so that we can relax the unrealistic assumption that the rate of change in input prices would remain constant over a stretch of time:

$$P_t = P_b \cdot \prod_{i=b}^{t} (1 + \kappa_i)$$

The power of this conclusion bears close notice. A price cap adjusted *exclusively* for changes in input prices paid by regulated firms would operate exactly as a price cap that reflects separate adjustments for general changes in prices throughout the economy and for productivity growth within the regulated industry itself. Calibrating price-level regulation solely according to changes in input costs borne by regulated firms could eliminate what has been to date the unwieldy task of computing an *x*-factor distinct from measures of price change, on either an economy-wide or industry-specific basis. In other words, FERC's adoption of PPI – 1% in *Oil Pipe Lines I* came dangerously close to regulatory brilliance, even though neither FERC nor its reviewing court defended the PPI – 1% index as a productivity offset,[237] much less by reference to the conventional formula for price-level regulation.

3. *Oil Pipe Lines II*

FERC freely admitted that the methodology approved in *Oil Pipe Lines I* was "not a choice for all time" and promised to "monitor the index's ability to track changes in pipeline costs and review the appropriateness of its choice of index . . . every five years."[238] After FERC's first five-year review in 2000, it elected to adhere to the PPI – 1% index.[239] The Association of Oil Pipe Lines filed a new challenge to FERC's price ceiling.[240]

The D.C. Circuit's decision in *Oil Pipe Lines II* affirmed one crucial aspect of FERC's 2000 order and remanded the rest of the order for clarification of its economic methodology.[241] In measuring "actual cost changes experienced by the oil pipeline industry," FERC used a poorly specified "floating-weight" methodology that combined the simple

237. *See Oil Pipe Lines I*, 83 F.3d 1424 (D.C. Cir. 1996).

238. *Id.* at 1430.

239. Order Concluding Initial Five-Year Review of the Oil Pipeline Pricing Index, 93 FERC ¶ 61,266 (2000).

240. *Oil Pipe Lines II*, 281 F.3d 239, 240 (D.C. Cir. 2002).

241. *See id.*

average of pipeline costs per barrel-mile, the volume-weighted average of those costs, and the median of the pipeline cost distribution.[242] Whatever market-based justification FERC might have had for eschewing the volume-weighted average of pipeline costs (the benchmark preferred by the industry) was undermined by the agency's failure to account for the presence of distinct high-cost crude oil pipelines and lower cost "product" pipelines carrying refined products.[243] FERC could not articulate rationales beyond unsupported desires to "create[] cost-controlling incentives" and to lower rates, even to the point of pushing pipelines to "imminent bankruptcy."[244]

Although the court hinted that FERC might have been able to justify its rejection of the pipelines' preferred methodology on the basis of the standard econometric critique that fixed-weight indexing ignores substitution effects and overstates inflation,[245] the court concluded that FERC had "not actually rest[ed] its decision" on such a rationale.[246] *Oil Pipe Lines II* remanded for a full explanation of FERC's cost measurements, as well as the agency's refusal to remove statistical outliers and its unexplained abandonment of the use of net plant to calculate return on investment and income taxes in the computation of pipelines' capital costs.[247]

Critically, however, *Oil Pipe Lines II* affirmed FERC's decision to retain its PPI – 1% indexing methodology.[248] The Association of Oil Pipe Lines proposed two adjustments that had the potential to "undermine the case for PPI – 1."[249] First, the pipelines argued that the PPI – 1% ceiling had been so successful in improving the entire industry's productivity that "any modeling of future costs" by FERC "should control for" the

242. *Id.* at 241–42.

243. *See id.* at 243.

244. *Id.* at 244.

245. *Id*. at 244–45.

246. *Id.* For standard explanations of the vulnerability of fixed-weight price indexes to consumer substitution of cheaper for more expensive goods and services, see Marilyn E. Manser & Richard J. McDonald, *An Analysis of Substitution Bias in Measuring Inflation, 1959–85*, 56 ECONOMETRICA 909 (1988); Jack E. Triplett, *Economic Theory and BEA's Alternative Quantity and Price Indexes*, 72 SURV. CURRENT BUS., April 1992, at 49, 49–50; Allan H. Young, *Alternative Measures of Change in Real Output and Prices*, 72 SURV. CURRENT BUS., April 1992, at 32, 35.

247. *See Oil Pipe Lines II*, 281 F.3d at 245–48; *cf.* Colo. Wild v. U.S. Forest Serv., 435 F.3d 1204, 1216 (10th Cir. 2006) (observing that a reviewing court "cannot substitute [its] views on statistics (including skewed data and outlier analysis) for those of" an expert agency "and insist that one measure or another be used").

248. *Oil Pipe Lines II*, 281 F.3d at 248.

249. *Id.* at 247.

"onetime cost savings" attributable to the introduction of price-level regulation.[250] Second, the pipelines proposed that FERC be required to account "for anticipated future cost increases due to increased environmental and safety regulations."[251]

The D.C. Circuit rebuffed both adjustments.[252] The court reasoned that these proposals "essentially require FERC to perform the same task—to predict how future cost changes may deviate from the historical trend."[253] The court applauded FERC's "refus[al] to engage in such speculation."[254] In the court's view, FERC had adopted "a purely historical analysis and . . . adhered to it" in order to avoid "embroil[ing] itself in the complexity and iffiness" of a "forward-looking methodology."[255]

In affirming FERC's adherence to PPI – 1%, *Oil Pipe Lines II* took special pains to distinguish the agency's purely historical methodology from the speculative "consumer productivity dividend" that the D.C. Circuit rejected in *United States Telephone Ass'n*.[256] *Oil Pipe Lines II* endorsed FERC's defense of PPI – 1% as coming the "closest of all the indices considered . . . to tracking the *historical changes* in the actual costs of the product pipeline industry."[257] The court contrasted this justification for PPI – 1% with the 0.5% consumer productivity dividend that *USTA* vacated.[258] "We found unexplained" the FCC's decision to continue "lopp[ing] 0.5% off the historic trend line in anticipation of special productivity gains expected to flow from the switch to rate caps," reasoned the court in *Oil Pipe Lines II*, "as the benefits of the one-time shift could hardly be expected to go on forever."[259]

A superficial reading of *Oil Pipe Lines II* suggests that the D.C. Circuit disavowed its own evaluation of the FCC's *x*-factor calculation in *USTA*. But in reality *Oil Pipe Lines II* did no such thing. The D.C. Circuit's second encounter with FERC's price cap for oil pipelines established two principles. First, *Oil Pipe Lines II* confirmed the characterization in *Oil Pipe Lines I* of PPI – 1% as a purely historical

250. *Id*.
251. *Id*.
252. *Id.*
253. *Id*.
254. *Id*.
255. *Id.*
256. *Id.*
257. *Id.* (internal quotation omitted).
258. *Id.* (citing *USTA*, 188 F.3d 521, 527 (D.C. Cir. 1999)).
259. *Id.* (citing *USTA*, 188 F.3d at 527).

methodology, with no pretense to adjusting rates for productivity gains within the pipeline industry.[260]

Second, and more important, *Oil Pipe Lines II* distinguished PPI – 1% from the ill-fated consumer productivity dividend that failed to survive review in *USTA*.[261] Even though the FCC described the 0.5% consumer productivity dividend as a component of its *x*-factor, that adjustment is more properly evaluated as a *z*-factor element of price-level regulation.[262] Any adjustment purporting to reflect gains from price-level regulation rather than economic changes endogenous to the regulated industry should be attributed to the regulators themselves, and not to the industry or any individual firm. That is the classic distinction between a *z*-factor and an *x*-factor.[263] As *USTA* recognized, purported gains from regulatory transitions are just that—transitory—and should not be incorporated, whatever its nomenclature, into the productivity-based, technology-forcing component of price-level regulation.

4. *Flying J* and Its Aftermath

On remand from *Oil Pipe Lines II*, FERC revisited the cost computation, outlier, and net plant accounting issues that the D.C. Circuit had questioned.[264] In *Flying J Inc. v. FERC*,[265] the third and final installment of the *Oil Pipe Lines* trilogy, FERC abandoned all of those contested elements of its 2000 rate order.[266] Indeed, to the chagrin of shippers who thought that a defense of those "innovations following remand" would have enabled FERC to retain "a price-cap index of PPI – 1,"[267] FERC "chose an index of plain PPI."[268]

Flying J hinted that FERC's indexing methodology might have been vulnerable to more sophisticated attacks. But the reviewing court did no more than taunt the shippers for failing to articulate or press more effective economic arguments.[269] It expressed bemusement that "no one in the current litigation seems to advocate use of an index differing from

260. *Id.*
261. *Id.*
262. *See supra* text accompanying notes 165–75.
263. *See supra* Part III.B.
264. Flying J Inc. v. FERC, 363 F.3d 495, 497–99 (D.C. Cir. 2004).
265. 363 F.3d 495.
266. *Id*. at 497.
267. *Id.* at 498.
268. *Id.* at 497.
269. *Id*. at 498.

PPI by fractions of a whole number."[270] Having invited either the agency or an interested party in *Oil Pipe Lines II* to argue "that a fixed-weight index is inferior to its floating-weight analog because the former fails to account for substitution from high-priced to low-price [*sic*] goods over time,"[271] the D.C. Circuit in *Flying J* declined to address the issue on the paper-thin rationale that the shippers had failed to raise the point on appeal, despite having "raised the point before FERC on remand."[272]

Finally, the court revealed its awareness of "an issue that is inherent in cost and price indices."[273] The shippers complained that FERC had chosen to base its index on oil pipeline volumes for 1994 rather than 1999.[274] "At the heart" of this dispute, observed the court, lay "the difference between the Laspeyres and Paasche methods" of indexing, "with the former weighting elements on the basis of their share of the total in the initial period, and the latter assigning weights based on end-period shares."[275] The court acknowledged that "the Laspeyres index tends to overstate . . . change" in quantities or prices "and acts as an upper bound on the actual rate of change."[276] A Laspeyres index's retention of "the original weights . . . tends to conceal the extent to which customers have . . . substitut[ed] away from goods with rising relative prices towards those with declining relative prices."[277] By contrast, the Paasche index "serves as a lower bound."[278] Observing that "the shippers' perfectly orthodox critique of an initial-period index" had been "matched by the equally orthodox critique of and end-period index," the court declined to declare "any of FERC's methodological choices" to be "erroneous and harmful."[279]

In a parting shot at what it must have perceived as the petitioning shippers' lack of economic thoroughness, the court did observe that "[n]o one appears to have advocated year-by-year weighting, which tends to

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270. *Id.*

271. *Id.*

272. *Id.*

273. *Id.* at 499.

274. *Id.*

275. *Id.* For a comparison of Laspeyres and Paasche indexes, see Young, *supra* note 246, at 33, 42–43.

276. *Flying J*, 363 F.3d at 500.

277. *Id.* (citing PETER RICHARD GRENVILLE LAYARD & ALAN A. WALTERS, MICROECONOMIC THEORY 157 (1978)); *cf.* Steven D. Braithwait, *The Substitution Bias of the Laspeyres Price Index: An Analysis Using Estimated Cost-of-Living Indexes*, 70 AM. ECON. REV. 64 (1980).

278. *Flying J*, 363 F.3d at 500.

279. *Id.*

split the difference" between the Laspeyres and Paasche indexes.[280] Although the court did not elaborate further, there is a deep economic literature on the development of chain-type, "ideal" indexes based on the geometric mean of the Laspeyres and Paasche indexes.[281]

FERC's price cap decisions since *Flying J*—indeed, since the beginning of the *Oil Pipe Lines* trilogy—have marked a steady retreat in the stringency of the agency's regulation of oil pipeline rates.[282] To this day, FERC pegs oil pipeline price caps to the Producer Price Index for Finished Goods.[283] After surrendering any claim that its original PPI – 1% standard in *Oil Pipe Lines I* included a productivity component,[284] FERC in *Oil Pipe Lines II* confirmed the purely historical ambitions of its PPI – 1% cap.[285] *Flying J* upheld FERC's retreat to PPI *simpliciter*.[286] In the five-year review cycle immediately following *Flying J*, FERC reset its oil pipeline pricing index at PPI + 1.3%.[287] FERC's current cap rests at PPI + 2.65%.[288] True to the notion that a price cap should apply across an entire industry, FERC has declined "to inquire into the particular circumstances of every pipeline and selectively remove pipelines that experienced cost changes due to one particular factor from the data set used to calculate the index."[289] At the same time, despite the

280. *Id.*

281. *See generally, e.g.*, IRVING FISHER, THE MAKING OF INDEX NUMBERS (1922); Douglas W. Caves, Laurits R. Christensen & W. Erwin Diewert, *The Economic Theory of Indexed Numbers and the Measurement of Input, Output, and Productivity*, 50 ECONOMETRICA 1393 (1982); W. Erwin Diewert, *Exact and Superlative Index Numbers*, 46 J. ECONOMETRICS 115 (1976). For an application of this debate to the determination of the *x*-factor in price-level regulation, see Makholm, *supra* note 67, at 99–101. For an application of "a geometric mean [to] exclude[] statistical outliers" in lieu of "an arithmetic mean (which does not exclude outliers)" in an administrative law setting, Colo. Wild v. U.S. Forest Serv., 435 F.3d 1204, 1215 (10th Cir. 2006), see generally *Am. Iron & Steel Inst. v. OSHA*, 939 F.2d 975, 990–91 (D.C. Cir. 1991).

282. *See* Five-Year Review of Oil Pipeline Pricing Index, 114 FERC ¶ 61,293 (2006).

283. *See* 18 C.F.R. § 342.3(d)(2) (2016).

284. *Oil Pipe Lines I*, 83 F.3d 1424, 1435 (D.C. Cir. 1996).

285. *Oil Pipe Lines II*, 281 F.3d 239, 247 (D.C. Cir. 2002).

286. Flying J Inc. v. FERC, 363 F.3d 495, 497, 500 (D.C. Cir. 2004).

287. *See Five-Year Review of Oil Pipeline Pricing Index*, 114 FERC ¶ 61,293.

288. *See* Five-Year Review of Oil Pipeline Pricing Index, 133 FERC ¶ 61,228 (2010) (*2010 Index Review Order*), *reh'g denied*, 135 FERC ¶ 61,172 (2011) (*2011 Rehearing Denial*); *see also* Notice of Annual Change in the Producer Price Index for Finished Goods, 147 FERC ¶ 61,125 (2014) (directing pipelines to multiply their indexed ceiling levels for July 1, 2013, through June 30, 2014, by 1.038858 to account for a rise in the PPI-FG index from 194.2 for 2012 to 196.6 for 2013, inasmuch as $196.6 \div 194.2 + 0.0265 \approx 1.038858$).

289. *See 2010 Index Review Order*, 133 FERC at ¶ 62,260.

concerns articulated in *Oil Pipe Lines II*,[290] FERC has never set separate caps for high-cost crude pipelines and low-cost product pipelines.[291]

C. Oil and Water May Not Mix, but Pipelines Prices and Access Charges Do

"And the end of all our exploring / Will be to arrive where we started / And know the place for the first time."[292] This cycle of D.C. Circuit cases—a trilogy on FERC's regulation of oil pipelines and an intervening decision on an FCC price cap on access charges—appears to have ended inauspiciously. After being goaded into treating its newfound responsibility under the Hepburn Act and Energy Policy Act with some measure of seriousness, FERC retreated, from the inception of the *Oil Pipe Lines* trilogy and to the present day, from a PPI – 1% ceiling with abortive pretensions to the imposition of a productivity-based *x*-factor to a PPI + 2.65% factor evocative of the "creamy returns" that the D.C. Circuit refused to countenance in 1984.[293] Along the way, *Oil Pipe Lines II* distanced FERC's oil pipeline regime from the one opinion, *United States Telephone Ass'n* (*USTA*), that offered real promise for reform and streamlining price-level regulation.

But we should not let the FCC's misleading characterization of the consumer productivity dividend at issue in *USTA* conceal that decision's enduring significance. *USTA* declined to endorse the FCC's indefinite inclusion of the consumer productivity dividend in the access charge price caps.[294] Although the FCC had described the consumer productivity dividend as a component of the *x*-factor,[295] closer examination confirms that this adjustment was more appropriately evaluated as a component of the parameter that the Commission's own rules classify as a *z*-factor. For of its tantalizing treatment of FERC's PPI-based price caps, the *Oil Pipe Line* cases never disavowed *USTA*'s suggestion that price-level regulation may be conducted on the basis of a single index: changes in the input prices paid by a regulated industry.[296] *That* suggestion, coupled with FERC's enduring reliance on a variant of the Producer Price Index,

290. *See Oil Pipe Lines II*, 281 F.3d at 244.

291. *See 2011 Rehearing Denial*, 147 FERC at ¶ 62,024; *2010 Index Review Order*, 133 FERC at ¶ 62,267.

292. T.S. ELIOT, FOUR QUARTETS 59 (Esme Valerie Eliot ed., 1971).

293. Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1509 (D.C. Cir. 1984).

294. *USTA*, 188 F.3d 521, 531 (D.C. Cir. 1999).

295. *Id.* at 524.

296. *See generally* Flying J Inc. v. FERC, 363 F.3d 495 (D.C. Cir. 2004); *Oil Pipe Lines II*, 281 F.3d 239 (D.C. Cir. 2002).

invites closer reevaluation of price-level regulation. This Article now turns to that final task.

VI. A STREAMLINED, SINGLE-INDEX APPROACH TO PRICE-LEVEL REGULATION

A. Three, Two, One

The full specification of price-level regulation adjusts a price cap according to a function of three parameters: the rate of economy-wide inflation (π), an x-factor reflecting industry-wide gains in total factor productivity, and a z-factor reflecting efficiency gains to the adoption of price-level regulation:

$$P_t = P_b \cdot (1 + \pi - x - z)^t$$

The withering away of z-factor adjustments after an initial transition reduces price-level regulation to a simpler two-parameter specification:

$$P_t = P_b \cdot (1 + \pi - x)^t$$

The *Oil Pipe Lines* trilogy demonstrated that the inflation index need not be one reflecting price change in the economy at large (the implicit price deflator of the GDP) or even price change in a market basket of consumer goods and services (CPI), but rather a producer-oriented index such as PPI.[297] *United States Telephone Ass'n* showed that the difference between a general measure of inflation and an adjustment for total factor productivity within an industry is equivalent to an index of input costs for that industry.[298] $\pi - x = \kappa$, as it were. This matched pair of insights reduces price-level regulation to a single-parameter exercise:

$$P_t = P_b \cdot (1 + \kappa)^t$$

where κ represents the rate of change in input prices borne by a regulated industry. Even more generally:

$$P_t = P_b \cdot \prod_{i=b}^{t} (1 + \kappa_i)$$

Decided at the end of the United States' first decade of experience with price-level regulation, *USTA* simplifies this legal chore in yet another way. *USTA* demonstrated that z-factor adjustments are

297. *See supra* Part V.B.4.

298. *USTA*, 188 F.3d at 524.

irrelevant to economic conditions outside a regulatory agency and are legally unsustainable beyond the initial transition from conventional cost-of-service ratemaking.[299] Elimination of *z*-factor adjustments reduces price-level regulation to a binary choice.[300] Regulators may continue to adhere to the prescription that American authorities have endorsed for the past quarter-century.[301] That approach requires the choice of an inflation index, followed by the careful determination of an *x*-factor.[302]

A formulaic alternative, which this Article has defended on the precedential strength of *USTA* and the *Oil Pipe Lines* trilogy, would collapse the choice of inflation index and the determination of the *x*-factor into a single step: the application of an index of input costs borne by the regulated industry as a whole.[303] Isolating a single, industry-specific cost index demystifies a transitional regulatory reform that sometimes appears to have fallen victim to the name of its most distinctive step. The *x*-factor remains mysterious in its origin and (judging by the protests lodged against regulatory agencies that have tried to fix its value)[304] arbitrary in its ultimate determination and application.

The traditional two-parameter specification does boast at least one countervailing virtue: Treating inflation and the *x*-factor as distinct adjustments reminds regulators that the economic fate of individual firms (including regulatory incentives to control costs and to innovate) lies two steps removed from a price cap. To achieve any gains under price-level regulation, a firm must beat the rest of its industry, which cohort's collective fate in turn depends on its relative position within the broader economy. In other words, a firm wins under a price cap to the extent that it beats its competitors *and* to the extent that its industry beats the rest of the economy.

Under the two-parameter, inflation-minus-*x* model of price-level regulation, the indisputable first step consists of choosing the broadest available inflation index.[305] The primary virtue of a broader index of price change lies in its immunity from manipulation. No monopolist, regardless of its size, can plausibly affect general price inflation throughout the United States economy. A price cap's ability to reduce or eliminate the

299. *USTA*, 188 F.3d 521.
300. *See supra* Part V.B.2–4.
301. *See, e.g.*, *Oil Pipe Lines I*, 83 F.3d 1424 (D.C. Cir. 1996).
302. *See* discussion *supra* Parts IV, V.
303. *See supra* Part V.B.2.
304. *See, e.g.*, *supra* Part V.B (discussing the *Oil Pipe Lines* trilogy).
305. Vogelsang, *supra* note 145, at 9–10.

tendency of a regulated firm to be "dissuaded from cost cutting efforts" under conventional cost-of-service ratemaking depends heavily on the extent to which the cap is "disconnected from *individual* firm costs."[306] The central goal of price-level regulation, after all, is to measure total factor productivity across an entire regulated industry, and emphatically not on a firm-specific basis.[307] Adjusting rates according to an index of costs throughout the industry helps ensure that "no one [firm's] cost experience has much impact on the caps to which it is subject."[308] "[W]hereas fixing rate maximums on the basis of individual [firms'] costs" can deter regulated firms "from adopting cost-reducing innovations," the "cost reduction" experience of any one firm under price-level regulation "is unlikely to much affect the industry-wide index."[309]

At the other extreme, it makes no sense whatsoever to set a price cap according to a measure chosen specifically for its ability to reflect individual firms' costs. At worst, calibrating price-level regulation according to the regulated firm's actual costs or to some exogenous measure purporting to measure those costs comes perilously close to "permit[ting] [a] regulated compan[y] to select the rate of return index" that offers it the most generous rates.[310]

Finally, using a broad measure of inflation discharges one of the core obligations of public utility law in any of its guises—the need to ensure a provider of infrastructure of an adequate return on investment.[311] The reasonable, investment-backed expectations of public utility shareholders are based strictly on the opportunity cost of their investment in the regulated firm.[312] Nothing in contemporary regulatory reform undermines the principle that a measure of general inflation is most appropriate for protecting the expectations of utility investors.[313] "Any investor paying attention" to the evolving law of regulated industries must "realize that he [cannot] rely indefinitely on traditional regulatory

306. *Oil Pipe Lines II*, 281 F.3d 239, 244 (D.C. Cir. 2002).

307. *See* Loube, *supra* note 145, at 289; Makholm, *supra* note 67, at 97.

308. *Oil Pipe Lines II*, 281 F.3d at 247.

309. Frontier Pipeline Co. v. FERC, 452 F.3d 774, 777 (D.C. Cir. 2006).

310. Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1525 (D.C. Cir. 1984).

311. *See* Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944); Bluefield Waterworks & Improvement Co. v. Pub. Serv. Comm'n, 262 U.S. 679, 692-93 (1923); Chicago v. Fed. Power Comm'n, 458 F.2d 731, 750–51 (D.C. Cir. 1971), *cert. denied*, 405 U.S. 1074 (1972).

312. *See generally* Jim Chen, *The Second Coming of* Smyth v. Ames, 77 TEX. L. REV. 1535, 1549–59 (1999) (debunking the notion that constitutional concepts such as the confiscatory ratemaking doctrine of *Smyth v. Ames*, 169 U.S. 466 (1898), should provide additional checks against innovative deregulatory techniques).

313. Webb, *supra* note 125, at 847.

methods," but must rather adjust to novel approaches.[314] Because the "Constitution does not bind rate-making bodies to the service of any single formula or combination of formulas,"[315] regulated firms "have no vested interest in any particular [ratemaking] calculation."[316] Constitution and statutory ratemaking principles require that the regulatory "determination of fair prices" be "based on reasonable financial requirements of the industry."[317] Price-level regulation delivers at least that much.

B. Beta, Data, PPI

The foregoing intuitions suggest that FERC has implemented an administratively convenient but economically imperfect price-cap methodology by pegging oil pipeline rates to the Producer Price Index. If the *Oil Pipe Lines* cases are interpreted as disputes over the inflationary component of a price cap, as opposed to the *x*-factor, then a casual critic may perceive grounds for complaint. Basing a price cap on producer prices instead of general price inflation undermines the primary purpose of price-level regulation, which is to disentangle ratemaking from any individual firm's costs. To the extent that regulators rely on a price index within the economic sway of a sufficiently large monopolist, a coordinated group of firms, or even firms acting consciously in parallel,[318] price-level regulation loses some of its power to enhance each regulated firm's incentive to cut costs and perhaps even to innovate.

Economic redemption of the *Oil Pipe Lines* trilogy and FERC's price caps, from the original PPI – 1% designation to their current PPI + 2.65% incarnation, lies in *USTA*'s insight that the residue of a general inflation index and an appropriate productivity offset for an industry is the rate of

314. Verizon Commc'ns Inc. v. FCC, 535 U.S. 467, 528 (2002) (describing regulatory discretion over rates as constrained solely by the "constitutional bar against confiscatory rates").

315. Fed. Power Comm'n v. Nat. Gas Pipeline Co., 315 U.S. 575, 586 (1942); *accord* Permian Basin Area Rate Cases, 390 U.S. 747, 776–77 (1968) ("[R]ate-making agencies are not bound to the service of any single regulatory formula; they are permitted . . . to make the pragmatic adjustments which may be called for by particular circumstances." (quotation omitted)).

316. Farmers Union Cent. Exch., Inc. v. FERC, 734 F.2d 1486, 1517 (D.C. Cir. 1984).

317. Wisconsin v. Fed. Power Comm'n, 373 U.S. 294, 298–99 (1963); *accord* Duquesne Light Co. v. Barasch, 488 U.S. 299, 315 (1989) (quoting *Wisconsin v. Fed. Power Comm'n*, 373 U.S. at 299).

318. *Cf., e.g.*, Bell Atl. Corp. v. Twombly, 550 U.S. 544, 549–50 (2007) (requiring more coordination than even "conscious parallelism" as the basis for a cause of action under § 1 of the Sherman Act, 15 U.S.C. § 1 (2006)).

change in that industry's input costs.[319] Neither FERC's pipeline pricing orders nor the D.C. Circuit's opinions on review, standing on their own, support the synthesis of inflation and *x*-factor calculation into a single step.[320] Under fire in *Oil Pipe Lines I*, FERC never again defended PPI-based indexing on *x*-factor grounds,[321] and the D.C. Circuit affirmatively upheld PPI – 1% as a strictly historical exercise.[322]

Indeed, the econometric record since 1984—whether measured according to prices paid throughout the broader economy or according to prices received by domestic producers of finished goods—demonstrates that PPI-Finished Goods has come closer than even CPI-U, the BLS' standard measure of inflation, to tracking the United States economy[323]:

319. *See USTA*, 188 F.3d 521 (D.C. Cir. 1999).

320. *See, e.g.*, Flying J Inc. v. FERC, 363 F.3d 495 (D.C. Cir. 2004); *Oil Pipe Lines II*, 281 F.3d 239 (D.C. Cir. 2002); *USTA*, 188 F.3d 521; *Oil Pipe Lines I*, 83 F.3d 1424 (D.C. Cir. 1996).

321. *See Oil Pipe Lines I*, 83 F.3d 1424.

322. *Id.* at 1445.

323. *See supra* note 210.

Table 2: The Implicit Price Deflator, CPI-U, and PPI-Finished Goods, 1984–2013

Year	GDP-IPD	CPI-U	PPI-FG
1984	55.466	103.9	103.7
1985	57.240	107.6	104.7
1986	58.395	109.6	103.2
1987	59.885	113.6	105.4
1988	61.982	118.3	108.0
1989	64.392	124.0	113.6
1990	66.773	130.7	119.2
1991	68.996	136.2	121.7
1992	70.569	140.3	123.2
1993	72.248	144.5	124.7
1994	73.785	148.2	125.5
1995	75.324	152.4	127.9
1996	76.699	156.9	131.3
1997	78.012	160.5	131.8
1998	78.859	163.0	130.7
1999	80.065	166.6	133.0
2000	81.887	172.2	138.0
2001	83.754	177.1	140.7
2002	85.039	179.9	138.9
2003	86.735	184.0	143.3
2004	89.120	188.9	148.5
2005	91.988	195.3	155.7
2006	94.814	201.6	160.4
2007	97.337	207.342	166.6
2008	99.246	215.303	177.1
2009	100.000	214.537	172.5
2010	101.221	218.056	179.8
2011	103.311	224.939	190.5
2012	105.166	229.594	194.2
2013	106.733	232.957	196.6
Average Growth	**2.283%**	**2.823%**	**2.230%**

Over this 29-year span, CPI-U grew at an annual rate of 2.823%, or 0.54% more than the 2.283% growth rate in the implicit price deflator of

the GDP.[324] That gap is a relatively modest reflection of much larger gaps between these inflation indexes, which I have estimated elsewhere as 0.659% from 1974 to 2014[325] and which the celebrated Boskin Report of 1996 pegged between 0.80 and 1.60%.[326] What is even more striking is the near equivalence of the IPD and PPI-FG.[327] Both indexes, finished this three-decade stretch in a dead heat, at 2.283 and 2.230%, respectively.[328] Although the IPD outpaced the PPI-FG by roughly 0.75% a year from 1984 to 1996, the PPI-FG all but closed that gap between 1997 and 2013.[329]

The relationship among these indexes can be expressed in more formal statistical terms. Pearson's *r* is the standard measure of correlation between two sets of data. When specified for an entire population rather than a sample, Pearson's correlation coefficient is designated as $\rho_{x,y}$:

$$\rho_{x,y} = \frac{\operatorname{cov}(x,y)}{\sigma_x \sigma_y}$$

Beta is a measure of covariance. For any two sets of data, represented by independent variable *x* and dependent variable *y*, beta for *y* is the ratio of the covariance between the two data sets to the variance of *x*[330]:

$$\beta_y = \frac{\operatorname{cov}(x,y)}{\operatorname{var}(x)} = \frac{\operatorname{cov}(x,y)}{\sigma_x^2}$$

The mathematical relationship between beta and Pearson's correlation coefficient can be reduced to the verbal description of beta as "correlated relative volatility":

$$\beta_y \propto \rho_{x,y}$$

$$\beta_y \cdot \frac{\sigma_x}{\sigma_y} = \frac{\operatorname{cov}(x,y)}{\sigma_x^2} \cdot \frac{\sigma_x}{\sigma_y} = \frac{\operatorname{cov}(x,y)}{\sigma_x \sigma_y} = \rho_{x,y}$$

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324. *See supra* Table 2.

325. *See* Chen, *supra* note 98, at 9, 12.

326. *See* MICHAEL J. BOSKIN ET AL., COMM. ON FIN. U.S. SENATE, 104TH CONG., FINAL REPORT OF THE ADVISORY COMMISSION TO STUDY THE CONSUMER PRICE INDEX (Comm. Print 1996), *reprinted in* GETTING PRICES RIGHT: THE DEBATE OVER THE CONSUMER PRICE INDEX 5, 20–64 (Dean Baker ed., 1998). The advisory commission and its report were known by the name of the commission's chairman, Michael J. Boskin.

327. *See supra* Table 2.

328. *See supra* Table 2.

329. *See supra* p. 962.

330. *See*, *e.g.*, Irwin Friend & Marshall Blume, *Measure of Portfolio Performance Under Uncertainty*, 60 AM. ECON. REV. 561, 565 (1970).

In this instance, because IPD as BEA data and CPI-U and PPI-FG as BLS data are reported according to differing scales, I rescaled IPD according to an imputed 1984 value of 103.8 (the arithmetic mean of CPI-U and PPI-FG for that year) before calculating beta. To wit:

$$\beta_q = \frac{\text{cov}(\pi^*, q)}{\text{var}(\pi^*)}$$

where π^* represents IPD as the best available measure of inflation, rescaled according to my best estimate of IPD's value for 1984, and q represents the target index in question, either CPI-U or PPI-FG.

The following table reports correlation coefficients and betas for CPI-U and PPI-FG, relative to GDP-IPD, for the 1984 to 2013 test period:

Table 3: Correlation and Beta for CPI-U and PPI-Finished Goods, Relative to the Implicit Price Deflator

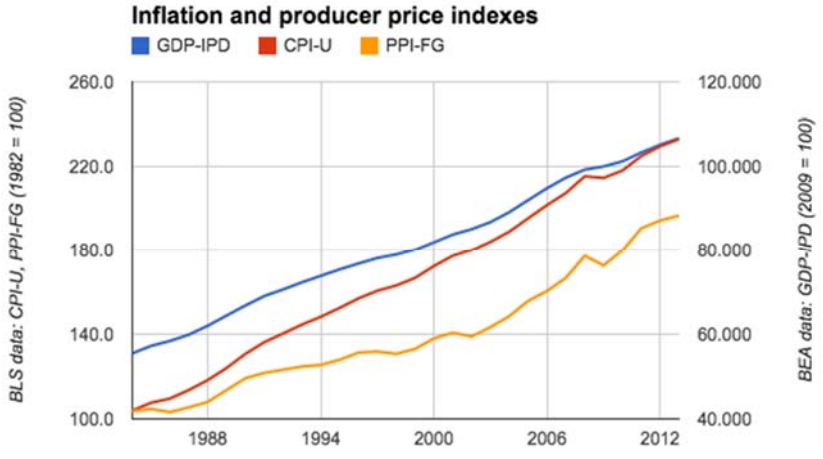
Target Index	CPI-U	PPI-FG
Pearson's *r*	0.9996	0.9806
Estimated β_q	1.3171	0.9161

The very high correlation coefficients for both CPI-U and PPI-FG, relative to IPD, express the extremely close relationship among all three indexes. Since CPI-U, unlike PPI-FG, purports to measure inflation, it should be unsurprising that Pearson's *r* for CPI-U relative to IPD is relatively closer (by a tiny margin) than *r* for PPI-FG, and extremely close to 1 in absolute terms.

Of greater interest is beta for each of these indexes. Beta reveals how CPI-U and PPI-FG each covary with the implicit price deflator as the best available measure of inflation. The beta for CPI-U, at 1.1912, very closely tracks the 16.5% gap between CPI-U and the IPD as measures of inflation from 1984 to 2013. Beta for PPI-FG is nearly equal to 1. That measure's covariance with the IPD was nearly perfect.

A graphical presentation of these three indexes provides even more vivid visual evidence of the relationships between them, especially the critical link between the IPD and PPI-FG:

Graph 2: Comparing the Implicit Price Deflator, CPI-U, and PPI-Finished Goods, 1984–2013



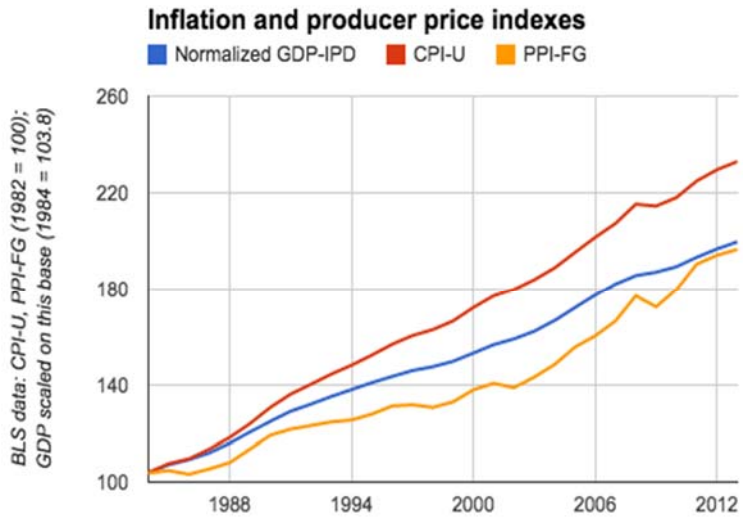
Implicit price deflator, CPI-U, and PPI-Finished Goods, 1984 to 2013

CPI and PPI data, both being products of the BLS, are reported on a scale where 100 designates their value in 1982.[331] On the graph above, the BLS scale is reported on the left axis. CPI-U, in red, and PPI-FG, in gold, are directly comparable. In 1984, both of these BLS-reported indexes were close to their 1982 base value of 100.[332] By 2013, the 18.3% gap between those indexes after twenty-nine years is readily apparent.[333] As a product of the Bureau of Economic Analysis, the IPD is reported on a scale where 100 designates its value in 2009.[334] That scale is reported on the right axis.[335] The congruence between PPI-FG and the IPD is less apparent, but still may be perceived through the rough parallelism of the blue IPD line and the gold PPI-FG line.

Indeed, replotting IPD for 1984 through 2013 on a 1984 base value of 103.8 (halfway between that year's value for CPI-U and PPI-FG) reveals not only the similar rate of growth in IPD and PPI-FG over those three decades, but also these indexes' greater covariance:

331. *See supra* Graph 2.
332. *See supra* Table 3.
333. *See supra* Graph 2.
334. *See supra* Table 3.
335. *See supra* Graph 2.

Graph 3: A Normalized Comparison of the Implicit Price Deflator, CPI-U, and PPI-Finished Goods, 1984–2013



It is now more visually apparent how CPI-U grew steadily larger than the IPD from 1984 to 2013, while PPI-FG fell behind the IPD in the first half of this period but caught up in the latter half.[336] On the basis of this adjustment in the plotting of GDP-IPD data, I calculated betas for CPI-U and PPI-FG relative to the IPD.

Without truly intending any such revision of price-level regulation—indeed, despite its affirmative disavowal of any intention beyond purely historical reporting of pipeline costs—FERC may have stumbled onto a price cap methodology that is as practically workable as it is theoretically sound. The *Oil Pipe Lines* trilogy echoes one of the grandest cycles in the law of regulated industries. The notorious "fair value" rule of *Smyth v. Ames*[337] entitled a regulated firm to demand "a fair return upon the value of that which it employs for the public convenience."[338] Although "[i]n theory the . . . fair value standard mimics the operation of the competitive market," inasmuch as "investments . . . [whose] benefits exceed their costs . . . reward[] [utilities] with an opportunity to earn an 'above-cost'

336. *See supra* Graph 2.
337. 169 U.S. 466 (1898).
338. *Id.* at 547.

return,"[339] practical difficulties plagued the valuation of property whose owners bear legal obligations unknown in other segments of the economy.[340] The purely historical "prudent investment" rule arose as an economically deficient but administratively convenient alternative.[341]

In its most recent pronouncement on the constitutional limits on rate regulation, the Supreme Court declined to demand "rigid [enforcement] of the prudent investment rule" and thereby "foreclose a return to some form of the fair value rule just as its practical problems may be diminishing."[342] In an age where secondary markets provide economic signals historically obscured by command-and-control regulation and overwhelming amounts of data are collected and distributed, the purely historical instinct underlying the prudent investment rule and the *Oil Pipe Lines* trilogy may and should give way to superior information and fully considered economic judgment.

The availability and reliability of economic data needed to index price caps should dictate the path of reform in price-level regulation. Theory leaves little doubt that producer cost information across the entirety of a regulated industry could facilitate a single-parameter, one-step approach to price-level regulation. The practical question is whether any version of Producer Price Index data or any other index can facilitate single-parameter price-level regulation.

C. Chain-Type Price Indexes for Purchased Inputs by Industry

The Producer Price Index and its variants provide a good starting point, though probably not a perfect solution. The general PPI reported by the Bureau of Labor Statistics would require two modifications before it could be used as a measure of industry-wide input costs.[343] First, the PPI is designed to "measure[] average changes in prices *received* by domestic producers for their output," not changes in prices *paid* by producers.[344] Second, the relevant index would not be the main PPI, but a subindex tailored according to a specific industry.[345] The historic depth

339. Duquesne Light Co. v. Barasch, 488 U.S. 299, 308 (1989).

340. *See id.* at 309.

341. *See* Missouri *ex rel.* Sw. Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 291 (1923) (Brandeis, J., dissenting).

342. *Duquesne*, 488 U.S. at 316 n.10.

343. BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, BLS HANDBOOK OF METHODS ch. 14, at 1 (June 2015) [BLS HANDBOOK OF METHODS, CHAPTER 14], http://www.bls.gov/opub/hom/pdf/homch14.pdf [https://perma.cc/XU3C-8DH6].

344. *Id.* at 1.

345. *Cf. id.* at 4 ("A Producer Price Index for an industry is a measure of changes in prices

of the data may also be less than ideal. For instance, BLS's producer price index for telecommunications reaches back no further than 2003.[346] Nevertheless, the quest for price indexes that reflect conditions even in highly volatile industries such as information technology is at least as old as price-level regulation itself.[347] The development of an index focusing solely on regulated firms' input prices seems within the reach of a reasonably competent regulatory agency.

Indeed, BLS's counterpart within the Department of Commerce, the Bureau of Economic Analysis, has devised chain-type price indexes for purchased service inputs across a wide range of industries.[348] This is precisely the type of producer *cost* index that could provide the value of κ (or at least inform its computation) in a single-parameter, $P_t = P_b \cdot (1 + \kappa)^t$ approach to price-level regulation. Among the industry-specific input price indexes that the BEA has calculated, three are strong candidates for use in price-level regulation: "utilities," "pipelines," and "broadcasting and telecommunications." The following table reports BEA data, available since 1997, for those three industries and their relationship to the implicit price deflator of the GDP:

received for the industry's output sold outside the industry (i.e., its net output).").

346. *See id.*

347. *See, e.g.*, James Sinclair & Biran Catron, *An Experimental Price Index for the Computer Industry*, SURV. CURRENT BUS., Oct. 1990, at 16.

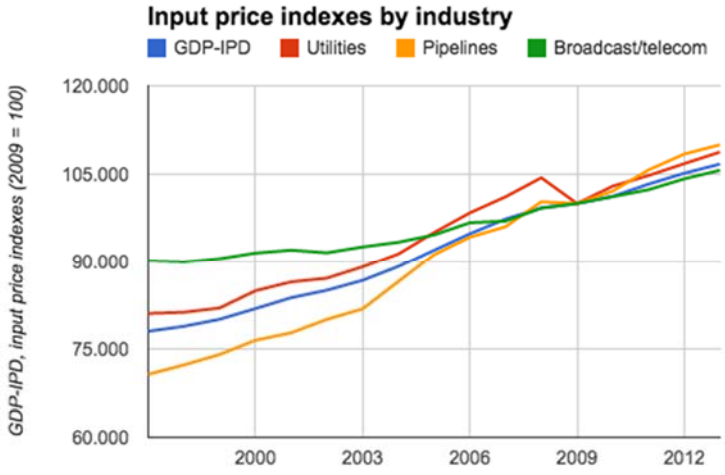
348. *See* BLS HANDBOOK OF METHODS, CHAPTER 14, *supra* note 343, at 9.

Table 4: Comparing the Implicit Price Deflator with Industry-Specific Price Indexes for Utilities, Pipelines, and Broadcasting/Telecommunications Companies, 1997–2013

Year	GDP-IPD	Utilities	Pipelines	Broadcast/ Telecom
1997	78.012	81.052	70.655	90.149
1998	78.859	81.261	72.257	89.941
1999	80.065	81.997	74.041	90.524
2000	81.887	84.945	76.473	91.501
2001	83.754	86.463	77.754	92.014
2002	85.039	87.106	80.044	91.559
2003	86.735	89.059	81.845	92.560
2004	89.120	91.346	86.528	93.361
2005	91.988	95.029	91.231	94.626
2006	94.814	98.396	94.225	96.708
2007	97.337	101.148	96.035	96.999
2008	99.246	104.403	100.297	99.209
2009	100.000	100.000	100.000	100.000
2010	101.221	102.968	102.123	101.173
2011	103.311	104.784	105.733	102.359
2012	105.166	106.815	108.448	104.213
2013	106.733	108.791	110.036	105.677
Average Annual Growth	**1.978%**	**1.857%**	**2.807%**	**0.998%**
Implied *x*-factor = $\pi - \kappa$		**0.122%**	**-0.829%**	**0.980%**
Beta		**0.9232**	**1.2868**	**0.4915**

And in graphical form:

Graph 4: Comparing the Implicit Price Deflator with Industry-Specific Price Indexes for Utilities, Pipelines, and Broadcasting/Telecommunications Companies, 1997–2013



Implicit price deflator and input price indexes, 1997 to 2013

These indexes show that input costs borne by producers in the utilities, pipelines, and broadcasting and telecommunications industries varied widely from each other and, more to the point, from economy-wide inflation from 1997 through 2013.[349] The average annual rates of growth varied from a low of 0.998% in broadcast and telecommunications to a high of 2.807% for pipelines.[350] Because a single agency, BEA, reports all of these indexes, they share a base year of 2009.[351] The slope of each index's curve in the graph above reveals the rate of growth.[352] And the relationship of each industry's cost index to the IPD (indicated by the blue curve) is readily seen.[353]

An industry-specific measure of input costs immediately reveals the x-factor that regulators would compute in a two-parameter version of price-level regulation. Since $\kappa = \pi - x$, it follows that $x = \pi - \kappa$. A slower rate of growth in input costs within an industry, such as broadcast and

349. *See supra* Table 4.
350. *See supra* Table 4.
351. *See supra* Table 4.
352. *See supra* Graph 3.
353. *See supra* Graph 3.

telecommunications, implies a relatively high *x*-factor.[354] Had the FCC consulted BEA's input cost index for broadcasting and telecommunications in any of its price cap proceedings, that index would have provided support for fixing the *x*-factor in the neighborhood of 1%. Industries influenced by Moore's law should be dynamic[355]—and be assigned correspondingly aggressive *x*-factors reflecting their gains in total factor productivity.

By contrast, if input costs are outpacing inflation, as they did for pipelines, the *x*-factor will be negative.[356] BEA data suggest that the *x*-factor for a price cap on pipelines from 1997 to 2013, a period roughly contemporaneous with the *Oil Pipe Lines* trilogy, should have been approximately –0.829%.[357] Since PPI-FG has already been shown to closely track the IPD, a weighted average of FERC's adjustments relative to PPI should approximate the *x*-factor latent in that agency's oil pipeline price cap.[358] From 1996 to 2002, FERC used PPI – 1%. From 2002 to 2006, PPI prevailed.[359] FERC's 2006 rate order adopted PPI + 1.3%;[360] its 2010 order has directed PPI + 2.65% ever since.[361] A weighted average of those rates yields an implied *x*-factor of –0.544%. The weighted average for the twelve years following *Oil Pipe Lines II* is –1.317%. The *x*-factor implied by BEA data on pipeline input costs (–0.829%) falls comfortably between those two figures. Although FERC and the D.C. Circuit would disavow the notion, the PPI-based price cap for oil pipelines has implemented—in practice if not in legal form—a negative *x*-factor commensurate with rising costs in that industry, particularly for crude oil transport.[362]

Most intriguingly of all, perhaps, beta for each of the three industries corresponding to one of the BEA's input cost indexes spans a range from 0.4915 for broadcast and communications to 0.9232 for utilities and 1.2868 for pipelines.[363] Because IPD and the industry-specific input indexes are

354. *See supra* Table 4.

355. *See generally* Gordon E. Moore, *Cramming More Components onto Integrated Circuits*, ELECTRONICS MAG., Aug. 1965, at 4.

356. *See supra* Table 4.

357. *See supra* Table 4.

358. *See supra* Table 2.

359. *See* Five-Year Review of Oil Pipeline Pricing Index, 114 FERC ¶ 61,293 (2006).

360. *See id.*

361. *See 2010 Index Review Order*, 133 FERC ¶ 61,228 (2010), *reh'g denied*, *2011 Rehearing Denial*, 135 FERC ¶ 61,172 (2011); *see also* Notice of Annual Change in the Producer Price Index for Finished Goods, 147 FERC ¶ 61,125 (2014)

362. *See supra* Table 4.

363. *See supra* Table 4.

reported on the same scale, beta can be calculated straightforwardly as the ratio of (1) each index's covariance relative to IPD to (2) the variance of the IPD.[364] Greater input inflation in the pipeline industry corresponds not only with a negative *x*-factor for that industry, but also greater beta.[365] The reverse is true for broadcasting and telecommunications.[366] Unsurprisingly, the utilities category—presumably corresponding to electricity and water, commodities whose demand tends to rise and fall with the broader economy—represented the industrial clade whose costs most closely tracked the gross domestic product of the United States and whose beta was closest to unity.[367]

Adoption of a single-parameter, $P_t = P_b \cdot (1 + \kappa)^t$ approach has the final theoretical virtue of harmonizing price-level regulation with portfolio theory,[368] particularly the capital asset pricing model that has proved so influential in the setting of rates of return (particularly return on equity) under conventional ratemaking.[369] An early criticism of price-level regulation alleged that price caps raised the betas of entire industries subjected to what, two or three decades ago, was a novel legal practice.[370] Studies conducted for the World Bank in the 1990s found that infrastructure firms subject to price caps had higher betas than their counterparts awarded a regulated rate of return.[371] Higher beta, *ceteris paribus*, signals the need for a higher rate of return, especially on equity, to attract investment in a more volatile, presumably riskier company.[372]

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364. For a specification of the formula for beta, see *supra* note 330.

365. *See supra* Table 4.

366. *See supra* Table 4.

367. *See supra* Table 4.

368. *See generally* JAMES MING CHEN, POSTMODERN PORTFOLIO THEORY: NAVIGATING ABNORMAL MARKETS AND INVESTOR BEHAVIOR (2016).

369. *See, e.g.*, AEP Tex. N. Co. v. Surface Transp. Bd., 609 F.3d 432, 434–37, 439–44 (D.C. Cir. 2010); Connect Am. Fund, 28 FCC Rcd. 7123, 7146–69 (2013); Represcribing the Authorized Rate of Return for Interstate Servs. of Local Exch. Carriers, 5 FCCR 7507 (1990); A. Lawrence Kolbe, Michael J. Vilbert & Bente Villadsen, *Measuring Return on Equity Correctly*, PUB. UTIL. FORT., Aug. 1, 2005, at 23.

370. *See* Ian Alexander & Timothy Irwin, *Price Caps, Rate-of-Return Regulation, and the Cost of Capital*, VIEWPOINT (World Bank Grp., D.C.), Oct. 1996, https://openknowledge.worldbank.org/bitstream/handle/10986/11604/multi_page.pdf?sequence=1&isAllowed=y [https://perma.cc/2VZ4-HENZ].

371. *See id.*; Ian Alexander, Colin Mayer & Helen Weeds, *Regulatory Structure, Risk, and Infrastructure Firms: An International Comparison* (World Bank Policy Research, Working Paper No. 1698 Nov. 30, 1999), http://www.ssrn.com/abstract=620633 [https://perma.cc/9253-6X94].

372. *See, e.g.*, Robert A. Korajczyk, *Introduction* to ASSET PRICING AND PORTFOLIO PERFORMANCE: MODELS, STRATEGY AND PERFORMANCE METRICS, at xiii, xv (Robert A. Korajczyk ed., 1999); William F. Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium*

In price-level regulation, higher beta in input costs relative to the baseline of general inflation signals an industry whose costs are growing faster than those in other sectors of the economy,[373] and therefore one that needs to charge higher prices to customers and to pay higher returns to investors in order to survive.

The betas reported here are distinct from the stock market betas evaluated by the World Bank. My relevant benchmark is neither the universe of publicly traded companies or the "investments in other business undertakings which are attended by . . . risks and uncertainties" comparable to public utility companies.[374] Rather, I emphasize the relationship between the input costs in industries deemed suitable for price-level regulation and price change in the broader economy.

In financial markets, beta provides the simplest measure of investment risk that cannot be managed by mere diversification.[375] It is a measure of systematic risk. In a two-stage process for setting a price cap, the *x*-factor serves the function of identifying the extent to which the regulated industry systematically differs from the broader economy.[376] An industry-specific index of input costs performs the same function, as one might expect of a parameter that is equivalent, conceptually if not exactly in practice, to a broad measure of inflation, minus total factor productivity unique to that industry.[377]

After the application of either (1) a general measure of inflation, adjusted by an industry specific *x*-factor or (2) an cost index that isolates industry inputs from the rest of the economy, what remains are those drivers of risk and reward that are idiosyncratic to the individual firm.[378] That is precisely the room for managerial discretion that price-level regulation should be creating. The single-parameter model of price-level regulation properly aligns beta with a rising index of input costs within an industry,[379] and with it the expected cost of capital needed to attract investment in an industry whose costs are outstripping inflation.

Under Conditions of Risk, 19 J. FIN. 425, 427–28 (1964).

373. *See supra* Table 4.

374. Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n, 263 U.S. 679, 692 (1923); *accord* Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944).

375. *See, e.g.*, William F. Sharpe, *A Simplified Model for Portfolio Analysis*, 9 MGMT. SCI. 277, 281 (1963); Jack L. Treynor, *How to Rate Management of Investment Funds*, 43 HARV. BUS. REV. 63, 66 (1965).

376. *See* VICKERS & YARROW, *supra* note 145; Loube, *supra* note 145, at 289–90; Vogelsang, *supra* note 145, at 5, 10.

377. *See supra* Part V.B.2.

378. *See* Friend & Blume, *supra* note 330, at 561.

379. *See id.* at 562–64.

VII. CONCLUSION

"[N]either law nor economics has yet devised generally accepted standards for the evaluation of rate-making . . . ."[380] Even at its best, public utility regulation "will always [raise] . . . embarrassing question[s]" of indeterminacy and inefficacy.[381] As a consciously transitional regulatory tool, price-level regulation continues to strive toward bridging conventional rate-of-return regulation with outright deregulation.[382]

Intense controversy over this technique suggests that price-level regulation has not "significantly reduce[d] the burden of regulatory proceedings" relative to the old rate-of-return methodology.[383] Battles over inflation indexes, "the productivity offset and allowable exogenous costs" suggest that "price caps do not eliminate gamesmanship" from regulation.[384] Paradoxically, contrary to the expectation "that price cap regulation will result in lower administrative costs" by lowering the need for "direct [governmental] oversight," regulatory commissions in states applying price caps are twenty-five percent larger than commissions in states adhering to conventional rate-of-return regulation.[385] The substitution of price-level regulation for its rate-of-return alternative has represented the *regulators'* own "strategic response . . . to maintain relevancy in the volatile and uncertain environment" that has swamped many industries formerly subject to command-and-control oversight.[386]

Despite these blemishes in execution, "it is arguably better to take the risk of capture" and other defects inherent in discretionary regulation "with price cap than with cost-of-service regulation, especially where efficiency incentives are important."[387] By enabling regulators to "control[] the *prices* of dominant firms" while leaving "control of their *profits* . . . to the competitive marketplace," price-level regulation has proved "most effective as a transitory step on the path toward total deregulation and full competition."[388] In the three decades since its

380. Permian Basin Area Rate Cases, 390 U.S. 747, 790 (1898); *accord* Duquesne Light Co. v. Barasch, 488 U.S. 299, 308 (1989).

381. Smyth v. Ames, 169 U.S. 466, 546 (1898); *accord Duquesne*, 488 U.S. at 308.

382. GÓMEZ-IBÁÑEZ, *supra* note 3, at 219.

383. *Id.* at 242.

384. Verizon Commc'ns, Inc. v. FCC, 535 U.S. 467, 487 (2002); *see also USTA*, 188 F.3d 521, 524 (D.C. Cir. 1999).

385. Jason R. Abel, *Entry into Regulated Markets: The Development of a Competitive Fringe in the Local Telephone Industry*, 45 J.L. & ECON. 289, 311 (2002).

386. *Id.* at 309.

387. GÓMEZ-IBÁÑEZ, *supra* note 3, at 243.

388. Ronald R. Braeutigam & John C. Panzar, *Effects of the Change from Rate-of-Return*

introduction, price-level regulation has become the dominant form of rate regulation in Great Britain and the United States.[389] By 2002, no fewer than forty-eight states had adopted price-level regulation as their default method for regulating incumbent local exchange companies.[390] Although critics continue to question whether price-level regulation provides adequate "incentives for capital investment,"[391] its infusion of "stronger incentives to improve efficiency" demands that "price cap . . . be judged a great success."[392]

With good reason, the Supreme Court has characterized price-level regulation as the mostly successful "final stage in a century of developing ratesetting methodology."[393] As this Article has shown, the progressive streamlining of price-level regulation, from an elaborate variation on the theme of conventional ratemaking to a three-, two-, and finally single-parameter exercise in patrolling utility prices according to price indexes beyond the control or influence of any regulated firm. The emergence of price indexes for inputs purchased across entire industries, from transporters of petroleum and natural gas to conveyors of electricity and text messages, heralds the final and potentially most productive phase in the transformation of price-level regulation.

Regulation to Price-Cap Regulation, 83 AM. ECON. REV. 191, 197 (1993).

389. *See* Ingo Vogelsang, *Incentive Regulation and Competition in Public Utility Markets: A 20-Year Perspective*, 22 J. REG. ECON. 5 (2002); *cf.* Christopher R. Knittel, *Regulatory Restructuring and Incumbent Price Dynamics: The Casse of U.S. Local Telephone Markets*, 86 REV. ECON. & STAT. 614, 615 (2004).

390. *See* David E.M. Sappington, *Price Regulation*, *in* 1 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS: STRUCTURE, REGULATION AND COMPETITION 225 (Martin Cave et al. eds., 2002).

391. GÓMEZ-IBÁÑEZ, *supra* note 3, at 241.

392. *Id.* at 240.

393. Verizon Commc'ns, Inc. v. United States, 535 U.S. 467, 487 (2002).