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The Utility of Finance

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Abstract: Public Utilities Commissions (PUCs) are charged with regulating a utility's rates to prevent monopoly pricing subject to the constraint that the utility's investors earn a rate of return commensurate with that expected by businesses facing similar risks. Although the task of assessing risk-adjusted returns is a staple of modern finance, we know surprisingly little about how well PUCs accomplish their regulatory mandate when judged against standard benchmarks of financial economics. This article analyzes a dozen years' worth of gas and electric rate-setting decisions from PUCs across the United States and Canada, demonstrating empirically that allowed returns on equity diverge significantly and systematically from the predictions of accepted asset pricing methodologies in finance. Our analysis suggests that current regulatory practice more plausibly reflects an amalgam of other non-finance desiderata, including political goals, incentive provision, regulatory capture and lack of financial valuation expertise among regulators. We also present evidence based on a unique field experiment suggesting that training in finance can partially ameliorate the divergence between PUC rate setting and financial methodologies.

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I. Introduction

During the last three decades, a significant transformation has been underway in regulatory areas where time and risk valuation affect legal outcomes: The emergence and growth of the centrality of financial valuation methodologies to inform legal outcomes. While such approaches were generally foreign to legal and regulatory decision-making in the early 1980s, corporate finance now permeates a vast and growing set of doctrinal areas, ranging from securities fraud, to corporate law, to bankruptcy to tax, to mergers and acquisitions.[1]

Among this burgeoning set of applications, the advance of finance into regulation of public utilities was perhaps *particularly* inevitable. Indeed, the challenge of scrutinizing rates of return has long been a key element of utilities regulation, reflecting an expansive conception of necessary state and federal regulatory power over the actions of natural monopolies, often with important economic implications in play.[2] As is well known, the legal governance of public utilities is designed to ensure that the utility provides critical services to the public at reasonable costs, and to protect consumers against bargaining inequalities, informational disadvantage, collusive pricing, and market inefficiency due to the public's dependency on the continuous provision of public necessity. At the same time, for both legal and practical reasons, regulators must also allow utilities' capital providers to recoup a competitive rate of return on their investments. Accordingly, public utility commissions (PUCs) are vested with power to supervise, administer and regulate the economic activities of utilities, all in the name of striking this balance.

A key component of the utilities regulation process thus pertains to the challenge of pegging rates and prices at levels that yield an appropriate risk-adjusted return for utilities' capital investors. This mandate goes back a full century (at least), and is reflected in the oft-repeated edict from the 1923 United States Supreme Court opinion in *Bluefield Waterworks v. Public Service Commission* :

[1] See generally Roberta Romano, *After the Revolution in Corporate Law*, 55(3) JOURNAL OF LEGAL EDUCATION (September 2005). For specific doctrinal applications of outside of the utilities regulation context, see Kenneth Ayotte & Edward Morrison, "Valuation Disputes in Corporate Bankruptcy" (applying to bankruptcy proceedings) (unpublished manuscript, 2017); Eric Talley, "Finance in the Courtroom: Appraising Its Growing Pains," DELAWARE LAWYER 16 (applying to corporate and shareholder appraisal proceedings) (August 2017).

[2] William J. Novak, *The Public Utility Idea and the Origins of Modern Business Regulation*, in CORPORATIONS AND AMERICAN DEMOCRACY 139-159 (Naomi R. Lamoreaux and Willian J. Novak, eds., 2017).

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties, but it has no constitutional right to such profits as are realized or anticipated in highly profitable enterprises or speculative ventures.[3]

It was not until decades after *Bluefield*, however, that advances in financial economics made it practically possible to address the above mandate formally, using a variety of asset-pricing methodologies. A prime example of such methodological approaches is the Capital Asset Pricing Model—or CAPM—one of a host of now well-accepted approaches for determining how to adjust expected rates of return for anticipated risks.[4]

Yet, to what extent do rate regulators render decisions that comport with standard financial methodology in their decision-making process? This paper offers an empirical analysis of rate awarded by public utility commissions (PUCs), evaluating their relationship to factors that standard finance theory predicts would drive expected returns for capital investors. We analyze data of nearly a thousand PUCs gas and electric rate-setting decisions over a twelve-year period (2005-2016) emanating from PUCs across the United States and Canada. Our benchmark for analysis is the lens of accepted asset-pricing theories from financial economics. We inquire whether awarded rates of return for public utilities are set in a manner consistent with calibrating awarded returns against investment risk. In particular, we assess whether awarded rates of return track those prescribed for individual utilities according to the CAPM, the still-dominant model for quantifying risk and translating it to assessment of expected returns of equity.[5]

Our analysis strongly rejects the hypothesis above with significant confidence: specifically, we demonstrate that rate setting practices diverge appreciably from the predictions of financial economics across numerous dimensions. For example, awarded gross returns on equity (ROEs) tend to exhibit considerable stickiness around focal "odometer" points (particularly a flat 10%) regardless of the cyclical structure of other prevailing benchmark rates.

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[3] Bluefield Waterworks v. Public Service Comm'n, 262 U.S. 679 (1923). Accord FPC v. Hope Natural Gas Company, 320 U.S. 591 (1944) ("The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital").

[4] DAVID G. LUENBERGER, INVESTMENT SCIENCE (1998).

[5] IVO WELCH, THE CAPITAL ASSET PRICING MODEL, IN CORPORATE FINANCE, Chapter 10, 213 (2017).

Moreover, awarded ROE spreads over risk free treasuries have progressively *widened* significantly since 2005, even though systematic risk in the utilities industry has *fallen continuously* during the same period. Indeed, if the awarded ROEs were an asset class, they would generate a mean positive abnormal return ("alpha") of *between 7.5 and 8.5 percent*, an amount that overshadows even the performance of Fortune Magazine's top twenty stock investments for the last decade.[6] Finally, as anticipated market returns (i.e., systematic risk) have fluctuated during the period studied, awarded ROE spreads have consistently (and curiously) moved in the *opposite* direction, notwithstanding the fact that market returns on utilities' equity overwhelmingly have positive betas. Our analysis thus confidently rejects the hypothesis that awarded ROEs behave anywhere near what finance theory predicts would be the expected return of a commensurably risky investment.

What, then, explains the extreme deviation from standard finance theory's predictions? Although we cannot make definitive conclusions here, we tentatively identify a host of factors that may be at play, including the possibility that regulators' behavior reflects political patronage concerns, dynamic incentive provision, regulatory capture, and a simple lack of expertise in finance. We find, for example, evidence that the structural composition of the PUC is reflected in awarded ROEs: the percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award significantly *lower* returns on equity (over 100 BPs lower) than completely appointed ones. This effect arguably represents the electoral costs that commissioners pay with rate payers when they rates too high, and/or the greater impediments to long term incentive provision and/or regulatory capture among elected commissions. (Neither elected nor appointed commissions, however, issue rates that comport particularly well with the CAPM.)

Higher awarded rates may also aim to sustain an equity cushion designed to improve utilities' incentives for reliability (and possibly safety).[7] "Inventorying" power is still beyond the capacity of most generators. Sustaining the continuous and uninterrupted electricity service therefore requires maintenance of continuous and almost instantaneous balance between

[6] See Reviewing Fortune's 20 'Best Investments' Of The Last Decade, Seeking Alpha (9/22/2016, available at https://seekingalpha.com/article/4007867-reviewing-fortunes-20-best-investments-last-decade) (a gross annualized return of 8.1%).

[7] Paul Joskow and Jean Tirole, *Reliability and Competitive Electricity Markets*, 38(1) RAND JOURNAL OF ECONOMICS 60-84, 78 (2007).

production and consumption of electricity in power systems.[8] On certain occasions (such as the Super Bowl), utilities can expect the spike in demand, but not all spikes and dips can be foreseen. To mitigate the risk of power shortages and blackouts, some margin of excess generation capacity above the expected demand load must be kept at all times. Higher awarded rates can sustain investments in excess capacity and may theoretically enhance the reliability of energy provision in the light of the volatility of capital expenditures and the lack of technical storage feasibility.

Another hypothesis is that regulators aim to sustain the financial stability of utilities via rate making, so as to reduce the likelihood of a bailout or a subsidy following financial distress. As utilities are "too important to fail SINFIs, exclusively providing social necessities,[9] rate regulation may implicitly function as micro-prudential regulation for public utilities, using the equity cushion to mitigate the risk of insolvency and illiquidity. The prioritization of such other goals may provide a cogent account for why PUCs appear to veer so far from accurate calibration of risk-adjusted returns.

Alternatively, regulators may place significant weight on the consistency and predictability of awarded rates, independent of systematic risk dynamics. Indeed, the dominant approach for risk-return calibration among regulators tends not to be CAPM, but rather a simplified application of the Gordon dividend growth model (often referred to by regulators—somewhat misleadingly—as the Discounted Cash Flow or "DCF" approach[10]). This methodology—which is specifically endorsed by FERC and many other state regulators, has substantially fewer moving parts than CAPM (limited generally to price, expected dividends and perpetuity growth rates). Consequently, before submitting a request for a rate increase, a utility may be better able to predict the outcome with greater certainty, allowing it to plan its rate increase requests strategically (e.g. to avoid requests during a sensitive election cycle or

[8] Jose Fernando Prada, *The Value of Reliability in Power Systems – Pricing Operating Reserves* (Massachusetts Institute of Technology, Energy Laboratory, Working Paper, 1999); RICHARD BROWN, ELECTRIC POWER DISTRIBUTION 15, 143 (2009).

[9] Shlomit Azgad-Tromer, *Too Important to Fail: Bankruptcy versus Bailout of Socially Important Non-Financial Institutions*, 7(1) HARVARD BUSINESS LAW REVIEW 160 (2017).

[10] To non-utilities-oriented finance professionals, DCF analysis refers to the estimation of fair-market value for an entire company or its equity, a task that rates of rates of return (however computed) as inputs. As used among utilities regulators, however, DCF means something different, and describes the practice of imputing risk-adjusted returns from observed prices using the Gordon dividend growth model.

economic downturns). Through delivering a more predictable result, however, the (so-called) DCF approach can often diverge from CAPM (and other more foundational asset pricing models), a factor that may permit regulators to commit credibly to stable investment returns ex-ante (even if inconsistent with their putative regulatory mandate)..[11]

A final hypothesis that could be driving *at least part* of the behavior we observe is that risk valuation can place appreciable technical demands on regulators and staffs that are outside their areas of expertise. To the extent an expertise gap exists, it may be addressable through greater financial economics training of commissioners and regulatory staffs. To test this conjecture, we exploit data from a unique field experiment that exposed state-level PUC commissioners and staffs to immersion training in asset pricing and finance (and particularly the CAPM). We find evidence that among treated PUCs, finance training *does* appear to dampen the divergence between post-training rate setting and the predictions of finance. The effects are relatively modest, however, perhaps due to the limited (one day) nature of the training program. Nevertheless, our findings suggest that at least some of the behavior we observe is due to a lack of expertise among decision makers, and that it may be possible to address that expertise gap programmatically. .

Our analysis proceeds as follows. In Section II, we provide a high-level overview of the rate-setting process, and its criticality to utility profitability and solvency. There we provide a brief overview of some details in formulating the weighted average cost of capital, an all-things-considered rate of return that combines tax rates, leverage levels, returns on debt and the all-important return on equity (ROE). We demonstrate how critical (and contentious) ROE determinations are to the overall process, and describe prevailing methodologies used by PUCs to set it. Section III describes our data and presents a series of tests of hypothesis that ROE

[11] Identified by Coase in 1972, the commitment problems and time-inconsistency reflect the risk of under-investment due to uncertainty. When rates are regulated, investors risk the possibility that the regulator would adjudicate a lower rate of return after the investments are absorbed in the corporation or project, expropriating their sunk investments. The expected equilibrium is under-investment, resulting in imminent public infrastructure meltdowns due to backed up maintenance and repair. Predictable rate setting methodology allows the regulator to commit to a fair return on irreversible investments ex ante. Ronald H. Coase, *Durability and Monopoly*, 15 JOURNAL OF LAW AND ECONOMICS 143 (1972); Glenn Blackmon and Richard Zeckhauser, *Fragile Commitments and the Regulatory Process,* 9 YALE JOURNAL ON REGULATION 73 (1992); David P. Baron and David Besanko, C*ommitment and Fairness in a Dynamic Regulatory Relationship*, 54 REVIEW OF ECONOMIC STUDIES 413-436 (1987); Gregory Lewis and Patrick Bajari, *Moral Hazard, Incentive Contracts and Risk: Evidence from Procurement,* 81 REVIEW OF ECONOMICS STUDIES, 1201-1228 (2014).

determinations mimic the pricing of risk, all of which are rejected. There we also explore other empirical factors that have some predictive power, and demonstrate the effect of finance training in substantially counteracting the inconsistencies between rate setting and asset pricing predictions. Section IV concludes.

II. Overview of the Regulatory Rate-Setting Process

Public utilities are widely considered natural monopolies, and regulation is designed to mitigate the potential welfare costs of market power, so that monopoly prices do not transfer greater than normal economic rents the consumers to the stockholders of the firm.[12] The welfare loss from the self-rationed production of the monopoly is often called "the deadweight costs" of monopoly, as some consumers who would have purchased at the competitive price are restricted from purchase, resulting in welfare loss.[13] Vulnerability to the exercise of market power is the primary justification for rate regulation.[14] While monopoly power can always visit deadweight losses on any market, the energy sector carries significant negative externalities with distributional consequences. Because utilities provide public necessities, and can be conceptualized as geographical franchises for energy provision, consumers' disadvantage, imposition, unreasonable charges, harmful prices, and harmful standards of service are also well recognized regulatory concerns.[15]

Prices and rates charged by electric and gas utilities are regulated in the United States by targeting (either explicitly or implicitly) market rate of return for a utility's investors (and particularly its equity holders).[16] The authority for rate regulation is divided between the federal government and the states, in which Federal Energy Regulatory Commission (FERC) holds the

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[12] See Richard A. Posner, *The Social Costs of Monopoly and Regulation*, 83 J. POL. ECON. 807, 810 (1975); Gordon Tullock, *The Welfare Costs of Tariffs, monopolies and Theft*, 5 W. ECON. J. 224, 225-26 (1967).
[13] *Id.*
[14] Severin Borenstein, *The Trouble With Electricity Markets: Understanding California's Restructuring Disaster*, 16(1) THE JOURNAL OF ECONOMIC PERSPECTIVES 191-211 (2002); Erin T. Mansur, Pricing Behavior in the Initial Sumer of the Restructured PJM Wholesale Electricity Market. 90(2) THE REVIEW OF ECONOMIC AND STATISTICS 369-386 (2008); Ali Hortacsu and Steven L. Puller, *Understanding Strategic Bidding in Multi-Unit Auctions: A Case Study of the Texas Electricity Spot Market*, 39(1) THE RAND JOURNAL OF ECONOMICS 86-114 (2008).
[15] See William J. Novak, supra note 2 id, at 158-159, arguing that "Monopoly was just one of many other important factors driving the public utility idea".
[16] IRSTON R. BARNES, THE ECONOMICS OF PUBLIC UTILITY REGULATION (1942). Rate-making is a kind of price-fixing: see Munn v. Illinois, 94 U.S. 3, 134 (1877).

jurisdiction over the interstate aspects of power and electricity, while the states largely retain jurisdiction for intrastate matters, including, most notably, retail sale[17.] There are therefore two arenas for rate-setting cases: (a) the FERC for utilities providing interstate power infrastructure; and (b) the state-based public utility commissions for utilities providing retail intrastate power service. In either case, however, a foundational principle that guides regulation of rates in both jurisdictions is that prices should reflect the "cost of service"[18] adjusted to deliver a fair, risk-adjusted rate of return for capital investors.

Consequently, regulators are required to deduce/compute the utility's rate of return, which is typically embodied in the utility's Weighted Average Cost of Capital (WACC)—essentially a tax-adjusted weighted average cost of debt and the expected return of preferred and common stock that a utility has issued to finance its investments. For a utility with a single class of debt and a single class of equity, the WACC is expressed as follows:

$$\text{WACC} = \left(\frac{Debt}{Debt + Equity}\right) \cdot (1 - \tau) \cdot \text{ROD} + \left(\frac{Equity}{Debt + Equity}\right) \cdot \text{ROE}, \tag{1}$$

where *Debt* and *Equity* denote the fair market value of the utility's outstanding debt and equity ownership claims, τ denotes the utility's marginal tax rate, and *ROD* and *ROE* denote the returns on debt and equity (respectively) demanded by capital investors. (The inclusion of the $(1 - \tau)$ term on the debt component reflects the fact that interest payments are made on a pre-tax basis, and thus are partially subsidized by the tax authorities.)

In computing the WACC, market values for debt and equity, as well as the utility's marginal tax rate are generally straightforward to observe.[19] The return on debt is similarly often straightforward, since the utilities debt instruments / lines of credit specifically note it. But how much should electric and gas utility stockholders earn? The somewhat unhelpful statutory

[17] See Federal Power Commission v. South Cal. Edison Co., 376 U.S. 205, 215-16 (1964); Miss. Power & Light Co. v. Mississippi ex rel. Moore, 487 U.S. 354, 388 (1988); FERC v. Electric Power Supply Association, 136 S. Ct. 760 (2016).
[18] I.A. KAHN, THE ECONOMICS OF REGULATION 26-27 (1970); Dr. Karl McDermott, Cost of Service Regulation in the Investor-Owned Electric Utility Industry: A History of Adaptation, Edison Electric Institute Working Paper (June 2012).
[19] One caveat is that many utilities operate as subsidiaries of larger (often inter-state) utilities, a factor that can complicate both our and regulators' analysis, as discussed below. In such cases, apportioning market values of debt and equity between affiliates can be difficult.

standard running as a scarlet thread throughout energy legislation determines the rates charged by a utility provider should be "just and reasonable"[20]. But what exactly does that mean?

As interpreted by the Supreme Court, the fixing of "just and reasonable" rates involves assessing a return on equity as will permit the utility's equity investors to earn a return commensurate with investors in comparators that face corresponding risks and uncertainties[21]. A "just and reasonable" rate should be reasonably sufficient to assure confidence in the financial soundness of the utility, and should be adequate to maintain and support its credit and enable it to raise the money necessary for its continued operation[22]. Investors' confidence and capital attractiveness are particularly salient for utilities because utilities in financial distress are likely to be sponsored, subsidized or bailed-out by taxpayers due to their unique position as situational monopolies providing of essential services.[23] An operating failure of the public utility, whether due to illiquidity, insolvency, or simple shortage of power supply, is expected to induce a public crisis of confidence, as the social and economic infrastructure of our lives is a based on an implied assumption of continuous and uninterrupted electricity provision.

The statutory mandate to regulate a public utility's ROEs to a just and reasonable level leaves rate regulators in somewhat of a methodological No Man's Land. State public utility commissions are generally free to establish their own methodologies in rate setting procedures. Perhaps due to its ease of use and comprehension by regulators not necessarily particularly vested in financial theories, the most popular method used to determine the ROE among state

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[20] Under the Federal Power Act all rates and charges made, demanded, or received by any public utility for or in connection with interstate wholesale sales shall be "just and reasonable"; so too all rules and regulations affecting or pertaining to such rates or charges: 16 U.S.C.S. § 824(b)(1); 16 U.S. C.S. § 824d(a). If the FERC sees a violation of that standard, it must determine the just and reasonable rate and impose it by order: 16 U.S.C.S. § 824e(a). Similarly, many state public utility statues contain provisions permitting commission authorizations to regulate "just and reasonable rates". See for example AL Code § 37-1-80 (2013) requiring that "the rates for the services rendered and required shall be reasonable and just to both the utility and the public. Every utility shall be entitled to such just and reasonable rates as will enable it at all times to fully perform its duties to the public, and will, under honest, efficient and economical management, earn a fair net return on the reasonable value of its property devoted to the public's service".

[21] Bluefield Water Works & Improvement Company v. Public Service Commission of the State of West Virginia et al., 262 U.S. 679 (1922), reasoning that "Rates which ae not sufficient to yield a reasonable return on the value of the property used… are unjust, unreasonable and confiscatory, and their enforcement deprives the public utility company of its property, in violation of the Fourteenth Amendment".

[22] *Id*, p. 692.

[23] Shlomit Azgad-Tromer, Too Important to Fail, supra note 9 id.

public utility commissions is what they (but few others) refer to as the discounted cash-flow (DCF) approach,[24] which is a variant on the Gordon Dividend-Growth model and conceives of the price of a stock to be present discounted value of its future perpetual dividend stream. The FERC has officially adopted a variant of the DCF as its preferred method for ROE computation (setting a benchmark that is emulated loosely by many state regulators[25]). This approach is based on an underlying premise that an equity investment is worth the present discounted value of its future stream of dividends, discounted at the appropriate risk-adjusted rate, as reflected in the "growing perpetuity" expression:[26]

$$P_0 = \frac{D}{\mathrm{ROE} - \mathrm{E(g)}}, \tag{2}$$

where P_0 is the observed price of the common stock during the regulatory testing period, D is the current dividend, and $\mathrm{E(g)}$ is the expected perpetual growth rate of dividends.

Rearranged to solve for the required rate of return, the ROE can be expressed as:

$$\mathrm{ROE} = \frac{D}{P_0} + \mathrm{E(g)}. \tag{3}$$

Under the FERC's approach, this expression is slightly modified to read:

$$\mathrm{ROE} = \frac{D \cdot (1 + \theta \cdot \mathrm{E(g)})}{P_0} + \mathrm{E(g)}, \tag{3'}$$

where θ is an adjustment factor intended to approximate the effect of the periodicity of "lumpy" dividend payments.[27] As many of the utility providers are public corporations, the price of their common stock and their dividend yield component are in the public domain[28].

[24] Kenneth Gordon and Jeff D. Makholm, *Allowed Return on Equity in Canada and the United States: An Economic, Financial and Institutional Analysis*, NERA Economic Consulting Working Paper 20 (2008). It bears noting that what the PUC utilities community refers to as a DCF approach is somewhat more specialized than what finance practitoners think of it as entailing. Because this paper is about utilities regulation, however, we adhere to that industry's nomenclature.

[25] [Cite]

[26] The FERC has adopted DCF as its main methodology for analyses of required rate of return in the 1970's. See, e.g., Minn. Power and Light Co., 3 FERC 61,045 at 61, 132-22 (1978).

[27] Under the FERC's approach, θ is pegged at 0.5, so that the dividend yield is multiplied by the expression (1+.5E(g)), an adjustment meant to account (somewhat imprecisely) for the fact that dividends are usually paid on a quarterly basis. Multiplying the dividend yield in this manner results in what the FERC refers to as the "adjusted dividend yield". See Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al., 147 FERC 61, 234 (2014).

To compute the constant dividend growth rate *E(g)*, the FERC uses a two-step procedure, averaging short-term and long-term growth estimates.[29] The Institutional Brokers Estimate System (IBES)'s five-year forecast for each company in the proxy group, is used to determine the expected growth for the short term[30]. The long-term growth rate—which is almost always lower—is based on forecasts of long-term growth of the economy as a whole, as reflected in GDP: public utilities are assumed to sustain long term growth consistent with the growth of the economy as a whole.[31] The practice endorsed by the FERC to compute the anticipated perpetuity growth rate is to accord the short-term forecast receives a two-thirds weighting and the long-term forecast receives a one-third weighting.[32] We note that when (i) the short-term rate exceeds the long-term rate (as it often does), and (ii) the long term rate is pegged around the expected long-term growth rate for the entire economy (as it usually is), the aggregated perpetuity growth rate under FERC's approach will also exceed the long-term growth rate for the entire economy. Although such assumptions lead to absurd results,[33] utilities regulators have long retained them.

The two-step DCF methodology is purportedly used by the FERC to establish a "zone of reasonableness" for ROEs. Yet, an ROE may be both within the realm of reasonableness and be considered unjust and unreasonable: in other words, not all ROEs within the purported "zone" are truly just and reasonable[34]. To inform the just and reasonable placement of the ROE within the zone of reasonableness, the FERC uses a variety of alternative risk-pricing approaches, such

[28] For the dividend yield component, the FERC uses a single, average dividend yield based on the indicated dividend and the average of the monthly high and low stock prices over a six-month period. See e.g., *Portland Natural Gas Transmission Sys*., Opinion No. 510, 13 FERC 61, 129, at pp 232-234 (2011).
[29] Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al, supra note 27 *id*, p. 10.
[30] Earnings forecasts made by investment analysts are considered the best estimate of short-term dividend growth because they are likely relied on by investors when making their investment decisions. See Transcon. Gas Pipe Line Corp., Opinion No. 414-B, 85 FERC 61, 323, at 62,269 & n. 34 (1998).
[31] Opinion No. 396-B, 79 FERC at 62, 382-82; Opinion No, 396-C, 81 FERC 61, 036 (1997), cited at Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al, supra note 27 *id*, p. 12. Up until the Bangor Hydro opinion in 2014, the FERC used a one-step DCF methodology for utility providers, which lacked a long-term growth projection.
[32] "Given the greater reliability of the short term projection, we believe it is appropriate to give it greater weight" – see Opinion No. 414-A, 84 FERC at 61, 423-24. The United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit) affirmed this two thirds/one third weighting for determine the overall dividend growth estimate at CAPP v. FERC, 254 F. 3d at 297 (2001).
[33] As several commentators point out, if an assumed perpetuity growth rate for the company exceeds the long term growth rate of the economy, then in the limit the company will eventually come to dominate the entire economy. See, e.g., R. Scott Widen, *Delaware Law, Financial Theory and Investment Banking Valuation Practice*, 4 NYU Journal of Law and Business 578 (2010).
[34] Association of Business Advocating Tariff Equity et al. v. Midcontinent Independent System et al., 156 FERC 61060, 8 (2016); So. Cal. Edison v. FERC, 717 F. 3d at 181-82 (2013).

as the CAPM (discussed below), risk-premium buildup benchmarking, and expected earnings analysis[35]. In addition, record evidence of state commission-approved ROEs is taken into account, and although not used directly to establish utilities' ROEs[36], state commission ROEs do serve as an indicator for an adjustment within the zone of reasonableness to satisfy the level sufficient to attract investment[37].

Although evidently well accepted among utilities regulators, for a variety of reasons (some noted above), the so-called DCF approach is not widely followed by financial professionals outside of the utilities context, the academic literature, or many other legal actors charged with risk pricing. For example, most recent Delaware courts opinions in appraisal matters underlying fairness opinions[38] rely much more centrally on the Capital Asset Pricing Model (CAPM)[39] or (to a lesser extent) the Fama-French three-factor model[40] as the preferred methods for estimation of the company's cost of capital[41]. The popularity of CAPM with finance professionals is based on its assessment of the relationship of investments with risk[42]. The basic intuition that underlies CAPM is that returns and risk go together like a horse and carriage:

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[35] ROGER A. MORIN, NEW REGULATORY FINANCE 108 (2006). Interestingly, utilities regulators have not generally attempted to impute rates of return through comparable company / transaction analysis.

[36] "State commission ROEs are established at different times in different jurisdictions which use different policies, standards and methodologies in setting rates" – see Middle South Services, Inc., Opinion No. 12, 16 FERC 61,101, at 61,221 (1981); see also: Boston Edison Co., Opinion No. 411, 77 FERC 61,272 at 62,171-62,172 (1996): ; Jersey Cent. Power & Light Co., Opinion No. 408, 77 FERC at 61, 002.

[37] Bangor Hydro-Electric Company et al, supra note 27 *id*, p 72: "we are faced with circumstances under which the midpoint of the zone of reasonableness established… has fallen below state commission approved ROEs, even though transmission entails unique risks that state-regulated electric distribution does not… the discrepancy between state ROEs and the… midpoint serves as an indicator that an upward adjustment is necessary to satisfy *Hope* and *Bluefield*".

[38] Under 8.Del.C. § 262(h), upon finding that a stockholder is entitled to an appraisal, the court must determine the fair value of the shares exclusive of any element of value arising from the accomplishment of the proposed transaction. R. Scott Widen, *Delaware Law, Financial Theory and Investment Banking Valuation Practice*, 4 NYU Journal of Law and Business 578 (2010); Gaurav Jetley and Xinyu Ji, *Appraisal Arbitrage – Is There a Delaware Advantage?* 71 The Business Lawyer 427 (2016).

[39] See TIM KOTLER, MARC GOEDHART AND DAVID WESSELS, VALUATION 293-315 (2005). Formulaically, the CAPM posits that an asset's expected return, $E(R_A)$ is given by the expression: $E(R_A) = r_f + \beta_A \cdot (\mathrm{E}(R_M) - r_f)$, where r_f denotes the risk free rate, $\mathrm{E}(R_M)$ denotes the expected return on the market portfolio, and β_A is the asset's "beta" – a measure of risk relative to the market.

[40] Widen notes that the Fama-French model has been used by Delaware Courts in addition to, or instead of, CAPM (p. 582), supra note 38 *id*. The Fama-French model expands on CAPM by adding size and value factors to the market risk factor in CAPM.

[41] Jetley and Ji, *id.*

[42] See IVO WELCH, CORPORATE FINANCE, supra note 5 *id*, at 215, 227 stating that "everyone uses it", citing research showing that 73% of CFOs reported that they "always or almost always use the CAPM", and concluding that "It is literally the dominant, if not only, widely used model to estimate the cost of capital".

CAPM provides a method for quantifying the stock's risk and its expected influence on the expected return for investors.[43] According to the CAPM, the key to assessing the value of a security is to assess the response of the returns of this security to the returns on the market index. The beta coefficient, β, is defined as the sensitivity of the return of that security to the return of the "market" portfolio.

When valuing businesses, the Delaware courts strongly prefer the CAPM (or similar models) for determining risk-adjusted discount rates. However, once that rate is determined, something akin to the dividend-growth model is frequently applied to predict the company's "terminal" value as a stream of cash flows growing consistently in perpetuity. In those applications, Delaware courts have pegged the anticipated perpetuity-growth rate as necessarily living within the range of values between the anticipated rate of inflation and the anticipated nominal GDP growth.[44] The rate of inflation is considered a floor for a terminal value estimate for a solidly profitable company,[45] while the expected GDP growth rate is considered a ceiling for corporations in mature industries.[46] As is well known by many finance practitioners (though perhaps not appreciated in by utilities regulators), a long-term perpetuity growth rate for a firm in excess of the anticipated GDP growth rate would imply that the firm in question would mechanically come to dominate the entire economy in the long term – a prediction seen by most as simply untenable.[47]

In theory, employing different valuation methodologies for rate setting purposes need not necessarily yield different results. The divergence between the PUCs' preferred model of DCF analysis and the more widely accepted CAPM model may be one of approach, but not outcome. With appropriate inputs, and a reliable market price, the DCF approach should yield a discount rate that is similar to that used by market participants. What is less clear, however, is whether the inputs into the DCF approach are, on the whole, reliable. The expected dividend growth rate—or *E(g)*— used to compute valuations under the DCF model is ultimately and inherently a

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[43] Compare: Love and Marriage (Frank Sinatra, lyrics by Sammy Cahn, 1955).
[44] Leo Strine at Global GT LP v. Golden Telecom, p. 26-27, id.
[45] See Lane v. Cancer Treatment Ctrs. Pf Am., Inc., 2004 WL 1752847, at *31 (Del. Ch. July 30, 2004); Peter A. Hunt, STRUCTURING MERGES & ACQUISITIONS: A GUIDE TO CREATING SHAREHOLDER VALUE 51 (2009).
[46] MICHAEL C. EHRHARDT & EUGENE F. BRIGHAM, CORPORATE FINANCE: A FOCUSED APPROACH 242 (2009).
[47] It is worth noting that there are other alternatives to the CAPM, and that the CAPM has its share of weaknesses too; however, it remains a dominant measure of risk-adjustment in finance.

prediction about the future. And, while accurate and reasonable projected estimates of the perpetuity growth rate in dividends could, *in theory*, yield ROE valuation outcomes similar to the CAPM, many of the central vehicles for generating perpetuity growth rates in DCF settings seem pre-programmed to overshoot. The actual degree of divergence of valuations inferred by different decision makers through different valuation methodologies is an empirical question—one we turn to now.

III. Data and Empirical Tests

In this section, we consider data from actual rate hearings in gas and electric utilities over a twelve-year period, evaluating the extent to which the rate setting process mimics a risk-adjusted return mandate. Our approach will be to treat the awarded return on equity from a rate hearing as a type of "asset price", exploring whether such returns in a manner similar to the returns on an equity investment yielding similar returns.

A. Data and Summary Statistics

We use as our primary data source the Public Utilities Fortnightly (PUF) ROE database, which we hand-collected from 2005 through 2016. The PUF data report on awarded ROEs in gas and electric utilities' rate hearings, across all fifty US states, several Canadian provinces, and the District of Columbia. We augmented this data set by merging it with a variety of other sources. First, we added data on several macroeconomic variables and market indicatives that would have been available to the PUC decision makers at the time of each rate hearing, benchmark rates (such as US Treasuries) and widely-utilized historical and forward-looking predictions on the market equity risk premium (taken from Duff & Phelps annual survey). We also collected Compustat and CRSP data for all publicly traded utilities in our sample (or, in many cases, on their publicly traded parents and holding companies[48]), which included firm-specific information on assets, liabilities, accounting returns, and securities market pricing. To this, we added PUC-specific data from the Institute for Public Utilities at Michigan State University, tabulating the composition, elected/appointed nature and political party representation on state PUCs. Finally, we included data on a unique quasi-field experiment in

[48] It is increasingly common for individual utilities to be wholly owned subsidiaries of parent entities, which in turn own other regulated and unregulated firms. This is a limitation in our data – but we also note that it is a limitation in the data that PUCs are often constrained to use as well.

which state PUC commissioners and their staffs received (on a temporally staggered basis) immersion training in finance and valuation.

We begin with summary statistics before proceeding to present results of a series of regression analyses. Consider first the Raw PUF data, which reports on awarded ROEs in announced regulatory hearings. Figure 1 provides a histogram of awarded ROEs for the entire sample.[49] Note from the Figure that there is considerable heterogeneity around the population mean of 10.1%. At the same time, however, awarded ROEs exhibit a pronounced mode at exactly 10%, suggesting it is a focal "odometer" point for regulators. Indeed, this mode at 10% appears strongly to persist over time.

[Insert Figure 1 Here]

The PUF data report on both gas and electric rate hearings, with a small number of combined gas and electric opinions. Table 1 compares the population of gas rate cases to electric cases. Overall, awarded electric ROEs are very slightly larger than those for gas, with a gap of around twenty basis points that tends to widen at the upper ranges of awarded ROEs (sixty basis points at the 95th percentile). While still not statistically significant without controlling for other covariates, this gap will be born out with more comprehensive analysis below, and may reflect additional considerations that high-end electrical generation / transmission projects receive (e.g., solar arrays). Since we treat gas and electric rate cases in the same analysis below, we will typically include controls for the type of case.

[Insert Table 1 Here]

Table 2 reports on awarded ROEs subdivided by jurisdiction (including three Canadian provinces). Note from the table that there does appear to be some inter-jurisdiction heterogeneity. For example, several states in the South seem to have higher awarded ROEs. There many reasons for this heterogeneity, but it suggests the prudence of allowing for jurisdictional-level effects in the regressions we report below.

[Insert Table 2 Here]

[49] It is worth noting that the unit of analysis for Figure 1 (as well as the analysis that follows) is the utility regulator decision. This is not generally the same as the average ROE in effect at any one time. Indeed, because rate hearings are held on intermittent schedules, new rates do not always replace old ones at regularized intervals.

Figure 2a considers awarded ROEs over time, as a function of the order date in the regulatory rate-setting decision. Note from the figure that there is a slight decreasing trend in awarded ROEs over time, starting at nearly 11% in 2005 but decreasing over time to around 9.5% by 2016. Interestingly, however, the overall reduction in awarded ROEs is not accompanied by lower variation in announced rates, which stays roughly consistent over the entire period (standard deviations are generally in the 50-60 BP range), with the exception of 2007 and 2008, where variance increases (standard deviations in the 80-90 BP range). Notwithstanding this aggregate variation over time, it is still clear from Figure 2a that the clustering of ROE awards around 10 percent persists throughout the observational period.

Of course, *raw* awarded ROEs are not particularly well suited to compare to other financial asset prices, without controlling for capital returns. Table 2b thus considers awarded ROE *spreads* over a (roughly) risk-free benchmark: 20-year U.S. Treasury bond yields. Note from the Figure that, unlike Figure 2a there is a clear and strong upward linear trajectory in the spreads between awarded ROEs and treasuries, from around 5.5% in 2005 to approximately 7.5% in 2016. It is also clearly more cyclical than the raw ROEs, suggesting that the rate setting process may be more impervious to cycles in financial markets than the financial assets it is meant to mimic. (This cyclicity is reflected in consistently higher standard deviations of ROE *spreads* above raw ROEs over the entire period, averaging around 20 BPs.) Nearly identical dynamics can be found against other benchmarks.[50]

[Insert Figures 2a and 2b Here]

It is noteworthy from Figure 2b that awarded ROE spreads have not only been cyclical, but that they have widened over time. It is entirely possible, of course, that allowable ROE spreads over treasuries widened over this period because utilities stocks became more systematically risky during that same period. However, Figures 3a and 3b shed considerable doubt on that hypothesis. Figure 3b tracks the raw, monthly CAPM beta estimates of all publicly traded utilities in the PUF data set (based on a 60-month trailing estimate of returns). As is typical of utilities betas, they tend to be below the market-wide measure of 1.0 (though not uniformly). Note that after a slight increasing trend through 2007, equity betas for utilities began

[50] The trends are almost identical against other tenors of U.S. Treasuries, as well as prevailing LIBOR rates.

to beat a steady retreat starting in 2008, and became overall much less volatile through at least the end of 2015. If utilities stocks as a whole were becoming increasingly risky over the period studied, we would expect that utility betas would increase overall as well. But as can be seen from the figure, the utilities-index beta is generally falling over this period. Figure 3a tracks the abnormal returns of utilities ("alpha") over this period, which were very slightly (though not statistically significantly) higher than zero.

[Insert Figures 3a and 3b Here]

Finally, although not strictly an application of asset pricing, it is perhaps worth asking whether the utilities' realized market return on equity subsequent to a rate hearing matches up well with the awarded ROE.[51] This inquiry is in some ways circular, since the rate case is meant to lock in a subsequent ROE. However, utilities may incur costs or investments in assets after the rate case that cause this mechanical identity to fail. Figure 4 provides a histogram of the extent to which awarded ROEs exceeded the mean realized ROE in the two years after the rate case. As can be seen from the figure, awarded ROEs appear to overshoot realized ROEs by between 1.5 and 1.75 percent—a figure that (while not statistically distinct from zero) raises some general questions about how well utilities rate setting operates. This difference in estimates may sound small, but in the electric and gas utilities industry in the United States, with estimated sector market capitalization of $600 billion[52], it translates into roughly $10 billion a year.

[Insert Figure 4 Here]

B. Identification Strategy

(1) Asset Pricing and financial theory

To investigate the conformity of rate decisions with standard predictions from finance, we now proceed to consider the awarded ROE, treating it as if it were an asset-pricing return on a traded financial asset. More specifically, to assess whether regulators are setting ROEs in a

[51] We calculate realized market return on equity as the investment return (including distributions) realized shareholders over the two years subsequent to the rate hearing.
[52] http://www.investopedia.com/articles/investing/031116/utilities-sector-industries-snapshot-nee-gas.asp

manner consistent with risk-adjusted returns, we test whether awarded ROEs behave on average in a manner that would predicted by the Capital Asset Pricing Model at the time the regulatory decision is made. We focus on CAPM for a variety of reasons. First, it is well known and accepted among finance practitioners and academics as a vehicle estimating returns. By contrast, the (so-called) DCF approach described above has far less acceptance. Second, unlike other empirical asset pricing models (such as Fama-French or other multi-factor models), the CAPM's key input – the market equity risk premium (ERP) – has readily available *forward looking* predictions available for it. Such predictions, in fact, are a key input into valuation arguments that utilize the CAPM, and are generally not available for Fama-French.

The methodology we use requires essentially a two-step process. First, we use CAPM to derive forward-looking predictions of ROE spreads for each utility in our data set at the time of the rate announcement. Second, we compare these predictions to the ROE spreads actually awarded by the regulator, which (as noted above) we hand-collect from 2005 through 2016. The second stage of this process is represented as follows. For each observed rate case with an ROE finding, we consider the following specification:

$$\left(R_{i,t} - r_{f,t}\right) = c_0 + c_1 \cdot \hat{S}_{i,t} + \gamma \cdot Z_{i,t} + \varepsilon_{i,t} \tag{4}$$

where $\left(R_{i,t} - r_{f,t}\right)$ represents the awarded ROE spread over the risk free rate for utility *i* at time *t*, $Z_{i,t}$ is a series of controls (discussed below, and including potential experimental manipulations) and $\varepsilon_{i,t}$ is an error term. The term $\hat{S}_{i,t}$ in (2) is the *predicted* spread of utility *i*'s stock at time *t*, which we derive at the utility level from the predictions of the CAPM. This predicted spread is given by the well-known expression:

$$\hat{S}_{i,t} = \alpha_{i,t} + \beta_{i,t} \cdot E\left(R_{M,t} - r_{f,t}\right) \tag{5}$$

where $\beta_{i,t}$ is the utility stock's risk relative to the market (its "beta"), $\alpha_{i,t}$ is the stock's abnormal deviation from the CAPM (or its "alpha"), and $E\left(R_{M,t} - r_{f,t}\right)$ is the anticipated equity risk premium (ERP). Although the textbook version of CAPM predicts that $\alpha_{i,t} = 0$ for all securities, we allow for deviations based on empirical relationships observable at the time of the rate hearing (and plausibly applicable to utilities). If regulator behavior is consistent with the predictions of CAPM, we would expect $c_0 = \gamma = 0$, and $c_1 = 1$ in Equation (4).

In all the regressions below, we utilize estimated utility- and time-specific values of $\alpha_{i,t}$ and $\beta_{i,t}$, using firm-level data if the utility is public and industry proxies otherwise. In our baseline specifications, we omit all non-CAPM controls; but later we include other (theoretically extraneous) controls that pertain to the commission hearing the rate hearing, including political party composition, size, and fraction elected versus appointed, as well as size and capital structure data on the utility. (This allows us to test the null hypothesis that all extraneous variables are irrelevant to the ROE determination—a hypothesis we reject.) As noted above, the strong prediction of the CAPM is that the coefficient $c_1 = 1$ while $c_0 = 0$. We acknowledge, as others have noted, the CAPM may under-predict returns for smaller-capitalization firms, as well as firms that have extreme market-to-book ratios, inducing a non-zero estimate of $\alpha_{i,t}$. However, we attempt to control for this by including estimates of $\alpha_{i,t}$ when available.

Our analysis explores a variety of estimation approaches for (4) and (5). For publicly traded utilities, we utilized both raw estimated 60-month alphas and betas (as of the month of the rate order), as well as a blended "Ibbotson-adjusted" values of alpha and beta which is a weighted average of the raw beta and/or alpha (weight 2/3) with industry wide counterparts (weight 1/3). For non-traded utilities, the industry alpha and beta prevailing at the time of the PUC order are used. For the ERP, we consider both the historical ERP measure and the (supposedly) more forward looking "Supply-Side" measure, both widely employed by financial professionals and provided by Duff and Phelps on an annual basis.[53] (We confirmed that each of these measures would have been available to the PUC at the time of each rate order.)

Consider our first set of regressions pictured in Table 3, which reports on a basic set of CAPM regressions (with standard errors clustered at the state level, as in all remaining regressions). Note from the Table that our key coefficient of interest, c_1, is not only nowhere near 1.0 (as predicted by the CAPM), but it is consistently *negative* in value. In all specifications, the estimate of c_1 is statistically and economically distinct from its predicted value (of 1) at any conventional confidence level. In addition, the constant (c_0) in the regression appears to reflect a substantial "regulatory abnormal return" embedded in the awarded ROE, above and beyond abnormal deviations predicted through empirical alpha values. The

[53] In all cases, we utilize the ERP predictions from Duff & Phelps, Stocks, Bonds, Bills, and Inflation (SBBI) Yearbook (2005-16) (now published by Wiley & Sons).

inconsistency of awarded ROEs with CAPM, moreover, persists even in the presence of state and year fixed effects.[54] We view this as strong evidence that whatever regulators are doing, they are *not* generally applying accepted asset pricing models to generate forward-looking estimates of equity cost of capital.

[Insert Table 3 Here]

(2) Extended Model

We now proceed to test several correction factors, shedding light on possible factors driving the deviation of regulators from CAPM predictions. If PUCs are not adhering, on average, to asset-price mimicking behavior, then what may be driving their decisions? In this section we lay out a set of hypothesis for $Z_{i,t}$ that might explain the phenomenon, and test them empirically.

a. Financial stability

The patterns we observe above may be driven by risk- or ambiguity-aversion among regulators, who disproportionally discount upside relative to downside political uncertainties.[55] The incentives underlying commissioners' decision making potentially result in a more risk averse policy than is socially desirable. Because the operating failure of utilities is often considered as a social catastrophe, regulators are likely internalize the risk of a financial failure of utilities as cataclysmic.[56] Commissioners are the ultimate political risk bearers for the utility's financial stability; financial distress of the utility carries a heavy political toll. In contrast, the costs of excessive electricity rates is a diffuse one, dispersed among all electricity consumers. Slavishly sticking to standard asset pricing formulations could incentivize utilities to run operations extremely close to the bone. Interruptions in the continuous electricity service and

[54] We note that the inclusion of year fixed effects could absorb much of the explanatory power of our predicted spreads based on CAPM (since the ERP figures vary only annually). Nevertheless, the abnormal regulatory returns remain significant in these specifications.
[55] Eric L. Talley, *On Uncertainty, Ambiguity, and Contractual Conditions,* 34 DEL. J. Corp. L. 755, 767 (2009).
[56] Talley, supra note 55 *id*.

financial distress of the utility undermine the public trust in the commission, potentially leading to a crisis of confidence in public governance.[57]

Commissioners' interests are thus better served by a bias toward greater institutional stability. Significantly, the asymmetrical regulatory incentives and the presence of regulatory capture or revolving doors are independent variables. Commissioners' interests are better served by promoting the industry's interests in higher rates regardless of their future employment opportunities at the regulated industry. Even the most dedicated public servant is expected to be biased towards higher rates given the expected public opinion in case of an operating default. As higher leverage typically results in higher estimated probabilities of financial distress[58], theoretically, utilities can use this regulatory risk aversion and strategically add higher leverage and thereby induce regulators to award higher rates. It is therefore a plausible hypothesis that rate regulators will respond to leverage as a prominent proxy in their rate-making process.

Realized ROEs tend to be persistently and positively related to leverage of all firms, including utilities as shown in Figure 5 below (generated from all public utilities represented in the PUF data).

[Insert Figure 5 Here]

However, our results suggest that in the regulated setting, higher debt-equity ratios appear to have no systematic relationship to awarded ROEs, and leverage appears not to have predictive value as to awarded ROEs (as shown in Table 4 below).

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[57] Azgad-Tromer, supra note __ id. Interruptions of power provision are often considered as social catastrophe and induce a crisis of confidence in public governance, triggering political response. For example, as California utilities were facing bankruptcy in 2001, California imposed statewide rolling blackouts, and ultimately authorized hundreds of millions of dollars to ensure adequate power flows, in what is often referred to as the "California Energy Crisis". LINCOLN L. DAVIES, ALEXANDRA B. KLASS, HARI M. OSOFSKY, JOSEPH P. TOMAIN AND ELIZABETH J. WILSON, ENERGY LAW AND POLICY 54 (2015). In 2003, blackout in the East Coast led to loss of power to over 50 million consumers as the networks in New York, Ontario, Northern Ohio, Michigan and a portion of other states collapsed, with over 60,000 MW of generating capacity knocked out of service, initiating the codification of reliability standardization by the U.S. Congress. https://en.wikipedia.org/wiki/Northeast_blackout_of_2003; http://www.elp.com/Electric-Light-Power-Newsletter/articles/2016/08/13-years-after-the-northeast-black-of-2003-changed-grid-industry-still-causes-fear-for-future.html

[58] For this reason, financial regulators often supervise leverage ratios in banks. See for example Basel III leverage ratio requirements : http://www.bis.org/publ/bcbs189.pdf

b. Operating Reliability

Rate regulators possibly aim to use the rate setting process to sustain thicker operating margins and thereby enhance the reliability of power provision and generation. The continuous and uninterrupted power service is an inherent expectation of our social lives, a core element of the social contract. Higher rates may serve to create an equity cushion that mitigates the risk of power outages due to the technical determinants of electrical energy provision. Reliable and continuous service by utilities requires such equity cushion due to the technical demands of energy provision. First, expenditures are particularly volatile for utilities, as their critical infrastructure is typically very expansive and custom-made, and is prone to severe storms and other natural disasters.[59] Excess capacity induced by supranormal rates may thus serve to sustain operating reserves sufficient to respond to sudden outages of generating plants or transmission lines, sufficiently quickly to accommodate the frequency, voltage, and stability technical parameters required to respond and sustain reliability of electricity service.[60] Second, because electric energy cannot be easily stored, it must be produced and delivered practically simultaneously. "Inventorying" power is still beyond the capacity of most generators. Sustaining the continuous and uninterrupted electricity service therefore requires maintenance of continuous and almost instantaneous balance between production and consumption of electricity in power systems.[61] On certain occasions (such as the Super Bowl), utilities can expect the spike in demand, but not all spikes and dips can be foreseen. To mitigate the risk of power shortages and blackouts, some margin of excess generation capacity above the expected demand load must be kept at all times.[62] Higher awarded rates can sustain investments in excess capacity and thereby enhance the reliability of energy provision in light of the volatility of capital expenditures and the lack of technical storage feasibility.

We are currently investigating these relationships empirically.

c. Commission Composition

Table 4 expands the analysis of Table 3 by adding a variety of firm-level and / or PUC-level controls, as well as a control for electricity rate cases.[63]

[Insert Table 4 Here]

Commission-level controls in Table 4 appear to provide some parts of the story behind regulatory rate setting. Note first that the number of commissioners on the PUC tends to predict a small reduction in "abnormal" awarded ROEs, possibly reflecting the possibility that larger commissions will are more likely to have either commissioners or staff with financial expertise. In addition, we find that the percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award over 100 basis points lower returns on equity than completely appointed ones. This electoral effect may represent the cost that commissioners pay with rate payers by setting rates too high, and/or the greater impediments to regulatory capture by elected commissioners. Party-affiliated commissioners also appear to be associated with lower ROEs, though this effect does not appear to persist with the introduction of state and year fixed effects, which are likely to absorb party-associated effects for relative stable PUC political compositions (as many are).

This result prompts the need in further research on structural design of the rate setting process. Most of the literature that is concerned with regulatory capture has been developed in the context of utility regulation.[64] Regulators often have an industry background, and their discretion may be biased due to the cultural proximity, including the shaping of assumptions, lenses and vocabularies as well.[65] Industry actors may provide a variety of inducements, including future employment options and selectively burnishing the reputational capital of commissioners, each of which might enhance their tendency to make pro-industry decisions.[66]

[63] All regressions in the Table utilize Ibbotson-adjusted Beta estimates and Supply-Side ERPs.

[64] Ernesto Dal Bo, *Regulatory Capture: An Overview*, 22 OXFORD REVIEW OF ECONOMIC POLICY 203 (2006). Capture was recently defined by The Tobin Project as "the result or process by which regulation… is consistently or repeatedly directed away from the public interest and towards the interests of the regulated industry"

[65] James Kwak, Cultural Capture, in PREVENTING REGULATORY CAPTURE supra note **Error! Bookmark not defined.** id. DANIEL CARPENTER AND DAVID A. MOSS, PREVENTING REGULATORY CAPTURE 15 (2014).

[66] For a specific application of revolving doors in public utility commissions, see Marc T. Law and Cheryl X. Long, *Revolving Door Laws and State Public Utility Commissioners*, 5 REGULATION & GOVERNANCE 405–424 (2011). For a strategic defense of revolving doors' efficiency see David J. Salant, David J, Behind the Revolving Door: A New View of Public Utility Regulation, 26(3) THE RAND JOURNAL OF ECONOMICS, 362–377 (1995).

The institutional, professional and social proximity of rate regulators to executives of regulated utilities suggests that aspects of regulatory capture may play some role, though we are not readily able to quantify this effect. Indeed, few regulators have been found guilty of corruption and capture theory has scant empirical support. The literature on capture remains focused on inferences from statistical correlations: Looking at the ultimate beneficiaries of the regulatory outcome and inferring the regulatory purpose from there.[67] Our results suggest that some regulatory structures may be more susceptible to capture than others, possibly suggesting various potential defense mechanisms jurisdictions might utilize. (We leave such questions largely to future research.)

d. Expertise and Training: A Quasi-Field Experiment

Although PUC commissioners and staff may be incentivized by a variety of factors other than asset-pricing concerns when setting rates, another factor deserving attention is whether the regulatory decision makers simply lack the expertise to evaluate finance-based arguments, thereby causing them to look to orthogonal factors. In other words, is the stark deviation from the predictions of CAPM illustrated above an artifact of some type of regulatory limitation on competence or receptivity to finance, or is it more reflective of inadequate training of regulators?

Our data allow us to test this question, using a fortuitous natural experiment. The Institute for Regulatory Law & Economics (IRLE) is a regulatory training endeavor sponsored by the University of Colorado Law School's Silicon Flatirons Center as a means of supporting thoughtful regulatory decision-making. From 2004-2016, the IRLE hosted an annual one-week summer workshop for state public utility commissioners and staff, with the goal of educating regulators about how to use economic analysis within the regulatory decision making.[68] The IRLE advertised its annual program as follows:

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[67] Daniel Carpenter, D*etecting and Measuring Capture,* in PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST AND HOW TO LIMIT IT (Daniel Carpenter and David A. Moss eds,2014); Ernesto Dal Bo and Martin A. Rossi, C*orruption and Inefficiency: Theory and Evidence from Electric Utilities*, 91 JOURNAL OF PUBLIC ECONOMICS, 939-962 (2007).For a specific application of revolving doors in public utility commissions, see Marc T. Law and Cheryl X. Long, *Revolving Door Laws and State Public Utility Commissioners*, 5 REGULATION & GOVERNANCE 405–424 (2011). For a strategic defense of revolving doors' efficiency see David J. Salant, David J, Behind the Revolving Door: A New View of Public Utility Regulation, 26(3) THE RAND JOURNAL OF ECONOMICS, 362–377 (1995).
[68] The institute did not host a Summer Workshop in 2015.

> Each May, the IRLE hosts a seminar geared towards educating state regulators about economic analysis of regulatory policy issues. Notably, the Institute distills the critical law and economics issues that arise in closely-regulated network industries and presents them in a coherent fashion. To present its curriculum, the IRLE draws on the expertise of leading academics, practitioners, and scholars. In short, the IRLE teaches regulators how to appreciate insights that emerge from important economic principles and concepts as well as how to apply them to regulatory situations in network industries.[69]

For the first four years of the workshop, finance was *not* included as part of the curriculum; but beginning in 2008, the IRLE began to devote an entire day (6 hours of lecture time) to finance, where regulators were exposed to some of the key components to discounted cash flow analysis and the CAPM, using examples from actual rate cases to motivate discussion.[70]

Although participants in the workshop were required to opt into attendance (and thus they self-selected), the mid-stream introduction of finance content helps to address some of the concerns that one might have with selection bias. In several baseline specifications, we compare treated commissions (i.e., those who attended) with untreated ones (those who never attended). However, in other specifications we consider the effect of finance training solely within the population of commissions that opted the IRLE workshops (effectively constructing a "placebo" group consisting of those PUCs who opted into the workshop but did not receive finance training in the first four years). Table 5 summarizes the first year in which the commissions in our observation sample attended IRLE's program, as well as the first year the commission received "treatment" by finance training. (In some cases, the commission attended the program but did not receive finance treatment because their years of attendance pre-dated the provision of finance).

[Insert Table 5 Here]

Our identification strategy comes from the following specification:

$$\left(R_{i,t} - r_{f,t}\right) = c_0 + c_1 \cdot \hat{S}_{i,t} + c_3 \cdot FinTrain_{i,t} + c_4 \cdot FinTrain_{i,t} \cdot \hat{S}_{i,t} + \gamma \cdot Z_{i,t} + \varepsilon_{i,t} \quad (6)$$

[69] IRLE Website: https://siliconflatirons.org/events/institute-for-regulatory-law-and-economics-irle/

[70] In the interests of full disclosure, one of the co-authors of this study (Talley) delivered the finance course in every year it was offered.

This specification is identical to equation (4), except for the addition of (a) an affine treatment effect variable $FinTrain_{i,t}$ that takes on the value of 1 if any member/staffer of PUC i has received finance training treatment on or before year *t*, and (b) a slope-shifting interaction term $FinTrain_{i,t} \cdot \hat{S}_{i,t}$, which allows for a training-induced change in the coefficient on the slope of the expected spread of the utility. The treatment effect from CAPM training would thus plausibly be reflected through shocks to both coefficients c_3 and c_4. Given the deviations from CAPM found in Tables 3 and 4 above, training would induce regulatory decisions more line with finance theory if $c_3 < 0$ and/or $c_4 > 0$. (Note in addition that the average combined CAPM coefficients for treated commissions would be a summed shift effect of $(c_0 + c_3)$ and a summed slope effect of $(c_1 + c_4)$.)

Tables 6 summarizes our results.[71] In the Table, the left panel considers all untreated PUCs, as a control, regardless of whether they opted to attend the IRLE program; the right panel retains only those PUCs that participated in the IRLE program (a universe that includes a "placebo" group never treated with finance training). As the Table illustrates, finance training results in some *moderate* effects on later ROE setting. First, the effect of finance training on the shift parameter (c_3) is consistently negative and statistically significant in the presence of various utility-level controls. Its economic significance (around 50 bps) is also notable, representing just under one standard deviation in raw announced spreads (see Table 1). Second, finance training also alters the CAPM slope coefficient the predicted direction, albeit modestly. The point estimates of the slope parameter (c_4) is mildly positive, but not statistically significant; and the point estimate is high enough that, when combined with the baseline slope estimate, treated PUCs exhibit a very slight positive relationship between systematic risk and awarded ROE. The electoral responsiveness of commissions appears to persist in the presence of treatment, but the size effect disappears in the right panel of regressions, suggesting that PUCs seeking treatment (regardless of whether they received finance training) tended to alter their decision making less as a function of size than untreated commissions.

[Insert Table 6 Here]

[71] As with the previous results, Table 6 clusters standard errors at the state level.

Two caveats deserve explicit attention before proceeding. First, we cannot rule out whether our findings as to the trainability of PUC regulators and staffs turned critically on the specific design of the treatment offered. The training program, part of a larger week-long immersion program in regulatory law and economics, was consistently staffed by substantially the same faculty over the observation period, proceeding in roughly consistent sequence. Although we observe program where finance training was not part of the curriculum (a convenient form of heterogeneity for selection-bias correction), our data therefore still do not permit us to distinguish about whether a peculiar aspect of this specific program was particularly effective.[72]

Second, to the extent that training is effective, we want to be cautious about whether greater fidelity to asset pricing is itself conducive to overall welfare concerns. Indeed, to the extent that accurate risk-adjusted returns adjudication crowds out other laudable social policy goals, the trainability of regulators may ultimately be normatively undesirable, at least for certain plausible alternative objectives regulators may pursue (such as dynamic incentive provision). We note, however, that while training tends to dampen several other predictive factors in rate-setting, they remain in the picture, and thus it does not necessarily follow that better risk pricing necessarily crowds out other goals.

All told, we view these results as evidence that there exists some potential to train legal decision-makers to utilize the concepts of finance. We note that the effect is concentrated in the shift parameter, and that it is still a fraction of the size of the abnormal portion of the ROE spread. Training evidently has mild effects on PUCs' responsiveness to prevailing systematic risk through the slope parameter. It may be possible that a multi-day or otherwise more immersive form of training would have even greater effects, but our data do not permit us to unpack this possibility.

[72] We note, for example, that finance training component in all observed years was provided by a single instructor (Talley).

IV. Conclusion

Under U.S. law, a public utility is entitled to earn a return on the value it employs for the convenience of the public equal to that made on investments in other businesses which are attended by corresponding risks.[73] We conducted an empirical analysis of rates awarded by PUCs in the U.S. and in Canada over a twelve year period (2005-2016), in order to assess the relationship of awarded rates of return on equity to standard asset pricing models adjusting expected rates of return with anticipated risks. Our analysis demonstrates that rate setting practices adopted by PUCs diverge appreciably (even violently) from the predictions of financial economics across numerous dimensions.

Instead, our analysis suggests that current regulatory practice more plausibly reflects an amalgam of other desiderata that include political goals, incentive provision, insufficient financial expertise and regulatory capture. We identify some factors may be at play, including the possibility that regulators' behavior reflects objectives that are either orthogonal or opposed to precise risk-return calibration, such as serving political constituencies, providing dynamic incentives, and possibly even regulatory capture. We find evidence that the structural composition of the commission is correlated with the awarded rates: The percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award up to 115 basis points lower returns on equity than completely appointed ones. We additionally conjecture that the divergence of observed regulatory behavior from asset-pricing fundamentals may be due (in part) to a lack of financial valuation expertise among regulators. To test this conjecture, we study a unique field experiment that exposed commissioners and their staffs to immersion training in finance. We find evidence that treated PUCs began to issue ROE rulings that were (moderately) more aligned with standard asset pricing theory than those of untreated placebo groups.

[73] Bluefield Waterworks v. Public Service Comm'n, 262 U.S. 679 (1923). Accord FPC v. Hope Natural Gas Company, 320 U.S. 591 (1944)

Appendix: Tables and Figures

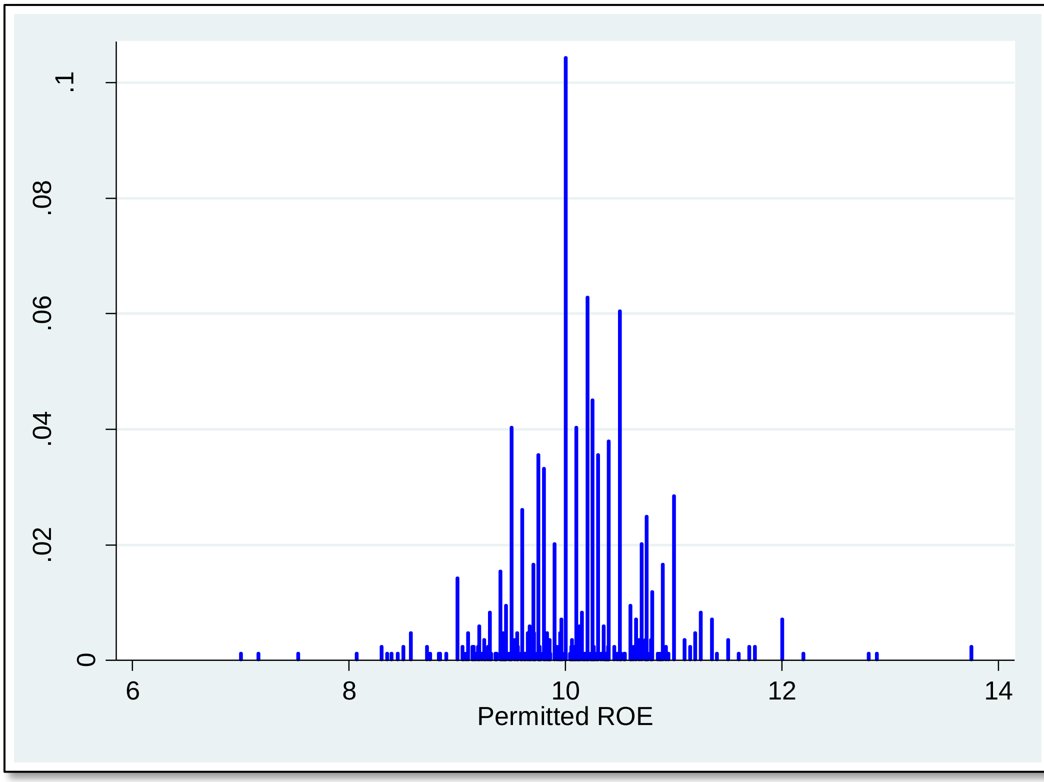

Figure 1: Histogram of Awarded ROEs (Source: Public Utilities Fortnightly, 2005-2016)

	Combined	Gas	Electric
Mean	10.113	10.014	10.188
S.D.	0.650	0.635	0.647
5%	9.14	9.05	9.23
25%	9.75	9.69	9.80
50%	10.10	10.10	10.15
75%	10.50	10.40	10.50
95%	11.00	10.85	11.25
N Obs	844	364	482

Table 1: Awarded ROE by Utility Type

State	Obs	Mean	S.D.	Min	Max	State	Obs	Mean	S.D.	Min	Max
AB	4	9.288	1.324	8.3	11.1	NC	10	10.460	0.306	10	11
AK	8	10.817	1.441	9.3	12.875	ND	9	10.350	0.483	9.5	10.75
AL	4	12.275	1.703	10.8	13.75	NE	4	9.925	0.395	9.6	10.4
AR	14	9.829	0.285	9.4	10.25	NH	5	9.636	0.076	9.5	9.67
AZ	12	9.938	0.490	9.5	11	NJ	10	9.920	0.283	9.55	10.3
CA	24	10.797	0.689	8.5	11.6	NL	1	8.500	.	8.5	8.5
CO	21	10.131	0.988	7.53	12	NM	7	9.906	0.293	9.48	10.27
CT	13	9.486	0.498	8.75	10.25	NV	15	10.163	0.420	9.3	10.7
DC	5	9.555	0.284	9.25	10	NY	44	9.514	0.464	9	10.7
DE	6	9.908	0.213	9.7	10.25	OH	13	10.258	0.301	9.84	10.65
FL	15	10.740	0.539	10	11.75	OK	13	10.280	0.343	9.5	10.75
GA	6	10.728	0.346	10.12	11.15	ONT	12	8.958	0.480	8.35	9.43
HI	9	10.200	0.570	9	10.7	OR	22	9.882	0.247	9.4	10.175
IA	11	10.609	0.835	10	12.2	PA	3	10.267	0.231	10	10.4
ID	15	10.170	0.595	9.5	12	QUE	1	8.900	.	8.9	8.9
IL	53	9.807	0.560	8.72	10.68	RI	5	9.960	0.508	9.5	10.5
IN	33	10.002	0.613	7	10.5	SC	11	11.009	0.717	10.2	12
KS	9	9.756	0.422	9.1	10.4	SD	1	9.250	.	9.25	9.25
KY	16	10.252	0.228	9.8	10.63	TN	5	10.206	0.166	10.05	10.48
LA	23	10.648	0.477	9.95	11.25	TX	24	9.869	0.254	9.5	10.4
MA	18	9.737	0.319	9.2	10.35	UT	11	10.160	0.294	9.8	10.61
MD	23	9.767	0.327	9.31	11	VA	28	10.118	0.438	9.5	11.5
ME	7	9.929	0.766	8.45	11	VT	7	9.923	0.427	9.45	10.7
MI	39	10.472	0.323	9.9	11.15	WA	29	10.045	0.285	9.5	10.4
MN	31	10.054	0.682	7.16	10.88	WI	86	10.457	0.414	9.45	11.2
MO	23	10.132	0.479	9.5	11.25	WV	1	9.750	.	9.75	9.75
MS	5	9.587	0.315	9.225	10.07	WY	18	10.144	0.507	9.5	10.9
MT	2	9.650	0.212	9.5	9.8						

Table 2: Awarded ROE by Jurisdiction (Incudes some Canadian Provinces)

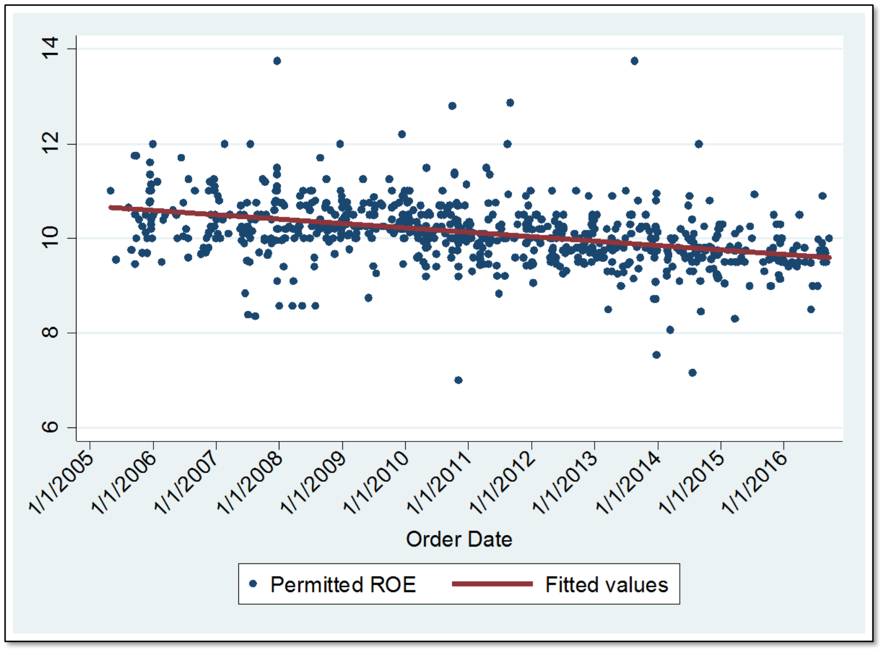

Figure 2a: Awarded ROEs, by Order Date

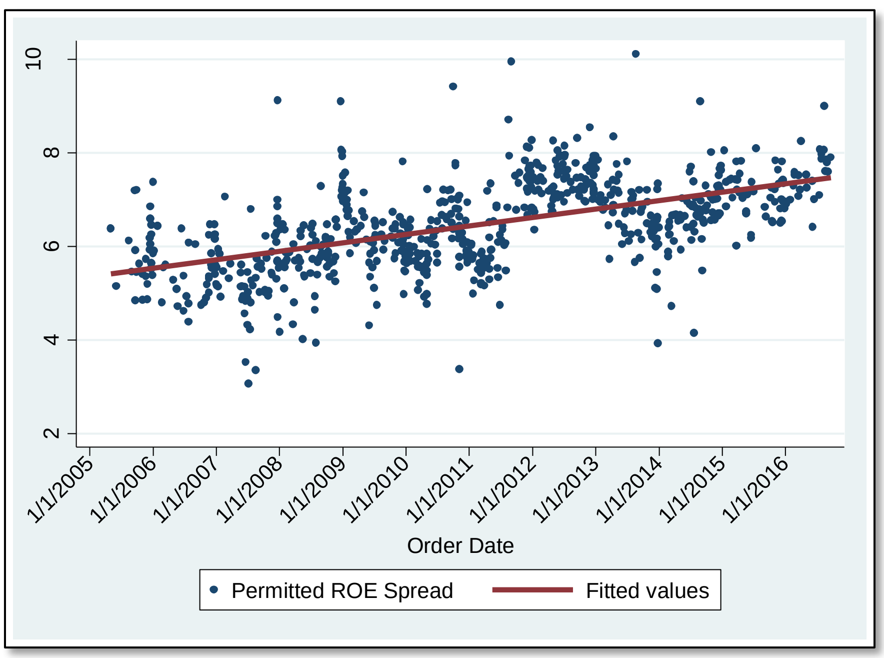

Figure 2b: Awarded ROE spreads over 20-yr US Treasuries, by Order Date

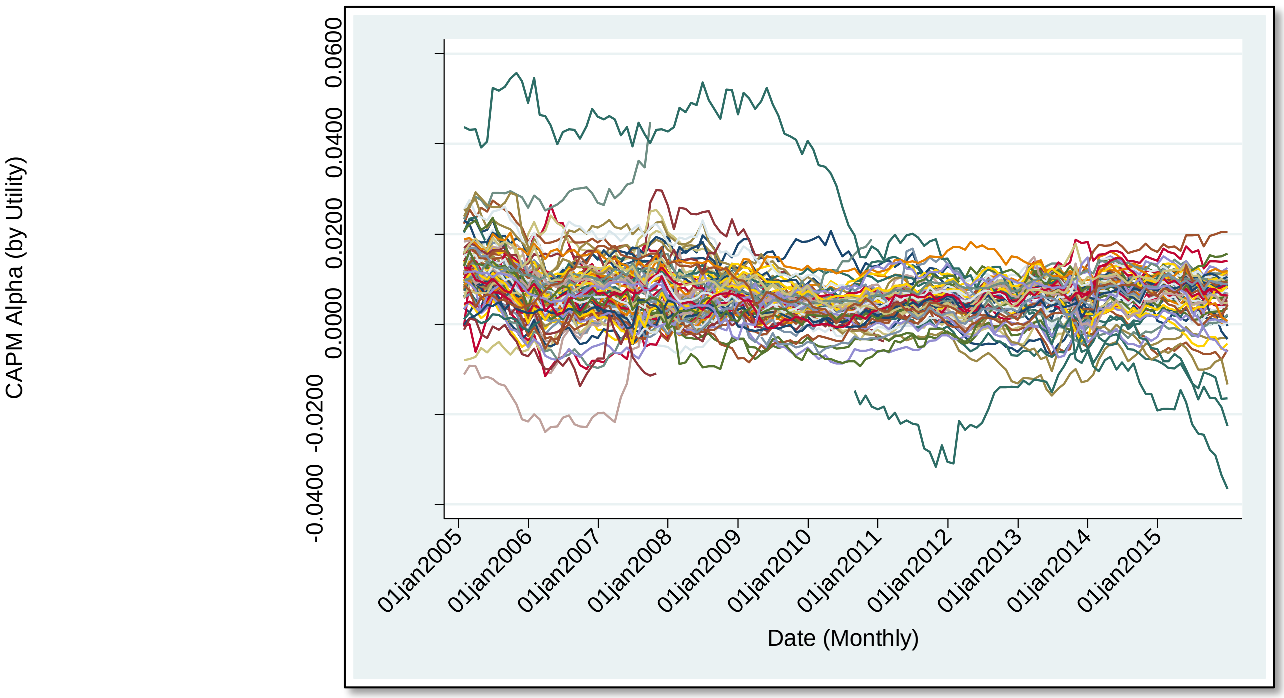

Figure 3a: Utility Alphas, by Month (60-month trailing CAPM estimation). Source: CRSP

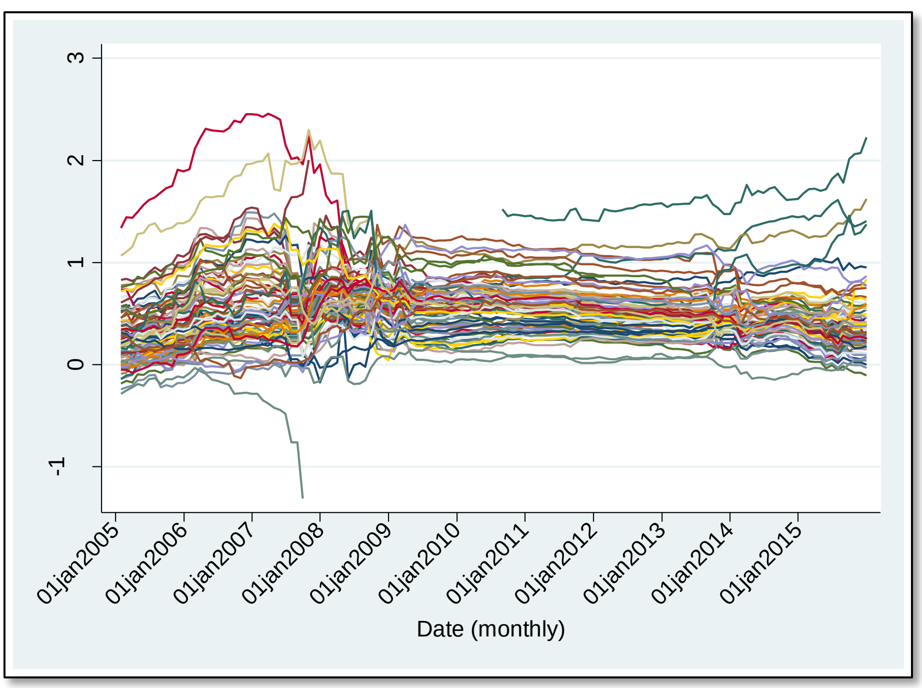

Figure 3b: Utility Betas, by Month (60-month trailing CAPM estimation). Source: CRSP

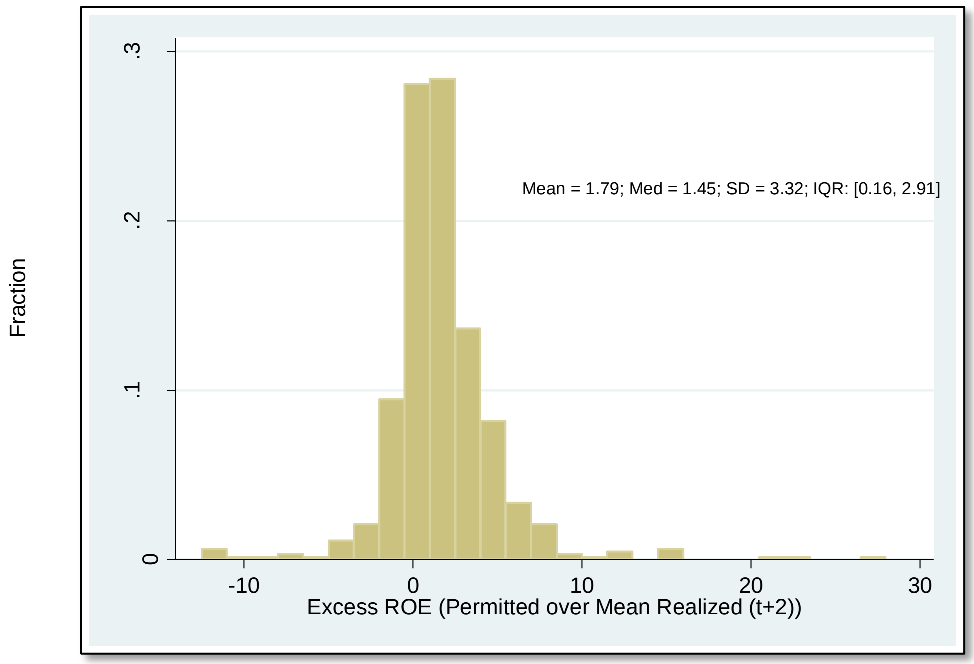

Figure 4: Excess of Awarded ROE over Mean Realized ROE (Two-Year Lead)

	Raw a & bx Historical ERP				Raw a & bx Supply-Side ERP			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
a + b· ERP	-0.136***	-0.011	-0.141***	-0.013	-0.142***	-0.011	-0.147***	-0.014
	(-7.62)	(-0.80)	(-7.46)	(-0.93)	(-7.00)	(-0.73)	(-6.85)	(-0.88)
Constant	7.038***	7.658***	7.061***	7.735***	7.002***	7.655***	7.022***	7.733***
	(69.52)	(69.01)	(88.51)	(91.13)	(69.49)	(69.26)	(86.54)	(90.90)
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.0608	0.5052	0.061	0.506	0.0527	0.5052	0.053	0.506
c^2	58.093	1173.033	55.61	106.64	48.967	1166.418	46.92	106.62
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	840	840	840	840	840	840	840
H_A: a + b · ERP = 1	4068***	5684***	3649***	5211***	3163***	4338***	2853***	4022***
H_B: a + b · ERP = 1\ Constant = 1	5219***	7493***	7834***	4723***	4907***	6574***	7489***	4412***
	Ibbotson a & bx Historical ERP				Ibbotson a & bx Supply-Side ERP			
	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
a + b· ERP	-0.229***	-0.014	-0.236***	-0.018	-0.237***	-0.015	-0.243***	-0.019
	(-8.86)	(-0.71)	(-8.66)	(-0.85)	(-8.00)	(-0.64)	(-7.81)	(-0.79)
Constant	7.437***	7.671***	7.469***	7.753***	7.363***	7.667***	7.389***	7.748***
	(61.52)	(63.04)	(64.53)	(79.30)	(60.88)	(63.21)	(62.50)	(78.90)
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.0865	0.5051	0.086	0.506	0.0731	0.5051	0.073	0.506
c^2	78.469	1168.482	75.08	106.56	64.017	1161.716	60.92	106.54
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	840	840	840	840	840	840	840
H_A: a + b · ERP = 1	2254***	2542***	2053***	2363***	1748***	1936***	1593***	1819***
H_B: a + b · ERP = 1 & Constant = 1	3811***	4333***	4164***	3149***	3924***	4124***	3906***	3172***

Table 3. CAPM OLS regressions. Dependent Variable = Permitted ROE spread over 20-year US Treasuries, by rate case. The panels explore permutations of equity as and bs (Raw versus Ibbotson-adjusted) and the market Equity Risk Premium (Historical versus Supply-Side), always estimated on the month of the PUC order. (For non-traded utilities, the industry a and b prevailing at the time of the PUC order is used.) Test statistics for notable CAPM hypotheses are shown in the bottom of each panel. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels; t-stats in parentheses. Standard Errors clustered by state.

	[1]	[2]	[3]	[4]	[5]	[6]
a + b· ERP	-0.217***	-0.222***	-0.209***	-0.022	-0.023	-0.024
	(-7.66)	(-7.17)	(-6.98)	(-0.90)	(-0.96)	(-0.91)
Constant	6.775***	8.275***	7.811***	7.558***	8.057***	8.091***
	(23.11)	(27.74)	(16.79)	(26.88)	(40.19)	(23.49)
Electric	0.092	0.182***	0.095	0.175***	0.188***	0.163***
	(1.46)	(2.99)	(1.60)	(4.02)	(4.54)	(3.90)
ROE	-0.002		-0.004	0		0
	(-0.43)		(-1.06)	(0.02)		(-0.20)
ln(Assets)	0.063+		0.069+	0.005		0.007
	(1.85)		(1.83)	(0.19)		(0.25)
D/E Ratio	-0.034		-0.025	0.009		0.016
	(-0.92)		(-0.62)	(0.34)		(0.54)
# of Commissioners		-0.138***	-0.143***		-0.061*	-0.083**
		(-3.58)	(-3.74)		(-2.21)	(-2.58)
Percentage Elected		0.24	0.169		-1.171***	-1.168***
		(1.00)	(0.67)		(-3.76)	(-3.52)
Percentage Women		0.163	-0.026		0.074	-0.051
		(0.48)	(-0.08)		(0.36)	(-0.23)
Percentage Democrat		-0.898***	-0.790***		-0.015	0.08
		(-3.55)	(-3.47)		(-0.09)	(0.49)
Percentage Republican		-0.523*	-0.497+		0.012	-0.001
		(-1.98)	(-1.86)		(0.07)	(-0.01)
State Fixed Effects	No	No	No	Yes	Yes	Yes
Year Fixed Effects	No	No	No	Yes	Yes	Yes
R^2	0.10	0.15	0.16	0.55	0.53	0.56
c^2	75.466	175.353	180.195	112.73	17288.17	322.97
p-val	0	0	0	0	0	0
N	705	823	699	705	823	699
H_A: a + b · ERP = 1	1853***	1555***	1634***	1692***	1847***	1516***
H_B: a + b · ERP = 1 & Constant = 1	1884***	2059***	1783***	910***	1141***	773***

Table 4. CAPM regressions with additional utility- and PUC-level controls. Dependent Variable = Permitted ROE spread. All Beta computations are Ibbotson adjusted and use Supply-Side Equity Risk Premium. Test statistics for notable CAPM hypotheses are shown in the bottom panel. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels; t-stats in parentheses. Standard Errors clustered by state.

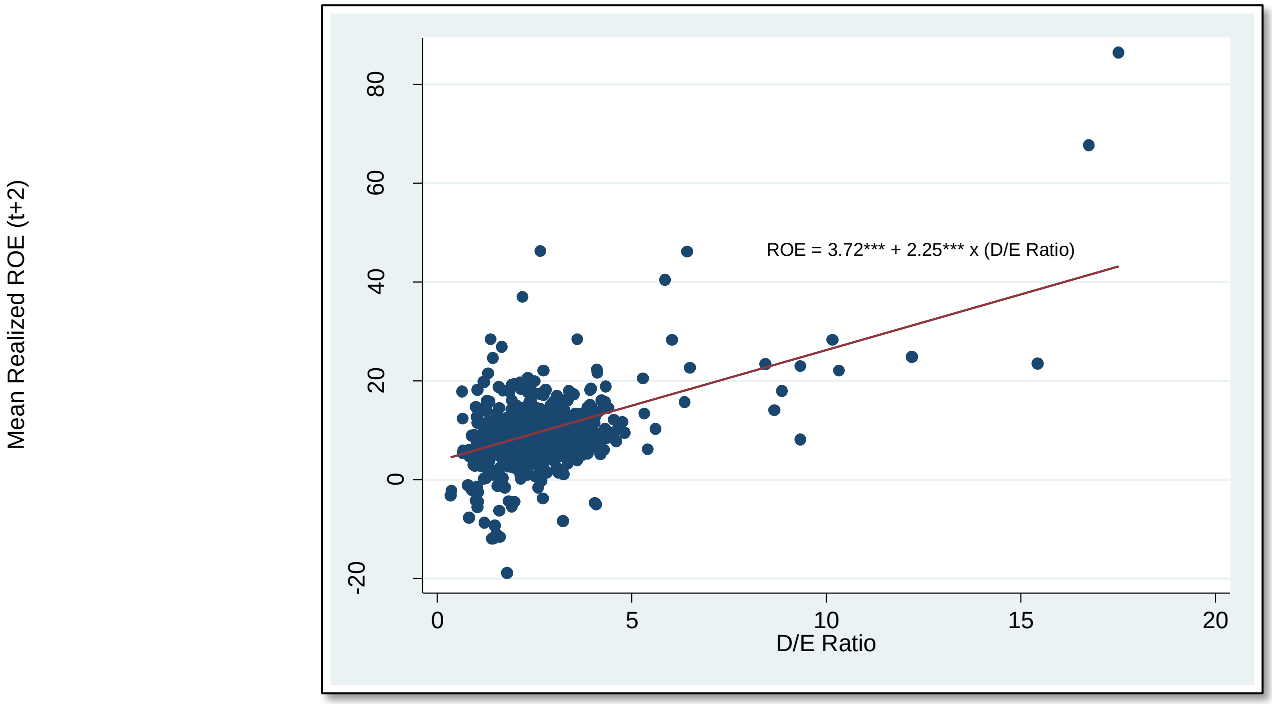

Figure 5. Mean Realized ROE (Two-Year Lead) and D/E Ratio. Source: Compustat, 2005-2016. (***=significance at the 0.001 level)

State	1st IRLE Year	1st Finance Year	State	1st IRLE Year	1st Finance Year
AL			MT	2004	2011
AK	2004	2008	NE		
AZ	2010	2010	NV		
AR	2004	2016	NH	2005	
CA	2004		NJ		
CO	2004	2008	NM	2005	
CT	2011	2011	NY		
DC	2004	2009	NC	2004	2016
DE			ND	2004	2010
FL	2004	2012	OH	2012	2012
GA			OK	2005	
HI			OR	2004	2013
ID			PA	2013	2013
IL	2005	2008	RI	2005	2008
IN	2004	2008	SC	2005	2009
IA	2004	2011	SD	2004	2013
KS	2004	2011	TN	2006	2011
KY	2012	2012	TX	2005	
LA			UT		
ME			VT	2007	2008
MD	2004		VA		
MA	2004	2008	WA	2007	2012
MI	2007	2009	WV		
MN	2008	2008	WI	2005	2009
MS			WY		
MO	2004	2010			

Table 5. Finance Training in IRLE Summer Institute, by (a) First Year of Attendance; and (b) First Year attendees received Finance Training.

	Control Grp = All Untrained PUCs				Control Grp = Untrained IRLE PUCs			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$\alpha + \beta \cdot$ ERP	-0.013	-0.024	-0.02	-0.024	-0.038	-0.051	-0.038	-0.051
	(-0.54)	(-0.98)	(-0.78)	(-0.88)	(-1.20)	(-1.66)	(-1.13)	(-1.52)
FinTrain x ($\alpha + \beta \cdot$ ERP)	0.003	0.037	0.007	0.029	0.051	0.083	0.047	0.072
	(0.06)	(0.61)	(0.13)	(0.50)	(0.80)	(1.14)	(0.76)	(1.03)
Constant	7.758***	7.742***	8.206***	8.301***	7.857***	7.649***	8.070***	8.093***
	(57.17)	(27.16)	(35.94)	(24.75)	(40.07)	(18.33)	(28.14)	(19.26)
FinTrain	-0.259	-0.410+	-0.252	-0.414+	-0.371	-0.548*	-0.366	-0.537*
	(-1.10)	(-1.78)	(-1.08)	(-1.78)	(-1.40)	(-2.19)	(-1.43)	(-2.25)
Electric	0.204***	0.184***	0.193***	0.171***	0.217***	0.197***	0.216***	0.191***
	(4.80)	(4.17)	(4.60)	(4.03)	(3.89)	(3.26)	(3.85)	(3.21)
ROE		0		-0.001		0.003		0.005
		(-0.18)		(-0.54)		(0.55)		(0.87)
ln(Assets)		0.005		0.006		0.002		0.007
		(0.16)		(0.22)		(0.05)		(0.16)
D/E Ratio		0.012		0.018		0.076*		0.077+
		(0.42)		(0.60)		(2.14)		(1.98)
# of Commissioners			-0.068***	-0.092***			-0.045	-0.066
			(-2.69)	(-3.23)			(-1.34)	(-1.65)
Percentage Elected			-0.950***	-0.854**			-0.994**	-1.267***
			(-3.17)	(-2.42)			(-2.56)	(-3.70)
Percentage Women			0.052	-0.067			0.057	-0.161
			(0.24)	(-0.31)			(0.21)	(-0.67)
Percentage Democrat			-0.016	0.071			0.017	0.023
			(-0.10)	(0.44)			(0.08)	(0.11)
Percentage Republican			-0.012	-0.032			0.177	0.072
			(-0.07)	(-0.17)			(0.98)	(0.38)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.523	0.556	0.534	0.57	0.53	0.553	0.534	0.559
χ^2	142.17	123.38	196.94	106.53	106.02	168.88	483.28	1014.28
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	705	823	699	574	478	574	478
H_A: ($\alpha+\beta$ERP) + FinTrain x ($\alpha+\beta$ERP) = 1	390.6***	248.3***	421.1***	281.4***	254.8***	158.6***	259.6***	165.9***
H_B: Constant + FinTrain = 0	1565.6***	378.9***	1061.4***	418.1***	1309.9***	200.6***	590***	238.3***
H_C: H_A & H_B	1340.1***	951.6***	532***	221.6***	1438.3***	102.6***	296.6***	120.2***

Table 6 Effects of Finance Training on Rate Setting. Dependent Variable = Permitted ROE spread. Manipulations are reflected in (a) the shift parameter "FinTrain", which equals 1 if the PUC had received an offer of treatment on or before the year of the observed order (and 0 otherwise); and (b) the slope parameter of "FinTrain x Beta x ERP". All Beta computations are Ibbotson adjusted and use Supply-Side Equity Risk Premium. Test statistics for notable CAPM hypotheses are shown in the bottom panel. The left panel uses all non-treated PUC-years as a control, while the right panel limits control group to PUCs seeking treatment at some time. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels (2-tailed test); t-stats in parentheses. Standard Errors clustered by state.