BEFORE THE
STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION

Docket No. DW 20-184

IN THE MATTER OF: AQUARION WATER COMPANY OF NEW HAMPSHIRE, INC.

REQUEST FOR CHANGE IN RATES

DIRECT TESTIMONY

OF

Mark E. Ellis

On Behalf of

New Hampshire Department of Energy

March 2, 2022

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I. INTRODUCTION

Q. Please state your name, by whom you are employed, and your business address.

A. My name is Mark E. Ellis. I am a self-employed economic and financial consultant. My business address is 8595 Nottingham Place, La Jolla, CA 92037.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of the State of New Hampshire Department of Energy (DOE).

Q. Please summarize your education and professional work experience.

A. I graduated from Harvard University with a Bachelor of Science in Mechanical and Materials Sciences and Engineering and from the Massachusetts Institute of Technology with a Master of Science in Technology and Policy.

I have over 25 years of professional experience in the energy industry. Before starting my consulting practice in 2020, I led the strategy function at Sempra Energy for fifteen years. My responsibilities included developing and implementing the enterprise-wide cost of capital function. Previously, I held various positions in strategy, project development, and engineering with McKinsey, ExxonMobil, Southern California Edison, and Sanyo Electric. This is my fourth utility regulatory proceeding. In 2020, I provided expert testimony on behalf of The Utility Reform Network (TURN) before the California Public Utilities Commission in PG&E's application for a $7.5-billion wildfire cost securitization. I am currently working on other cases in California and Hawaii, including a combined off-cycle cost of capital application by California's three PUC-regulated electric utilities. Attachment MEE-1 contains more detail on my professional background.

Q. Have you previously testified before the New Hampshire Public Utilities Commission?

A. No.

Q. What is the purpose of your testimony in this proceeding?

A. I have been asked by DOE to assess the testimony of Aquarion's rate of return witness, Mr. Dylan W. D'Ascendis, and to provide an approach to estimating Aquarion's recommended capital structure and rate of return.

Q. How is your testimony organized?

A. I begin with a detailed critique of Mr. D'Ascendis's testimony. I then explain my recommended approach to determining the appropriate capital structure and ROE and conclude with my equity ratio and ROE recommendations.

A. AQUARION RATE OF RETURN TESTIMONY OVERVIEW

Q. Please provide an overview of Mr. D'Ascendis's testimony.

A. Mr. D'Ascendis's testimony consists of three main components: utility and non-utility peer group selection, capital structure, and return on equity (ROE). The latter is based on three models – the constant-growth discounted cash flow model (DCF), capital asset pricing model (CAPM), and risk premium model (RPM) – plus adjustments for flotation costs and

Aquarion's size. The RPM, in turn, is based on two additional models, referred to as the Predictive Risk Premium Model (PRPM) and the total market approach (TMA).

Q. What is your overall assessment of Mr. D'Ascendis's analysis?

A. Every component and subcomponent of Mr. D'Ascendis's analysis – proxy group selection, capital structure, and return on equity and its constituent models – is rife with errors in theory, methodology, and/or implementation, as summarized in Table 1. My testimony will begin with a detailed critique of his testimony.

Table 1. Flaws and deficiencies in Aquarion rate of return analysis

Topic	Flaw/deficiency
Proxy groups	
• Non-Price Regulated Companies (NPRC) selected on basis of comparable levered beta	• Cost of capital peers should be as similar as possible; lack of price regulation inherently makes NPRC incomparable • Premise violates fundamental risk-return correspondence principle of finance theory • Conflicts with legal standards – *Hope*: "commensurate with returns on investments in other enterprises having corresponding risks" – *Bluefield*: "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" • Selection criteria – beta – includes half the market after adjusting for leverage • Logically flawed – No conceivably useful result: if NPRC has same returns as UPG, redundant; if different, model is flawed – Begs the question (assumes what must be proved) – that NPRC has same risk profile as Aquarion
Capital structure	
• Average of publicly traded UPG peers	• Simple peer comparison does not account for differences in leverage/credit rating • Peer companies have parent debt; not representative of operating company like Aquarion
Cost of debt	
• Historical average	• Incremental debt should reflect current market interest rates
Return on equity	
• Constant-growth DCF	• Assuming near-term growth rates into perpetuity demonstrably unreasonable (exceeds GDP within seven years)
• Risk premium model (RPM)	
– Predictive Risk Premium Model (PRPM)	• Pricing of all risk, not just systematic, conceptually flawed (implies holding a market cap-weighted basket of individual stocks will beat the market index) • Invalid application of short-term volatility model to estimate long-term returns • Used nowhere in finance except by model's developers and their coworkers • Zero empirical validity
– Total market approach	• Double-counted bond yield adjustments • Invalid use of beta for market-corporate bond spread • Invalid use or erroneous implementation of risk premium estimation methods (historic, low-R^2 regression, PRPM, DCF)
• Capital asset pricing model (CAPM)	• Adjusted beta not applicable to utilities • Risk premium based on historical 20-year rate inconsistent with 30-year model input • Mechanically calculated third-party betas inflated due to early 2020 market turmoil • Invalid use or erroneous implementation of risk premium estimation methods (historic, low-R^2 regression, PRPM, DCF) • Empirical CAPM not valid when using long-term risk-free rate
Adjustments	
• Small size premium	• Referenced studies all based on publicly traded companies, not subsidiaries • More recent research concludes size premium does not exist • Subsidiary small size premium is mathematically impossible (parent is weighted average of subsidiaries)
• Flotation cost	• Conceptually valid, but only when utility trades at book value • Conflicts with standalone principle
General ROE issues	
• Arithmetic returns	• Historical RPM and CAPM risk premia based on arithmetic, not geometric, returns overstate long-term return expectations
• Bond yields (RPM, CAPM)	• Forecast rates systematically upwardly biased; current rates are an unbiased predictor of future rates
• No adjustment for differences in capital structure across peer group	• Levered COEs are not directly comparable, due to differences in leverage and, therefore, risk profile • Per best practice, all COE estimates should be unlevered to 100% equity basis then relevered to target capital structure
• Duplicative use of models and data	• Analyses not independent; errors/bias compound instead of cancelling

B. RECOMMENDED APPROACH OVERVIEW

Q. What is your approach to developing your recommended equity ratio and ROE?

A. My recommended rate of return analysis has three components:

1. Proxy group (levered) cost of equity
2. Unlevered cost of equity
3. Integrated capital structure-ROE model

I will provide an overview here and more detail later in my testimony.

I estimate the proxy group members' average cost of equity (COE) using two models. The first is the multi-stage DCF model (MS DCF). This model is similar to the constant-growth DCF used by Mr. D'Ascendis, except it does not assume, unrealistically, that analysts' estimated growth rates are sustained into perpetuity. Instead, analysts' estimates are used for a few years, transitioning toward the utility sector average long-term dividend growth rate.

The second is the capital asset pricing model (CAPM). Key differences with Mr. D'Ascendis are the use of the current, not forecast, long-term risk-free rate and more reasonable long-term beta estimates. The Blue Chip Financial Forecasts used by Mr. D'Ascendis have been systematically upwardly biased for decades, and current rates are much better predictors of future rates. I develop my own beta estimates because the mechanically calculated Bloomberg and Value Line betas used by Mr. D'Ascendis have been inflated by the market turmoil in early 2020 in a manner that makes them unrepresentative of investors' current long-term expectations, and their adjustment toward 1.0 is not valid for utilities. I do not use the Empirical CAPM, because it can be demonstrated that the empirical observation upon which it is based is not valid when using a long-term risk-free rate.

Mr. D'Ascendis recognizes that "the higher the proportion of debt and preferred stock in the capital structure, the higher the financial risk to common equity owners. … Therefore, consistent with the basic financial principle of risk and return, common equity investors demand higher returns as compensation for bearing higher financial risk."[1] Nonetheless, he erroneously neglects to adjust his cost of equity estimates for differences between Aquarion's proposed capital structure and the proxy group members'. To account for these differences, I calculate each proxy group member's unlevered cost of equity, i.e., the cost of capital assuming 100% equity financing, and then relever the average using Aquarion's target capital structure. Without this process of unlevering and relevering, the peer-group average understates Aquarion's COE because their (market-based) equity ratios tend to be significantly higher than Aquarion's target capital structure.

To determine the target capital structure, I have developed an integrated model that explicitly accounts for the interactions between capital structure, ROE, and financial strength as reflected in the credit rating. This model is used to determine the optimal capital structure and ROE that minimizes customer costs while meeting the utility's target credit rating – assumed commensurate with the credit rating implied by Aquarion's proposal – and satisfying equity investors' return requirements. It is also used to estimate the potential customer savings relative to Aquarion's proposed rate of return.

Q. What is your recommended capital structure and ROE?

A. Table 2 summarizes my recommended capital structure, ROE, costs of short- and long-term debt, and weighted-average rate of return.

[1] Direct testimony of Dylan W. D'Ascendis (hereafter referred to as "DWD"), p. 11.

Table 2. Recommended rate of return summary
Percent

Capital source	Amount ($)	Weight	Cost rate	Weighted cost rate
Common equity	20,705,212	57.32	4.95	2.84
Preferred equity	2,300	0.01	6.00	0.00
Short-term debt	1,200,000	3.32	2.42	0.08
Long-term debt	14,211,714	39.35	4.62	1.82
Total	**36,119,226**	**100.00**	**4.74**	**4.74**

II. CRITIQUE OF AQUARION TESTIMONY

A. PROXY GROUPS

Q. Please explain Mr. D'Ascendis's proxy group selection.

A. Mr. D'Ascendis created two proxy groups for his analyses: a Utility Proxy Group (UPG) composed of water utility holding companies whose business profiles are similar to Aquarion's; and a comparison group of Non-Price Regulated Companies (NPRC) selected primarily on the basis of similar equity market risk (beta) characteristics.

Q. Do you endorse Mr. D'Ascendis's water utility peer selection criteria and the resulting proxy group?

A. Yes. Mr. D'Ascendis's Utility Proxy Group consists of seven publicly traded water utility holding companies. For the most part, his selection criteria appear reasonable. His analyses rely heavily on data from Value Line,[2] so inclusion in Value Line's Water Utility Industry group is a reasonable criterion. Two potential areas of concern are criteria (iv) and (vi), which require no dividend cuts in the previous five years and a positive dividend-per-share

2 Value Line is an independent investment research and financial publishing firm founded in 1931.

growth rate projection, respectively.[3] The outputs of each of his peer group analyses is based on the proxy group average, which is meant to represent the expected performance of the sector as a whole. Selectively removing poor performers would clearly bias his results, particularly the DCF method, in which the growth rate is a direct input. A review of the members of Value Line's Water Utility Industry group members reveals that these criteria did not result in the removal of any companies, although one of the eight group members, Consolidated Water, was excluded, apparently because its business is primarily outside the United States.[4]

It should be recognized that the UPG is composed of water utility holding companies, not their subsidiary utility operating companies, Aquarion's true peers. It is common for utility holding companies to hold debt not directly attributable to the operating utilities' regulated capital structure, which increases their leverage and risk.[5] These potential differences in financial profile will need to be accounted for in the cost of capital analyses.

Q. Do you endorse Mr. D'Ascendis's non-price regulated peer selection criteria and the resulting peer group?

A. No. All model results using the Non-Price Regulated Companies should be excluded from consideration.

3 DWD, p. 12.
4 As of July 9, 2021, Consolidated Water was no longer among the water utilities covered by Value Line.
5 See, for example, Moody's Investor Service, "Moody's announces completion of a periodic review of ratings of Aquarion Company," July 23, 2020; available at: https://www.moodys.com/research/Moodys-announces-completion-of-a-periodic-review-of-ratings-of--PR_428245: "Aquarion Company's (Aquarion) Baa2 rating reflects its credit profile as an intermediate holding company of low risk regulated water utilities operating in credit supportive jurisdictions in Connecticut, Massachusetts and New Hampshire; and a consolidated ratio of funds from operations (FFO) to net debt in the 8-11% range. The rating considers the substantial amount of intermediate holding company debt that is structurally subordinated compared to debt residing at its largest operating utility subsidiary, Aquarion Water Company of Connecticut (A3)."

Q. Why should all model results using the Non-Price Regulated Companies be excluded from consideration?

A. There are several reasons why the NPRC peer group should be excluded from consideration. Most generally, in selecting cost-of-capital comparison groups, finance textbooks universally recommend using *industry comparables*, firms with as many similar characteristics as possible; at a minimum, they should be in the same industry.[6] That the NPRC members are all non-utilities and not subject to price regulation makes them inherently incomparable to Aquarion.

An analogy might best illustrate the conceptual flaw with the NPRC. Suppose we wanted to develop a calorie intake recommendation for human biological males 25 to 35 years old. It would never enter our minds to base that recommendation, even in part, on data for human biological females of the same age – even if we selected only females whose weight fell within the same range as the males, akin to Mr. D'Ascendis's beta selection criterion.[7] The physiologies, activity levels, energy expenditures, body compositions, metabolisms, etc., of males and females are different enough that to include data on females to estimate male caloric needs would only introduce error, not improve the estimate.

The NPRC can be rejected from legal and financial first principles. The *Hope* standard cited by Mr. D'Ascendis – "the return to the equity owner should be commensurate with

[6] See, for example, Koller, Goedhart, Wessels, *Valuation: Measuring and Managing the Value of Companies*, 6th ed. (2015), pp. 345-46; Berk, DeMarzo, Corporate Finance, 3rd ed. (2014), pp. 414-5; Brealey, Myers, Allen, *Principles of Corporate Finance*, 10th ed. (2011), pp. 221-22.

[7] Limiting the data set based on weight, not height, is analogous to Mr. D'Ascendis's use of levered beta as his NPRC selection criterion. Levered beta is influenced by both underlying business risk and debt level, in the same way that weight is influenced by both underlying body composition (e.g., height) and calorie intake: the first is intrinsic, the second is discretionary. Just as adjusting for weight but not height would lead to a misleading calorie intake recommendation (e.g., calorie restriction for the underweight), so, too, estimating ROE based on beta without adjusting for leverage yields a misleading result. The NPRC members have relatively low levels of debt, so their unlevered betas, i.e., their underlying business risks, are substantially higher than the UPG's.

returns on investments in other enterprises having corresponding risks"[8] – is supported by finance theory, whose "basic postulate … is that assets with the same risk should have the same expected rate of return."[9] To maintain that companies with "corresponding risks" might *not* have returns commensurate with the UPG members', which must be the case for the NPRC to have any usefulness, both contradicts *Hope* and violates the most fundamental principle of finance.

The plain language of the passage in *Bluefield* cited by Mr. D'Ascendis clearly excludes the NPRC as a basis of comparison:[10]

> 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. [emphasis added].

The NPRC includes companies like Adobe, salesforce.com, Standard Motor Products, and J. M. Smucker – enterprises that in no way could be considered to be investing in "business undertakings … attended by corresponding risks and uncertainties," much less "at the same time and in the same general part of the country," as a small regional water distribution utility in New Hampshire. Given these companies' lack of monopoly power and exposure to market competition, they are also significantly more speculative.

The NPRC fails in its methodology, as well. The key criterion for inclusion is an unadjusted beta between 0.45 and 0.75.[11] Beta is a measure of equity market risk and an

[8] Data request response DOE 5-16 Attachment 1, p. 2 (Attachment MEE-2).
[9] Modigliani, Pogue, "An Introduction to Risk and Return: Concepts and Evidence," *Financial Analysts Journal*, 30:3 (May-June 1974), p. 69.
[10] DWD, p. 41; data request response DOE 5-16 Attachment 2, p. 1 (Attachment MEE-3).
[11] DWD, pp. 35-36. As explained below, equity betas are often adjusted for their tendency, on average, to trend toward the market average of 1.0 over time.

input in the CAPM. As explained further below, a key step in using the CAPM to estimate a target company's cost of equity is to adjust for differences in leverage (share of debt in the capital structure).[12] When the NPRC members' betas are adjusted for leverage, the range increases to 0.30-0.75 – wide enough to include the unlevered betas of roughly half the companies in the US.[13] A peer group that large does not provide any basis for a meaningful comparison.

The NPRC can also be rejected on purely logical grounds. Since risk and its relationship to the cost of capital cannot be precisely measured, the only way to know whether a dissimilar peer group has the same risk profile as the more similar peers is to compare their estimated returns. To the extent they are the same, though, the dissimilar peer group is redundant; to the extent they differ, it can only be concluded that the less similar group does not have the same risk profile as the more similar group. While it is *possible* for assets with the same risk to have different returns (in contradiction to finance theory and the *Hope* standard), Mr. D'Ascendis provides no evidence to support such an assertion. Mr. D'Ascendis is committing the logical fallacy of begging the question – assuming what first must be proven.

Finally, as will be explained further below, his implementations of the discounted cash flow, risk premium, and capital asset pricing models used to estimate the NPRC's COE are

[12] See, for example, Koller, et al, *Valuation*, 6th ed., pp. 286-87: "Simply using the median of an industry's raw regression betas, however, overlooks an important factor: leverage. A company's beta is a function of not only its operating risk, but also the financial risk it takes. Shareholders of a company with more debt face greater risks, and this increase is reflected in beta. Therefore, to compare companies with similar operating risks, you must first strip out the effect of leverage. Only then can you compare betas across an industry." Note the implied assumption that betas are only compared across a *single* industry, not across multiple industries.

[13] M. Ellis analysis using DWD betas, market capitalization and enterprise value from Yahoo! Finance as of April 6, 2021, and industry betas from NYU finance professor Aswath Damodaran (https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html).

flawed in numerous ways. Even if the NPRC were conceptually sound, the results would not be valid.

B. CAPITAL STRUCTURE

Q. Please explain how Mr. D'Ascendis arrives at his capital structure recommendation.

A. Mr. D'Ascendis recommends Aquarion maintain its current capital structure, citing in support the UPG's average debt and preferred and common stock ratios. As described above, these holding companies can have different risk profiles than their subsidiary utility operating companies, due to differences in leverage. Consequently, while the Utility Proxy Group average can provide a helpful comparison, it does not necessarily indicate the appropriate capital structure for Aquarion's business and financial profile.

Q. How should the capital structure be determined?

A. The appropriate capital structure can be determined more rigorously by using the analytical methods employed by credit rating agencies. Water utility operating companies typically have S&P/Moody's credit ratings between A-/A3 and A+/A1.[14] This range is assumed to be the credit quality target for Aquarion.

[14] See, for example, Attachment DWD-4, p. 5, which lists the credit rating of several water utility operating companies.

Q. How is the capital structure determined from the target credit rating?

A. In determining credit quality, credit rating agencies primarily consider three financial ratios: debt to capitalization (D/C), funds from operations – net income plus depreciation, amortization, and deferred taxes – to debt (FFO/D), and FFO interest coverage (IC).[15]

Moody's provides sufficient detail on their methodology to calculate the credit rating for any given combination of D/C, FFO/D, and IC metrics, as shown in Table 3. Two of the metrics incorporate FFO. FFO is based on net income, i.e., ROE, so credit rating will vary with ROE. Given a target credit rating and ROE, we can work backward from the corresponding credit metrics to the required capital structure.

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[15] See, for example, Moody's Investors Service, "Rating Methodology: Regulated Water Utilities" (June 2018), p. 21; available at: https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1121971. FFO interest coverage is the ratio (FFO + interest)/interest. Moody's methodology includes a fourth financial metric, retained cash flow after dividend payments, with a much lower weighting than these three. Aquarion does not appear to have a consistent dividend policy, ranging from -10% to 100% over 2007 to 2020, so this metric is ignored in this analysis.

Table 3. Moody's credit rating financial metrics[16]

Factor 3 – Leverage and Coverage (40%)

The following tables show the scorecard-scoring categories for each Leverage and Coverage sub-factor and the weighting thereof.

Rating Factor	Weight	Aaa	Aa	A	Baa	Ba	B	Caa
Adjusted Interest Coverage Ratio (1) OR FFO Interest Coverage (2)	12.5%	≥8x OR ≥10x	4.5-8x OR 7-10x	2.5-4.5x OR 4.5-7x	1.5-2.5x OR 2.5-4.5x	1.2-1.5x OR 1.8-2.5x	1-1.2x OR 1.5-1.8x	<1x OR <1.5x
Net Debt / Regulated Asset Base (3) OR Debt / Capitalisation	10%	<25%	25-40%	40-55%	55-70%	70-85%	85-100%	≥100%
FFO / Net Debt	12.5%	≥40%	25-40%	15-25%	10-15%	6-10%	4-6%	<4%
RCF / Net Debt	5%	≥30%	20-30%	10-20%	6-10%	4-6%	2-4%	<2%

Notes:

(1) The Adjusted Interest Coverage Ratio is our preferred metric for water utilities where allowed revenues/tariffs are determined using a 'building block' or equivalent approach and where the components of allowed revenues/tariffs are consistently available and can be verified by from an independent source – in many cases, publications from the regulatory authority itself. For the numerator, Interest net of Inflation Accretion is added back to the extent it was deducted in calculating FFO. Capital Charges represent expenditures recovered in revenues that are not accounted for as operating expenses and are not treated as additional invested capital incrementing the RAB, including regulatory revenue profiling to smooth the impact of tariff increases on customer bills.

(2) In jurisdictions where regulatory revenues/tariffs are not determined with a 'building block approach' or where the regulatory information needed to calculate Capital Charges may not be consistently available, we use the FFO Interest Coverage, calculated (or for forward periods estimated) as (FFO + Interest Expense) / Interest Expense.

(3) For the utilities regulated under a RAB-based model where the RAB accurately represents the invested capital on which the water utility will earn a return over time, we measure leverage as Net Debt to RAB. For water utilities that (1) are regulated under tariff models without a RAB; (2) are regulated under a RAB-based model but where the RAB may not accurately represent the invested capital on which the water utility will earn a return over time (e.g. because of ex-post rate-setting); or (3) where RAB may not be consistently available, we use Debt to Capitalisation.

Q. How do ROE, equity ratio, and credit rating interact?

A. Figure 1 illustrates the relationship between ROE, equity ratio, and credit rating based on data from Aquarion's proforma financial statements in Table 4. Aquarion's proposed ROE of 10.25% is represented by the thick black line in the figure. At Aquarion's current cost of debt, 5.84%, the marginal return on rate base (RORB), grossed up for taxes (27.1%)[17] – i.e., the cost of capital ultimately borne by customers – is 10.14%. Combined with the proposed

[16] Moody's Investors Service, "Rating Methodology: Regulated Water Utilities" (June 2018), p. 21; available at: https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1121971.

[17] Schedule No. A, line 13.

equity ratio of 52.36%, Aquarion's credit rating, based on its financial metrics alone, would be between A-/A3 and A/A2.[18]

Figure 1. Relationship between ROE, equity ratio, ROE, credit rating[19]

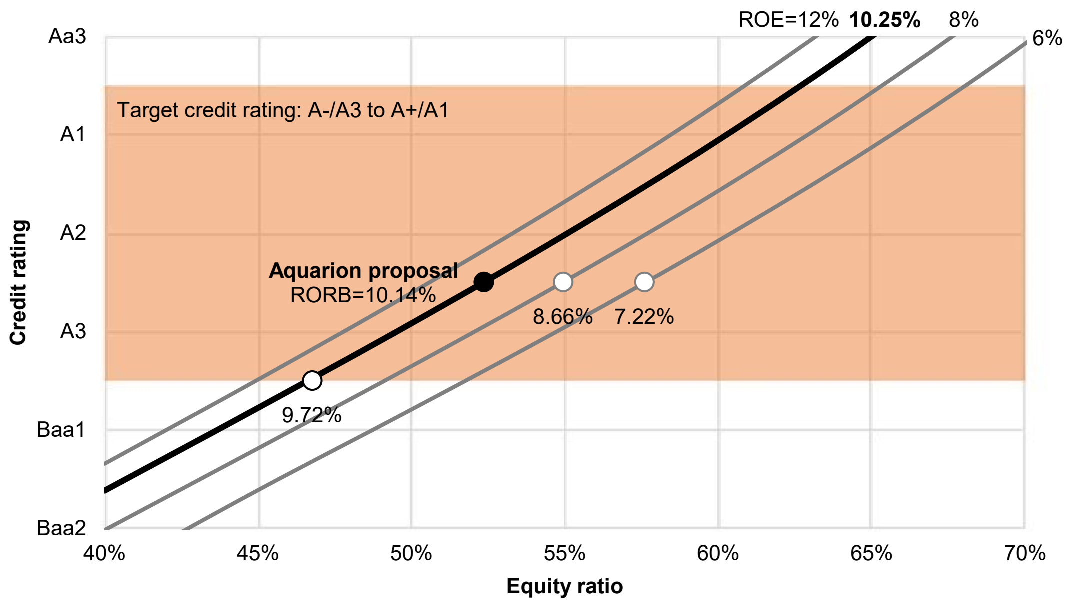


Table 4. Selected Aquarion proforma financial data[20]
$ thousand

Rate base	Net income	Depreciation	Deferred taxes	Funds from operations
36,119	1,938	1,311	92	3,342

A lower ROE requires more equity to maintain the same credit rating. Generally, at typical water utility target credit ratings, savings from a lower ROE, even after grossing-up for taxes, more than make up for the incremental total cost of the additional equity required in the capital structure. For example, at the A2/A3 credit rating implied by Aquarion's

[18] For brevity, hereafter, credit ratings will be given only on Moody's scale.
[19] For apples-to-apples comparison with Aquarion's proposal, this analysis assumes Aquarion's average cost of existing debt. The recommended capital structure and cost of capital will assume a cost of any incremental debt commensurate with Aquarion's credit quality, current market rates, and typical financing costs.
[20] Rate base: Schedule A, p.1; depreciation and deferred taxes: Schedule No. 1, p. 2; income: 10.25% x 52.36% equity ratio x $36,119,226 rate base = $1,938,483

proposal, an 8% ROE requires more equity, 54.9%, but the marginal pre-tax RORB is 8.66%, a savings of 15%. A 6% ROE requires 57.6% equity, but the 7.22% RORB saves 29%.

Many observers see utilities' healthy credit ratings and low cost of debt and conclude that the best way to reduce customer costs is to increase the amount of debt in the capital structure. For example, moving down one full credit grade, to the lowest end of the A3 band, at Aquarion's proposed 10.25% ROE the equity ratio can be as low as 46.8%. After adjusting for the higher cost of debt – 0.07%, the estimated current spread between the low ends of A2- and A3-rated public utility debt (see below) – RORB drops only 4%, to 9.72%. This analysis suggests that, rather than "lever up," it is much more effective to reduce ROE, provided it covers the true cost of equity, even if it requires more equity in the capital structure.

Q. What other factors influence the credit rating?

A. These three financial ratios – D/C, FFO/D, IC – account for approximately 35% of the total credit rating.[21] The other main factors are business profile, financial policy, and potential support from corporate parent(s). While Aquarion is considered a "low-risk regulated water utilit[y] operating in [a] credit supportive jurisdiction,"[22] and its immediate and ultimate parents, Aquarion Company and Eversource, could support its credit, these factors are difficult to quantify because of their potential interaction with the various financial ratios. It is therefore conservatively assumed that Aquarion's credit rating is determined solely by these three ratios, with no benefit from any other potential credit supportive factors.

[21] Retained cash flow has a weighting of 5%.
[22] Moody's Investors Services, "Moody's announces completion of a periodic review of ratings of Aquarion Company" (June 29, 2021); available at: https://www.moodys.com/research/Moodys-announces-completion-of-a-periodic-review-of-ratings-of--PR_444592.

Q. What capital structure do you recommend?

A. Because the capital structure cannot be determined independently of ROE, I will revisit it later in my testimony after estimating Aquarion's unlevered cost of capital.

C. COST OF DEBT

Q. How does Mr. D'Ascendis determine the cost of debt?

A. Mr. D'Ascendis uses Aquarion's current short- and long-term cost rates, grossed-up for financing costs, 2.42% and 6.14%, respectively.

Q. Are these rates appropriate?

A. Aquarion's short-term debt is intercompany,[23] and the interest rate has presumably been determined on an arm's length basis, per IRS guidelines.

Aquarion's current long-term debt is $13.9 million, which combined with its $1.2 million of short-term debt, sums to $15.1 million, or 41.8% of rate base. Aquarion's proposed debt ratio is 47.63%.[24] Aquarion would therefore need to issue $2.1 million of additional debt. Additionally, according to Aquarion's 2020 annual report, $5.0 million and $3.0 million of its current long-term debt will mature by July 2022 and June 2023, respectively.[25]

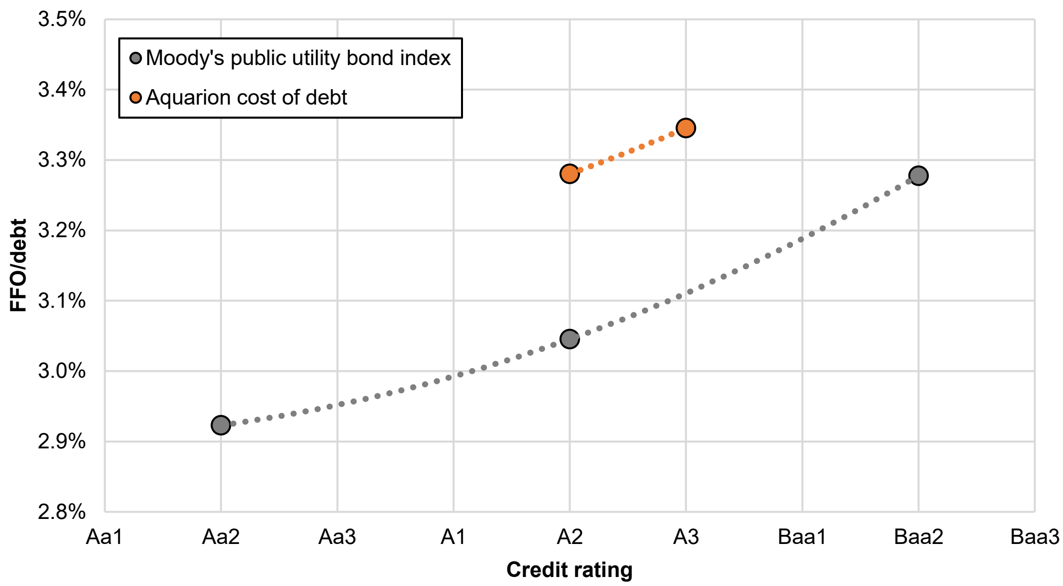
Aquarion's current average cost of long-term debt is 6.14%, reflecting the higher interest rates that prevailed at the time of its issuance, in 1993, 2005, and 2012. In the current lower-rate environment, any new debt will have a lower rate, which should be reflected in the average cost of debt.

[23] Schedule No. 4E.
[24] 1 – 52.36% common equity – 0.006% preferred equity.
[25] "Annual Report of Aquarion Water Company of New Hampshire, Year ended December 31, 2020," p. 51.

Q. How should the cost of new debt be determined?

A. The cost of new debt should reflect Aquarion's credit quality, current market rates, and expected financing costs. Figure 2 shows the relationship between credit rating and the current cost of public utility debt.[26] Assuming a credit rating between A2 and A3, Aquarion's current cost of debt, grossed-up 0.23% for financing costs,[27] is between 3.28% and 3.35%.

Figure 2. Aquarion cost of new debt[28]
December 2021



The average cost of debt will depend on the recommended capital structure and target credit rating, which I will discuss later in my recommended approach.

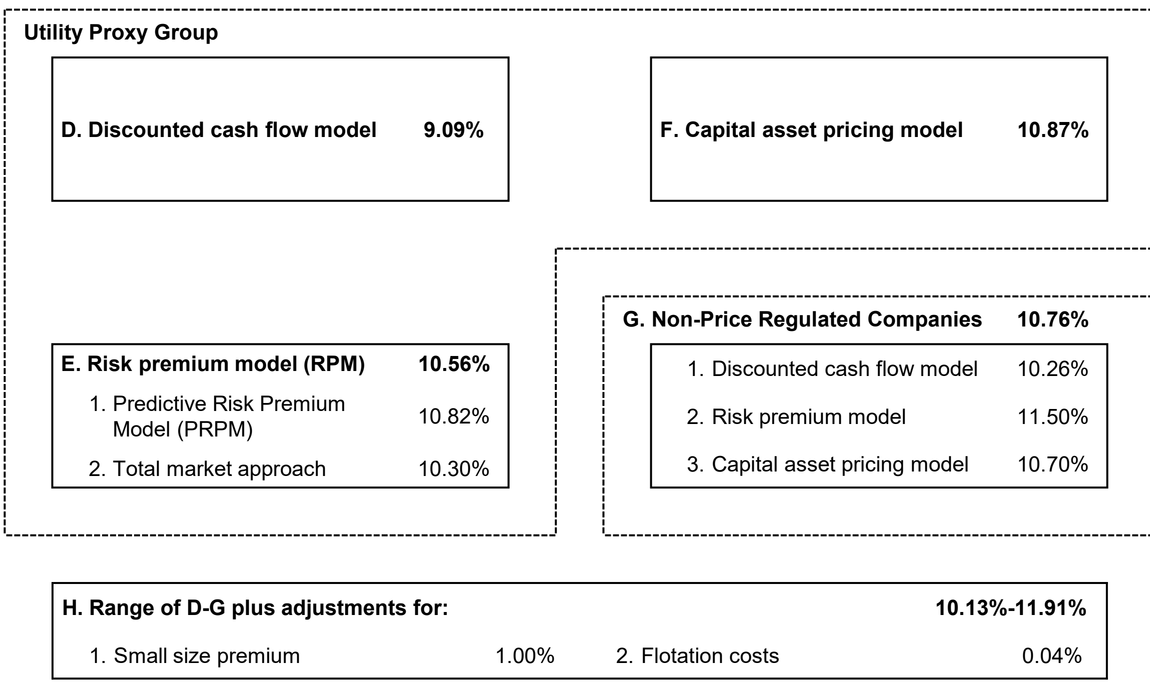
[26] The interest rate relationship is estimated by fitting a binomial regression line to the December 2021 monthly average Moody's Aa-, A-, and Baa-rated public utility bond yields.
[27] Schedule No. 4D. Difference between weighted average coupon (5.90%) and cost (6.14%) rates.
[28] December 2021 daily average. Moody's via S&P Global Market Intelligence.

D. AQUARION ROE CALCULATION OVERVIEW

Q. Please provide an overview of how Mr. D'Ascendis calculates Aquarion's ROE.

A. Mr. D'Ascendis's ROE calculation is based on three models: DCF, CAPM, and RPM. The RPM, in turn, is based on two additional models, referred to as the "Predictive Risk Premium Model" (PRPM) and "total market approach" (TMA). He adjusts his model results for Aquarion's size and its parent's flotation costs before arriving at his final recommendation. Figure 3 provides a high-level overview of Mr. D'Ascendis's methodology and results.

Figure 3. D'Ascendis ROE calculation methodology overview



E. DCF MODEL

Q. Which version of the DCF model does Mr. D'Ascendis use?

A. Mr. D'Ascendis uses the constant-growth DCF (CG DCF), which assumes a single, constant rate of cash flow growth. It is based on the well-known and widely used mathematical formula for the value of a growing perpetuity stream of cash flows. Here, the cash flows are expected dividends, and the perpetuity value formula can be expressed as:

$$M_0 = D_0 \frac{(1+g)}{(k-g)}$$

where M_0 refers to the current market value (stock price), D_0, the current dividend (typically four times the most recent quarterly payment), g, the forecast perpetuity growth rate, and k, the cost of equity. Rearranging terms, the cost of equity can be expressed as a function of the dividend yield, d ($\frac{M_0}{D_0}$), and growth rate:

$$k = d(1+g) + g$$

In some implementations of the CG DCF, the first-year dividend yield is calculated by multiplying the current yield by $1 + \frac{g}{2}$, instead of $1 + g$, to account for the quarterly, not annual, payment of dividends. Mr. D'Ascendis uses this approach.[29] Typically, the cost of equity is estimated for each member of the proxy group, with the mean or median reflecting the cost of equity for the target company. Mr. D'Ascendis uses the average of the mean and median for the final result of his DCF and other models.

The DCF model is a particularly apt representation of stock returns because its assumptions realistically reflect several key features of share prices and expected returns. First, the DCF model's perpetual cash flow stream assumption mirrors equity's claim on a firm's cash flows into perpetuity. Second, the assumption of steady growth in dividends reasonably reflects their much greater stability relative to other potential measures of profitability, like earnings or cash flow. Third, the resulting single discount rate into

[29] It can be demonstrated mathematically that, for dividend yields as of the starting time period of the model (t_0), the common method of using four times the most recent quarterly dividend is already slightly conservative, and this adjustment is therefore not necessary. While widely used, the origin of the $1 + \frac{g}{2}$ adjustment is not known.

perpetuity is consistent with the no-arbitrage principle of finance. If investors expected higher (lower) returns in the future, they would impute that into the price today and bid up (down) the price accordingly, such that near-term and long-term returns roughly equilibrate.[30]

It should be noted that the DCF model yields a *geometric* average return, or the fixed annual rate of return on M_0 that, if compounded every year, would have the same value over time as the sum of the DCF model's past and future streams of dividends, compounded (past) and discounted (future) at the same rate.

Q. Why is that clarification important?

A. When analyzing investment returns, another commonly reported average is the *arithmetic* average: the simple, unweighted average of returns across multiple historical holding periods (e.g., the average of monthly or annual returns over multiple years). A simple example illustrates the difference. Suppose a stock price increases by 50% in one year, then declines by 50% the following year, such that the ending value is 75% of the starting value. The arithmetic average is 0%, (+50% – 50%)/2, while the geometric average is -13.3%, $[(1 + 50\%) \times (1 - 50\%)]^{1/2} - 1$.

[30] Some equity return projections vary with forecast horizon. This is generally due to a valuation-reversion assumption in the model, e.g., price-to-earnings ratios returning to their long-term historical average over an initial horizon and remaining at that level afterward. See, for example, BlackRock's capital market assumptions, available at: https://www.blackrock.com/institutions/en-us/insights/charts/capital-market-assumptions. Whether variation in expected equity returns across different forecast horizons can be estimated with any accuracy is a subject of ongoing debate among academic and investment professionals. Some forecasters assume no mean reversion in their return forecasts. See, for example, AQR Capital Management, "2014 Capital Market Assumptions for Major Asset Classes" (1Q 2014); available at: https://www.aqr.com/Insights/Research/Alternative-Thinking/2014-Capital-Market-Assumptions-for-Major-Asset-Classes.

Returns can be reported on either basis, depending on the context, but investors are not indifferent between them. Investors care most about changes in asset values over time, and only the geometric return provides an unambiguous indicator of this change. Given a starting investment value, for any geometric return there is a single future value, but for any arithmetic return there are an infinite number of potential future values. If the geometric average return is 5%, for example, in two years the value will be 1.05 x 1.05 – 1 = 1.1025. In contrast, if the arithmetic return is 5%, in two years the value could be anywhere from 0, (1 + 110%) x (1 – 100%), to 1.1025 if the return is the same 5% in each year. The arithmetic return, on its own, does not indicate the future value and, unless it does not vary from year to year, systematically overstates it.

For this reason, geometric returns are generally considered a better measure of investor expectations. I will return to this topic later in my testimony in the discussion of the CAPM.

Q. How does Mr. D'Ascendis calculate the current dividend yield?

A. To calculate the dividend yield, Mr. D'Ascendis divides four times the most recent quarterly dividend by the average share price over the preceding 60 trading days, or approximately three months. While it is advisable to use a multi-day average of the share price to reduce the effect of any day-to-day price fluctuations that are not reflective of investors' long-term expectations, Mr. D'Ascendis's is unnecessarily long. Because share prices have a general tendency to trend upward over time, the longer the backward-looking averaging period, the lower the share price will tend to be, introducing upward bias in the dividend yield. Averaging over a more reasonable 20 trading days (roughly one month), would increase the share prices of the UPG by 3.9% and reduce the average dividend yield from 1.82% to 1.74%.

Q. How does Mr. D'Ascendis estimate each utility's perpetuity growth rate?

A. While estimating the current dividend yield is fairly straightforward (although, as just explained, there is scope for bias even there), estimating the perpetuity growth rate is more subjective. Mr. D'Ascendis uses analysts' consensus three-to-five-year estimated earnings-per-share (EPS) growth rate.[31] The DCF is a model of dividends, not earnings, so it would be preferable to use explicit dividend forecasts. While some analysts, such as Value Line, do provide dividend forecasts, they are less common. It is generally assumed that, over the long term, dividends and earnings grow at the same rate.[32]

Q. Is it reasonable to assume analysts' consensus growth rates into perpetuity?

A. No. There are several problems with using analysts' estimates for the perpetuity growth rate. A wealth of academic research has found that analyst forecasts tend to be optimistic.[33] The CG DCF model is based on the formula for a growing perpetuity, so the growth rate must reflect growth into perpetuity, but analysts' estimates look out only three to five years.

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[31] The sources used by Mr. D'Ascendis use the following forecast horizons, per their respective websites: Value Line: '17-'19 to '23-'25; Zack's: 3 to 5 years; Yahoo! Finance: next 5 years; Bloomberg: next five years. An additional concern with analysts' estimates is that the starting time period is usually unknown. In the rare instances where it is known, it is virtually certain not to be coincident with the starting time period assumed in the DCF model, i.e., the end of the last trading day of the share price averaging period. Value Line's starting period, for example, is '17-'19, at least a year stale at the time of Mr. D'Ascendis's calculations.

[32] Although there is substantial documentation of analyst bias, their estimates tend to be better predictors of future dividend growth than future earnings growth.

[33] See, for example, Goedhart, Raj, Saxena, "Equity analysts: Still too bullish," *McKinsey Quarterly* (April 2010); available at: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/equity-analysts-still-too-bullish). For a more recent example, see Cassella, Golez, Gulen, Kelly, "Horizon Bias and the Term Structure of Equity Returns" (2020); available at: https://ssrn.com/abstract=3328970).

Several observations and analyses demonstrate the unreasonableness of using analysts' estimates for the perpetuity growth rate in the constant-growth DCF model.

Incompatible forecast horizon

One concern with analysts' estimates is that the starting time period is not specified with precision. S&P explains of its estimates:[34]

> Long Term Growth Rate (LTG) is a compound annual growth rate based on current and projected EPS values provided directly by the analysts. … Most analysts define LTG as an estimated average rate of earnings growth for the next 3-5 years. The exact time frame differs from broker to broker. Since the analysts providing LTG may differ from the analysts providing fiscal year estimates and the variation in time periods of 3-5 years, it is not possible to reconcile LTG with fiscal year estimates.

The starting point for Yahoo! Finance's estimates is similarly unknown:[35]

> [A]s most analysts do not provide the basis of the calculation of their growth rates, the estimates collected are assumed to include a combination of past and future years with at least one future period included, and are calculated on a compounded annual growth rate (CAGR) basis.

Value Line is one source of estimates that does specify the starting point and forecast horizon for its estimates. Even then, they are virtually certain not to be coincident with the starting time period assumed in the DCF model, i.e., the end of the last trading day of the share price averaging period. Value Line's starting period for the UPG members, for example, is '17-'19, at least a year stale at the time of Mr. D'Ascendis's calculations.[36]

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[34] Via YCharts website, which reports estimates provided by S&P; available at: https://ycharts.com/glossary/terms/eps_est_long_term_growth.

[35] Via Stockopedia website; available at: https://www.stockopedia.com/ratios/long-term-growth-forecast-5107/. The passage refers to Reuters, now Refinitiv, the source of Yahoo! Finance's estimates; see: https://help.yahoo.com/kb/finance-for-web/SLN2310.html.

[36] Attachment DWD-3, pp. 2-8.

Earnings can vary significantly from one year to the next. Without knowing the forecast period, it is not possible to determine whether the growth rate reflects a long-term sustainable rate. Following a year of poor performance, for example, expected growth would be elevated, potentially significantly above what could be sustained long-term.

Inconsistency with analysts' own forecasts

In addition to their EPS growth rates, Value Line publishes a variety of other forecasts, including for share prices and dividends.[37] These forecasts can be used to estimate Value Line's own expected return for each company.[38] Table 5 shows the relevant data for the Utility Proxy Group, the CG DCF model results, and Value Line's own implied return. The DCF results are consistently higher than Value Line's implied returns, by 4.16% on average.[39]

Table 5. Value Line constant-growth DCF vs. implied COE for Utility Proxy Group[40]
As of October 2020

	'17-'19			3-to-5-year growth (%)		'23-'25	Estimated COE (%)		
Water utility company	Price	Dividend	Yield (%)	EPS	DPS	**price**	CG DCF	Value Line	DCF–VL
American States Water	61.74	1.07	1.73	6.5	9.5	68.15	8.35	3.95	4.39
American Water Works	93.10	1.79	1.92	8.5	8.5	115.15	10.58	5.94	4.64
California Water	43.45	0.75	1.73	6.5	5.5	46.00	8.35	3.00	5.35
Essential Utilities	36.41	0.85	2.33	7.0	7.5	47.25	9.50	7.14	2.36
Middlesex Water	47.47	0.92	1.93	6.0	5.5	57.50	8.05	5.40	2.65
SJW Group	59.27	1.12	1.89	10.5	7.0	80.30	12.59	7.30	5.29
York Water	34.66	0.67	1.94	7.0	6.0	40.00	9.08	4.66	4.42
Mean							**9.50**	**5.34**	**4.16**

[37] Value Line reports do not include actual share price forecasts, but EPS and price-earnings multiple (P/E) forecasts. Price can be calculated by multiplying these two figures: P = EPS x P/E.

[38] A simple DCF model can be constructed where the initial investment is the '17-'19 price, dividends through '23-'25 are forecast from the current dividend escalated at the dividend growth rate, and the terminal value is the '23-'25 price. The expected return is the internal rate of return (IRR) of this cash flow stream.

[39] It might be argued that Value Line's return forecast is only for the period through '23-'25 and that returns afterward will be higher, such that the combined return is equal to the CG DCF result. This conflicts with our understanding of markets. Because equities are a claim on future cash flows into perpetuity, if investors expect higher returns in the future, they will impute that into the price today and bid up the price accordingly, such that near-term and long-term returns equilibrate.

[40] M. Ellis analysis based on Attachment DWD-3, pp. 2-8.

Inconsistency with historical growth

Analyst earnings (and, by assumption, dividend) growth forecasts tend to be higher than the companies' long-term historical results. Table 6 compares the Utility Proxy Group members' growth forecasts to their historical 27-year (1993-2020) EPS and dividend-per-share (DPS) compound average growth rates (CAGR). On average, the forecast rate is 1.7% higher for earnings and 3.4% higher for dividends. The difference is even greater when adjusted for inflation. At the time of Mr. D'Ascendis's analysis, September 2020, forecast long-term inflation, as indicated by the one-month trailing 30-year Treasury-TIPS spread, was 1.76%.[41] In contrast, historical inflation over the 27 years from 1993 to 2020 averaged 2.18%. Forecast real dividend growth is 2.1%-3.8% higher than the Utility Proxy Group's historical performance.

Table 6. Utility Proxy Group earnings and dividend growth rates[42]
Percent, as of September 30, 2020

	Forecast EPS/DPS growth rate		27-year historical growth rate			
			Nominal		Real (2.18 inflation)	
Water utility company	Nominal	Real (1.76 inflation)	EPSs	DPS	EPS	DPS
American States Water	5.68	3.85	8.33	4.40	6.01	2.17
American Water Works	8.23	6.36	4.65	2.88	2.41	0.68
California Water	9.00	7.11	3.96	2.14	1.74	-0.04
Essential Utilities	6.55	4.71	6.72	6.80	4.44	4.52
Middlesex Water	4.35	2.55	4.48	2.67	2.25	0.48
SJW Group	11.40	9.47	6.05	5.03	3.79	2.79
York Water	5.95	4.12	4.95	3.35	2.71	1.14
Mean	**7.31**	**5.45**	**5.59**	**3.90**	**3.34**	**1.68**
Forecast – history			1.72	3.41	2.12	3.78

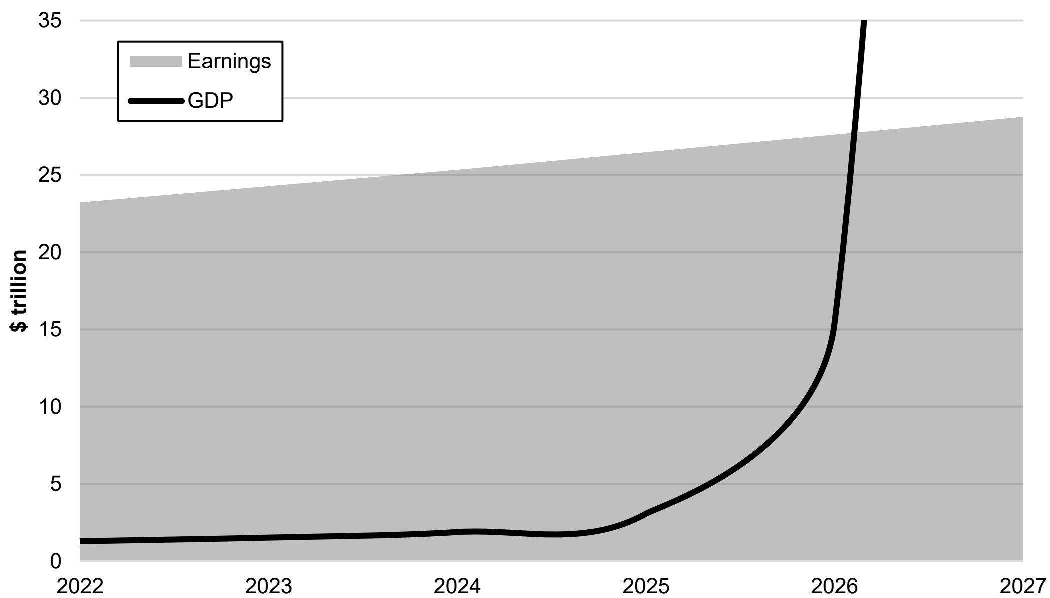
[41] Federal Reserve Bank of St. Louis Economic Data (FRED); available at: https://fred.stlouisfed.org/series/T30YIEM.

[42] M. Ellis analysis based on data from Attachment DWD-3, p. 1 (forecast growth rate); Wolfram Alpha, Yahoo Finance, and company SEC filings (historical EPS and DPS); BLS (historical inflation); St. Louis Fed (forecast inflation).

Economic impossibility

It is economically impossible for analysts' forecast growth rates to be sustained even one decade, much less into perpetuity. Figure 4 compares the forecast aggregate earnings of the US publicly traded companies for which analysts provide EPS growth forecasts to forecast US GDP.[43] Currently, these companies' combined earnings are equal to roughly 6% of US GDP. Yet if analysts' growth projections are correct, they will exceed total US GDP in just five years.[44]

Figure 4. US stock market forecast earnings vs. GDP[45]



[43] M. Ellis analysis of S&P GMI data for 972 stocks. Excludes companies with growth rates less than -100%.

[44] Sum of the forecasts for each company. Analysts' EPS estimates and growth rates from S&P Global Market Intelligence, as of December 31, 2021. GDP forecast is average of Congressional Budget Office, "The 2021 Long-Term Budget Outlook" (March 4, 2021), available at: https://www.cbo.gov/publication/56977; Energy Information Administration, "Annual Energy Outlook 2021," Table 20. Macroeconomic Indicators (February 3, 2021), available at https://www.eia.gov/outlooks/aeo/tables_ref.php; Social Security Administration, "The 2021 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds," Supplemental Single-Year Tables, (August 31, 2021), available at: https://www.ssa.gov/OACT/TR/2021/.

[45] Average of CBO, EIA, SSA nominal GDP forecasts. S&P GMI data for 972 stocks, as of December 31, 2021. Excludes companies with growth rates less than -100%.

Given their incompatible forecast horizons, inconsistency with analysts' own return forecasts and historical growth, and economic impossibility, it is unreasonable to use analysts' estimates for the perpetuity growth rate assumption in a constant-growth DCF model.

Q. Do you have any other concerns about Mr. D'Ascendis's implementation of the DCF model?

A. Yes. I have two additional concerns. The UPG members were selected on the basis of the similarity of their risk profiles to Aquarion's, and to each other's. They therefore should be expected to have similar costs of capital. Mr. D'Ascendis's DCF model results vary by a factor of over 2, from 5.97% to 13.55%. This is a clear indication that the model is poorly specified for its intended purpose.

Second, the DCF model produces an expected return on a company's equity. The UPG companies have different capital structures than Aquarion, so their equity risk profiles vary as well. The DCF model results need to be adjusted for differences in leverage among the UPG members, and between the UPG and Aquarion. This will be revisited later in my testimony when I discuss my recommended approach.

Q. Given the numerous shortcomings of the DCF model that you have identified, should it be used at all?

A. Discounted cash flow models are a robust approach to estimating expected returns and are widely used throughout finance. The key shortcoming of the constant-growth version of the DCF model used by Mr. D'Ascendis – assuming a relatively short-term growth rate into perpetuity – can be easily remedied by assuming that analysts' estimated growth rates apply only for a limited period, after which they converge toward a market- or sector-average terminal growth rate in a multi-stage DCF model (MS DCF). Despite the various deficiencies in analysts' estimates even in the short-term, they are widely viewed as the best available estimates of near-term investor expectations. That said, relatively little weight should be placed on them in estimating the cost of equity, and the MS DCF model weights them more appropriately. I will discuss the MS DCF model in more detail when I cover my recommended approach.

F. RISK PREMIUM MODEL

Q. Please provide an overview of Mr. D'Ascendis's risk premium model.

A. Mr. D'Ascendis's risk premium model (RPM) is actually a composite of several different models, all based on the concept of adding a premium to a low- or no-risk interest rate as investor compensation for assuming risk. His RPM result is a complicated average of the results of multiple subordinate analyses, summarized in Table 7. While the risk premium model might be sound in concept, the various versions included in Mr. D'Ascendis's testimony are (1) ill-suited to estimating the long-term expected returns that are the goal of the ROE analysis; (2) suffer from various errors in implementation; and/or (3) duplicative with the more widely used capital asset pricing model (CAPM).

Table 7. Constituent risk premium model analyses
Percent

Model	Description/data				Result
1. Predictive Risk Premium Model (PRPM)	Forecast 30-year Treasury yield + GARCH risk premium				**10.82**
	Forecast 30-year Treasury yield				2.11
	+ UPG average of GARCH (generalized autoregressive conditional heteroskedasticity) statistical risk premium model				8.71
2. Total market approach	Adjusted Aaa bond yield + risk premium				**10.30**
a. Adjusted bond yield	Forecast Moody's Aaa bond yield			2.96	3.56
	+ historical A2-Aaa premium			0.54	
	+ historical UPG-A2 premium			0.06	
Equity risk premium (f x average of b-e)	Large-cap Beta x (total market – Moody's Aaa/Aa2 corporate bond yield)	7.72	Utility Utility index – Moody's A2 utility bond yield	5.75	6.74
b. Historical average	Large company stocks	5.78	S&P Utility Index	4.21	
c. Regression		9.42		6.88	
d. PRPM		9.54		5.53	
e. DCF (forecast sources)	Value Line Summary and Index	10.73	NA		
	Value Line S&P 500 Index	10.99	Value Line S&P Utility Index	6.68	
	Bloomberg S&P 500 Index	10.74	Bloomberg S&P Utility Index	5.44	
f. Beta	Average of Value Line/Bloomberg	0.81	NA	NA	

1. Predictive Risk Premium Model

Q. What is the Predictive Risk Premium Model?

A. For one of his methods of calculating the risk premium, Mr. D'Ascendis introduces a proprietary methodology, the Predictive Risk Premium Model (PRPM). This approach, developed by Mr. D'Ascendis and several senior executives at his previous employer, Associated Utilities Services (AUS), uses a statistical modeling technique known as generalized autoregressive conditional heteroskedasticity (GARCH).

Estimating the expected return on equity has been the focus of intense and extensive research and analysis by academics and investment professionals for many decades, over which time a number of generally accepted practices have been developed and become widely used. The introduction of a new method like the PRPM inevitably raises a number of questions.

Q. What questions does it raise?

A. Several come to mind, including:

- What underlying equity risk factors does the model use to estimate returns?
- Is the method for determining those risk factors, i.e., the GARCH model, appropriate for the purpose of estimating a long-term cost of equity?
- In what other contexts, e.g., academic, regulatory, or investment management, has the PRPM been used?
- What evidence is there of the model's predictive validity?
- Is the model applied consistently, both within this specific analysis and with its original intent?
- Do the results of this specific analysis appear reasonable?

Q. What underlying equity risk factors does the PRPM use to estimate returns?

A. The PRPM uses one risk factor: the return volatility (standard deviation or variance) of each individual asset on its own, not relative to the market as a whole. As a result, the PRPM's cost of equity estimates reflect "*all* of the risk that investors actually face"[46] and "the risk to which investors are actually exposed, whether it's systematic risk or not."[47] While intuitively appealing, the PRPM's assumption that expected returns are correlated with total risk is not supported by either evidence or finance theory.

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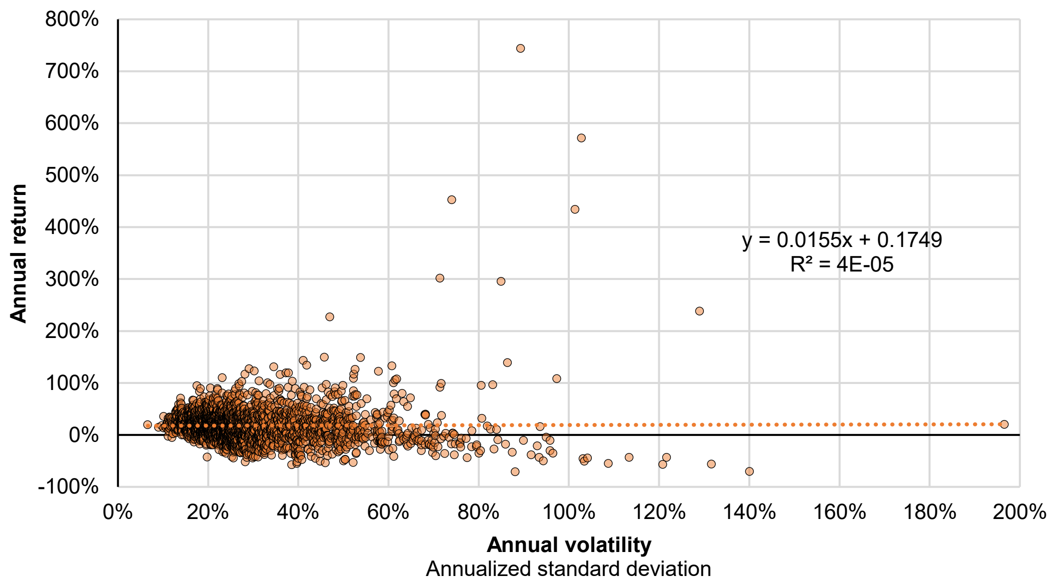
[46] Michelfelder, Ahern, D'Ascendis, Hanley, "Comparative Evaluation of the Predictive Risk Premium Model, the Discounted Cash Flow Model and the Capital Asset Pricing Model for Estimating the Cost of Common Equity," *The Electricity Journal*, 6:4 (May 2013), p. 85 [emphasis in original].

[47] Ahern, Hanley, Michelfelder, "New Approach for Estimating the Equity Risk Premium for Public Utilities," *The Journal of Regulatory Economics*, 40 (2011), p. 274.

Empirically, there is no observable relationship between total risk and return for individual securities, as can be seen in Figure 5, which plots annual total return against annualized volatility for the members of the S&P 500 for the five years 2016 through 2020.[48] The R^2 coefficient, a measure of how much of the return is explained by the standard deviation, is 0.00004, no better than random noise.[49]

Figure 5. Historical annual return vs. annual volatility for current S&P 500 members[50]
2016-2020



Q. Why don't returns reflect total risk?

A. Introductory finance textbooks sometimes begin their discussion of the fundamental principles of modern finance with this very observation: "there is no clear relationship between volatility and return," and "while volatility is perhaps a reasonable measure of risk

[48] Annualized volatility is the standard deviation of daily returns multiplied by the square root of 252, the approximate number of trading days in a year.
[49] For comparison, two sets of randomly generated numbers with the same mean and standard deviation as the sample can have an R^2 coefficient ten times higher.
[50] Index members as of October 31, 2021. M. Ellis analysis of S&P GMI absolute return data.

when evaluating a large portfolio, it is not adequate to explain the returns of individual securities."[51] The reason returns are not correlated to total risk is due to the benefits of diversification in reducing risk. The returns of individual stocks are not correlated, so their risks will tend to offset each other when held in a portfolio. Not all risk can be eliminated in this manner, but a significant portion can. The risk remaining after broad diversification is known as systematic or non-diversifiable risk; it can be thought of as the risk of the market overall, commonly represented by a broad market index like the S&P 500.

Diversification is easy and inexpensive – the management cost of index funds is on the order of 0.05%. If the diversifiable risk of stocks earned an additional risk premium, then investors could buy the stocks, capture the premium, and at the same time diversify and eliminate the risk. Under the no-arbitrage principle of financial markets, this opportunity to earn something for nothing would quickly be exploited and eliminated.[52]

A simple thought experiment demonstrates the fallacy of assuming expected returns should reflect total, not just systematic, risk. Consider an investor who buys a broadly diversified portfolio designed to replicate the market – say, every company in the S&P 500 in proportion to their weight in the index. Since, on average, their individual risks would be greater than the market as a whole (diversification reduces the risk of the market portfolio), by the logic of the PRPM, their expected returns should be, as well. Such an investor should expect their portfolio, which is meant to replicate the market, to beat the market. It's simply nonsensical.

[51] See, for example, Berk, DeMarzo, *Corporate Finance*, 3rd ed. (2014), p. 328.
[52] Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 13 (December 1976), pp. 341–360.

For these reasons – risk reduction through diversification and no arbitrage, two of the most fundamental principles of modern finance – a security's expected return tends to reflect only its systematic risk, not its total risk. There is no empirical or theoretical support for the PRPM's premise that returns should reflect *all* risk.

Q. Is the method for determining those risk factors, i.e., the GARCH model, appropriate for the purpose of estimating a long-term cost of equity?

A. The PRPM uses a statistical modeling technique known as generalized autoregressive conditional heteroskedasticity (GARCH). As described in "GARCH 101: An Introduction to the Use of ARCH/GARCH models in Applied Econometrics," an overview written by Robert Engle, the Nobel laureate who developed the technique, GARCH "models are especially useful when the goal is to analyze and forecast volatility"[53] – not returns, per se.

"Heteroskedasticity" refers to when the errors of an ordinary least squares regression (OLS) – of the type widely used elsewhere in finance and statistics, such as in the CAPM model[54] – are not constant over time. In practical terms, heteroskedasticity describes the phenomenon of stock and bond returns experiencing periodic bouts of high volatility that eventually return to a long-term average level. GARCH models explicitly model this time-varying, mean-reverting volatility. GARCH models are best suited to forecasting volatility in the near term – the next time step in the data series, e.g., one month into the future if using monthly returns. Given this near-term focus, the GARCH model is poorly suited for estimating long-term expected returns.

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[53] Engle, "GARCH 101: An Introduction to the Use of ARCH/GARCH models in Applied Econometrics," NYU Working Paper No. FIN-01-030 (2001), p. 1.

[54] The security market line in the CAPM is an OLS of return vs. beta, and beta is an OLS of the returns of an individual stock vs. the market.

Importantly, "the regression coefficients for an ordinary least squares regression are still unbiased, but the standard errors and confidence intervals estimated by conventional procedures will be too narrow, giving a false sense of precision."[55] OLS models like the CAPM can still produce accurate estimates of the long-term average; it's just the uncertainty around those estimates that varies over time. The PRPM is an attempt to solve a problem that does not exist with the current models used to estimate the long-term cost of equity.

Q. In what other contexts, e.g., academic, regulatory, or investment management, has the PRPM been used?

A. The PRPM was originally developed by Mr. D'Ascendis's colleagues at his former employer, AUS Consultants, several of whom now work with Mr. D'Ascendis at Scott Madden. The PRPM has only ever been introduced in regulatory proceedings by a small cohort of consultants affiliated with AUS and/or Scott Madden.[56] All of the published academic articles about the PRPM have been authored by this small group, as well.[57] While the PRPM has been mentioned in a handful textbooks for utility cost of capital practitioners, it cannot be found in any general finance textbooks. There is no record of its use, in regulatory or academic contexts, by any parties other than its creators and their professional colleagues.[58]

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[55] Engle, "GARCH 101," p. 1.

[56] During discovery, Mr. D'Ascendis was asked for a list of all known regulatory proceedings in which the PRPM has been introduced by experts other than his Scott Madden colleagues. He provided three examples, once by John Perkins in Maine PUC Case No. 2017-00198, and twice by Frank Hanley in Maryland PSC Case No. 9322 and Washington, DC, PSC Case No. 1093. Mr. Perkins was employed by Scott Madden at the time of his testimony; Mr. Hanley is a co-creator of the PRPM and former AUS employee.

[57] Data request response DOE 5-17b (Attachment MEE-4).

[58] Data request response DOE 5-17b (Attachment MEE-4).

Q. Is there any evidence of the model's predictive validity?

A. During discovery, Mr. D'Ascendis was asked for all available studies and analyses of the PRPM's ability to predict future returns. He provided copies of the two papers referenced in his testimony, neither of which provides substantive quantitative analysis of their predictive validity. They, do however, highlight substantial flaws in the model. Figure 6 presents two charts excerpted from the Ahern, et al, paper comparing actual annual returns to the predictions of the PRPM (blue), CAPM (red), and DCF (green) for a selection of utility companies. Even after adjusting for errors in the reported actual returns (purple; they have been inverted, so negative figures should be positive and vice versa), it is clear the PRPM has no validity in predicting actual returns even over the shorter time frame for which the model is specified.[59]

[59] The DCF and CAPM, as used in utility regulatory proceedings, are models of multi-year average expected returns, so it is not appropriate to evaluate their validity on a single-year basis.

Figure 6. Ahern, et al, comparison of PRPM estimated returns to CAPM, DCF, and actual returns[60]

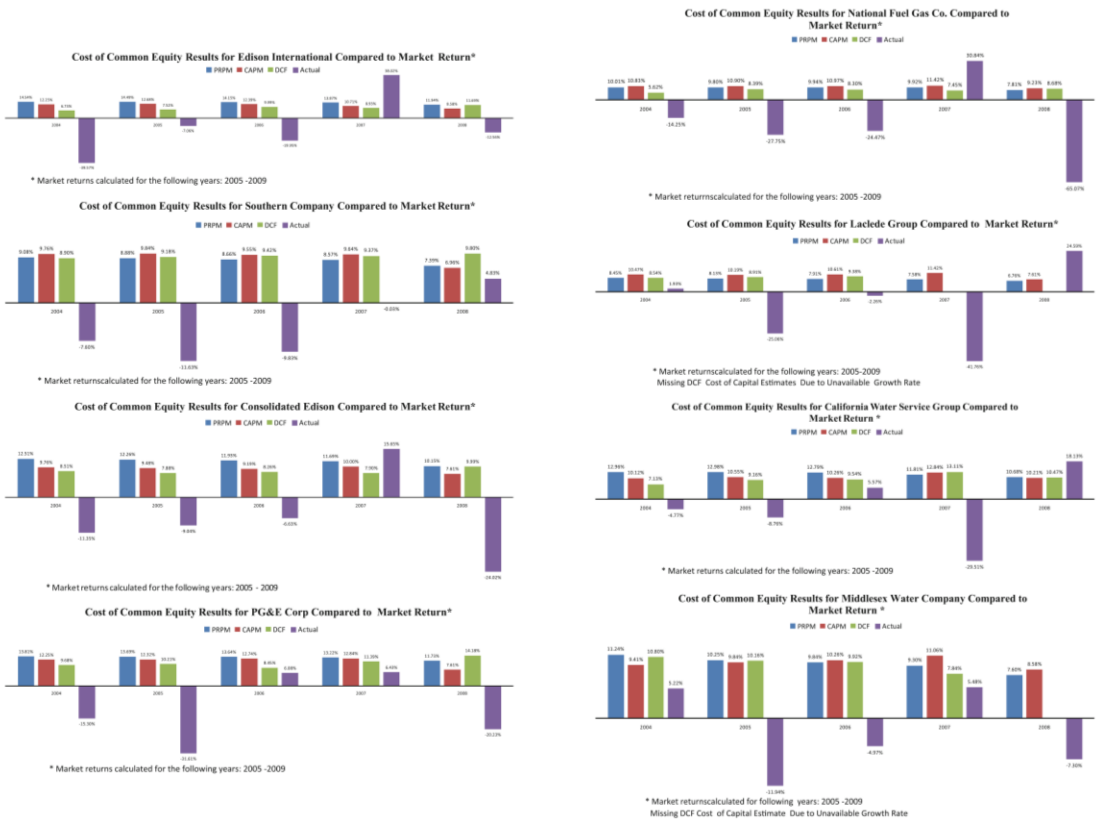

Figure 7 presents charts from the Michelfelder, et al, paper comparing the PRPM (solid), CAPM (dashed), and DCF (dot-dashed) results, one for each for four different categories of utilities. For gas and water utilities, the PRPM is consistently higher than the DCF and CAPM. For electric and combination utilities, it is also consistently higher except for approximately nine months of the six-year analysis window. This is to be expected, based on the model's premise of pricing all risk, not just systematic risk.

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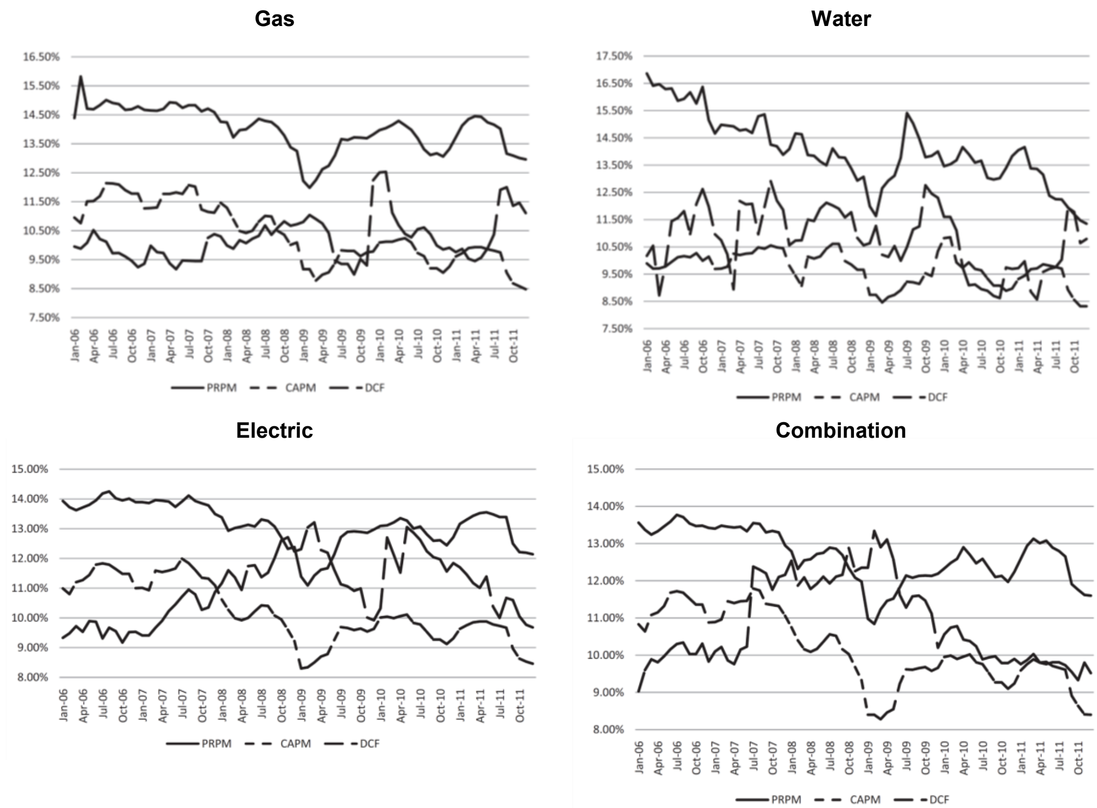
[60] Ahern, et al, "New Approach for Estimating the Equity Risk Premium for Public Utilities," *The Journal of Regulatory Economics*, pp. 275-76.

Figure 7. Michelfelder, et al, comparison of PRPM, CAPM, and DCF return estimates[61]

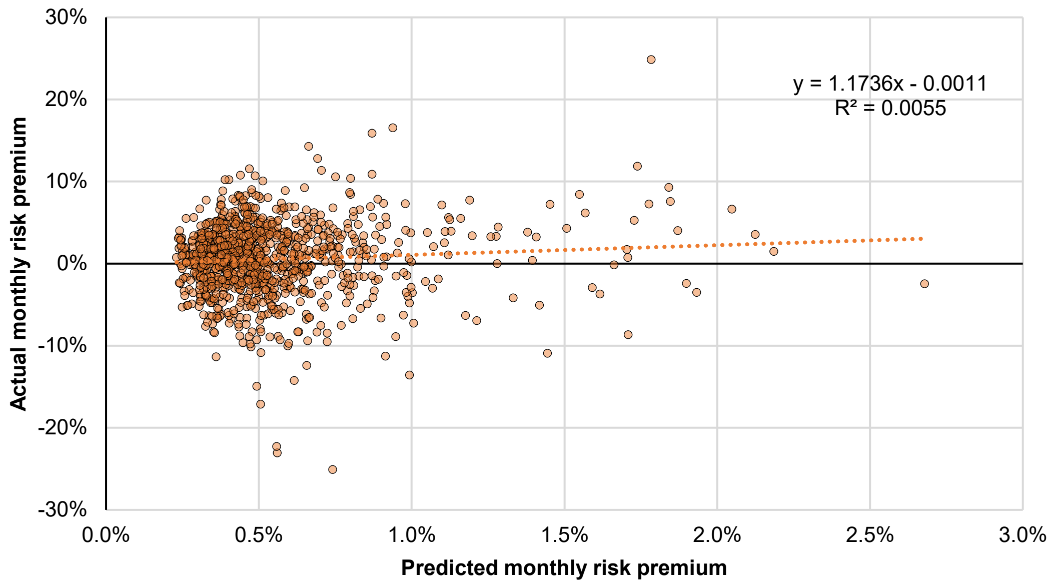


A more detailed analysis of the model's predictive validity was conducted on historical backcast data provided by Mr. D'Ascendis during discovery.[62] Figure 8 presents a cross-plot of the actual Ibbotson large company stock monthly risk premium against the PRPM's prediction from 1936 through 2019. Even at the monthly time step for which the PRPM is specified, it has virtually zero predictive validity, with less than 1% of the variation in the observed monthly risk premium explained by the PRPM ($R^2 = 0.0055$).

[61] Michelfelder, et al, "Comparative Evaluation of the Predictive Risk Premium Model, the Discounted Cash Flow Model and the Capital Asset Pricing Model for Estimating the Cost of Common Equity," pp. 87-88.

[62] Data request response DOE 4-2 Attachment 1 (Attachment MEE-5).

Figure 8. Large-cap composite monthly risk premium, actual vs. PRPM prediction[63]
1936-2019



The backcast data is for a broad market portfolio, for which a clear relationship between volatility and return might be expected (see above). Mr. D'Ascendis would not provide similar backcast data for the UPG members,[64] but there is no reason to expect that the PRPM's predictive validity would be any better for individual stocks. Simple inspection of the models results reveals this to be true. The predicted risk premia for the Utility Peer Group range from 7.05% to 14.28%, unreasonably wide for companies with similar risk profiles.[65] As with Mr. D'Ascendis's DCF model results, such dispersion is another indication that the PRPM model is improperly specified for its intended use.

Q. Does Mr. D'Ascendis apply the model consistently, both across its various uses in his analysis and with its original intent?

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[63] M. Ellis analysis of data request response DOE 4-2 Attachment 1. Annualized PRPM results were converted to monthly values for apples-to-apples comparison with actual monthly risk premium data (Attachment MEE-5).
[64] Data request response DOE 5-17c (Attachment MEE-4).
[65] Attachment DWD-4, p. 2.

A. No. As summarized in Table 7, within the RPM, Mr. D'Ascendis uses the PRPM to calculate several different risk premia. The first inconsistency is his use of three different interest rate indexes: Treasurys, Aaa/Aa2-rated corporate bonds, and A2-rated public utility bonds. No explanation is provided for these choices.

The risk premium is calculated as the product of two outputs of the GARCH model: the predicted conditional variance and the GARCH coefficient, which can be considered the slope of the regression line between the risk premium and the predicted variance. For the UPG members, the variance used is the average of the current (spot) conditional variance and the average of all historical conditional variances. In contrast, for the three index risk premia, the variance used is the average of all historical conditional variances. Mr. D'Ascendis does not provide any explanation for this difference in approach beyond exercising "his professional judgment."[66]

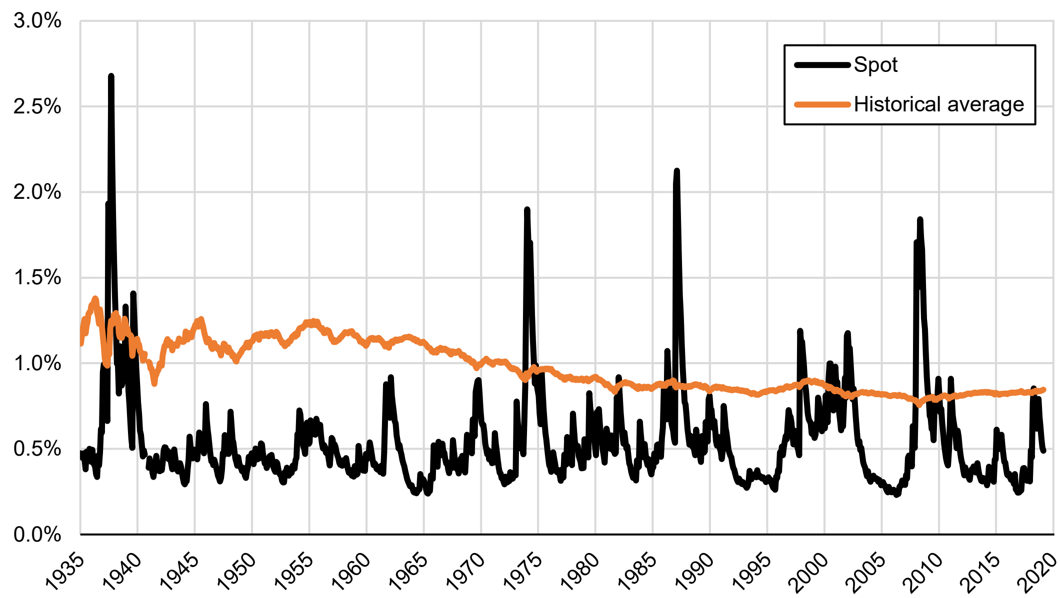
The use of the historical average variance is inconsistent with the intent of the GARCH model, which is best suited for predicting volatility in the next time step – one month, in this case, as Mr. D'Ascendis is using monthly returns. Presumably, using just the spot variance would introduce significant variability in the predicted risk premium, casting doubt on the model's reliability. The annualized risk premium in the backcast data range up to 37% – too high to reasonably reflect investors' long-term return expectations.

Using the historical average variance, though, introduces significant upward bias. Figure 9 shows the same backcast risk premium data in Figure 8, as well as the risk premium recalculated using the same trailing average historical conditional variance back to January 1926 used by Mr. D'Ascendis.[67] The arithmetic average monthly risk premium nearly

[66] Data request response DOE 5-17d (Attachment MEE-4).
[67] Data request response OCA 1-1 Attachment, tab PRPM WP1 (Attachment MEE-6).

doubles, from 0.54% to 0.97%; the corresponding arithmetic average annualized risk premium increases from 6.77% to 12.36%. This surprising result appears related to the time period over which the trailing historical variances are averaged. It is clear, though, that the long-term average yields a significantly upwardly biased risk premium relative to the monthly spot estimate for which the GARCH model is intended. A similar bias appears in the other two index-based PRPM risk premia.

Figure 9. Large-cap composite PRPM predicted monthly risk premium using spot and average historical variance[68]



An additional source of upward bias arises from Mr. D'Ascendis's annualization of monthly rates using the formula: $annual = (1 + monthly)^{12} - 1$, which assumes there is no month-to-month variability in the risk premium. As discussed above, any variability will reduce the realized return over multiple time periods. The GARCH model is a model of conditional variance, and its results change each month. Converting the monthly expected

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[68] M. Ellis analysis of data request response DOE 4-2 Attachment 1 (Attachment MEE-5).

risk premium to an annual rate would require downward adjustment for this volatility; Mr. D'Ascendis fails to do so. This source of bias is largely mitigated by his decision to use the historical average variance, which is much less volatile than the spot variance, but it introduces even more upward bias in the resulting equity risk premium.

Q. Do the results of the analysis appear reasonable?

A. As noted above, the UPG results, which are based on an average of historical and spot variance, are too dispersed to be reasonable. The key driver of this dispersion is their GARCH coefficients, which range from 1.5198 to 5.9529.[69] The GARCH coefficient is the relationship between volatility and return in excess of the risk-free rate. The UPG members all have similar risk profiles, so it is not clear why this relationship should vary so much among them. It appears to be a statistical artifact of Mr. D'Ascendis's implementation and application of the model. The highest GARCH coefficient is for American Water Works (ticker AWK), which also has the least historical return data for use in the model, although over twelve years of data are used. Mr. D'Ascendis ultimately removes AWK from the UPG PRPM analysis as "not meaningful."[70] That the PRPM requires decades of company-specific historical data to produce meaningful results raises other concerns, such as the validity of forward-looking expected return estimates based on a model so sensitive to data from over a decade in the past, and is yet one more indication of the PRPM's unsuitability for estimating the type of long-term return required in utility regulatory proceedings.

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[69] Attachment DWD-4, p. 2.
[70] Attachment DWD-4, p. 2.

Q. Do you have any other concerns with the PRPM?

A. Mr. D'Ascendis adds the risk premia calculated for each UPG member to the 30-year Treasury (T30). Given that we are estimating the long-term cost of equity, this is an appropriate choice. But in estimating the risk premium using the GARCH model, he uses Ibbotson's long-term government bond data, which is based on the 20-year Treasury.[71] Because the T30 tends to have a higher yield than the 20-year – +0.07% on average over the year through December 2021 – his estimated risk premium will be overstated relative to the 30-year benchmark. This upward bias arises as well in his implementation of the CAPM model, where various estimates of the market risk premium are estimated from historical data.

Additionally, Mr. D'Ascendis uses a forecast, not current market, T30 rate. There are several problems with forecast rates; the most critical is that his source, Blue Chip Financial Forecasts (BCFF), has been consistently upwardly biased for over two decades. He also uses forecast rates in his CAPM analysis, so I will cover this issue in more detail there.

Q. What is your overall assessment of the PRPM model and its results?

A. The premise of the PRPM violates the most fundamental principles of finance theory, is unsuitable for estimating long-term returns, lacks empirical invalidity, has not been used by anybody other than its developers and their coworkers, contains numerous flaws in its conception and implementation, is applied inconsistently, and produces clearly biased and unreasonable results. It is entirely unsuited for estimating the cost of equity in a utility cost of capital proceeding, and any and all results using the PRPM should be disregarded.

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[71] Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), pp. 44.

2. Total market approach

Q. What is the total market approach to the risk premium model?

A. "Total market approach" (TMA) is the term Mr. D'Ascendis uses to refer to the more common version of the risk premium model, as distinct from the PRPM, in which the cost of equity is estimated by adding a utility-specific equity risk premium to a utility bond yield.

Mr. D'Ascendis's TMA entails a number of constituent analysis, as outlined in Table 7. Two utility equity risk premia are estimated. The first is the beta-adjusted premium of the large-cap index over the average Aaa/Aa2- or Aaa-rated corporate bond yield (beta-adjusted MRP). The second is the premium of the S&P Utilities Index over the A2-rated utility bond yield (URP). The average of these two premia is added to a bond yield meant to reflect the UPG's, and presumably Aquarion's, cost of debt. It is based on the Aaa-rated corporate bond yield, with adjustments to reflect the UPG's/Aquarion's lower credit quality.

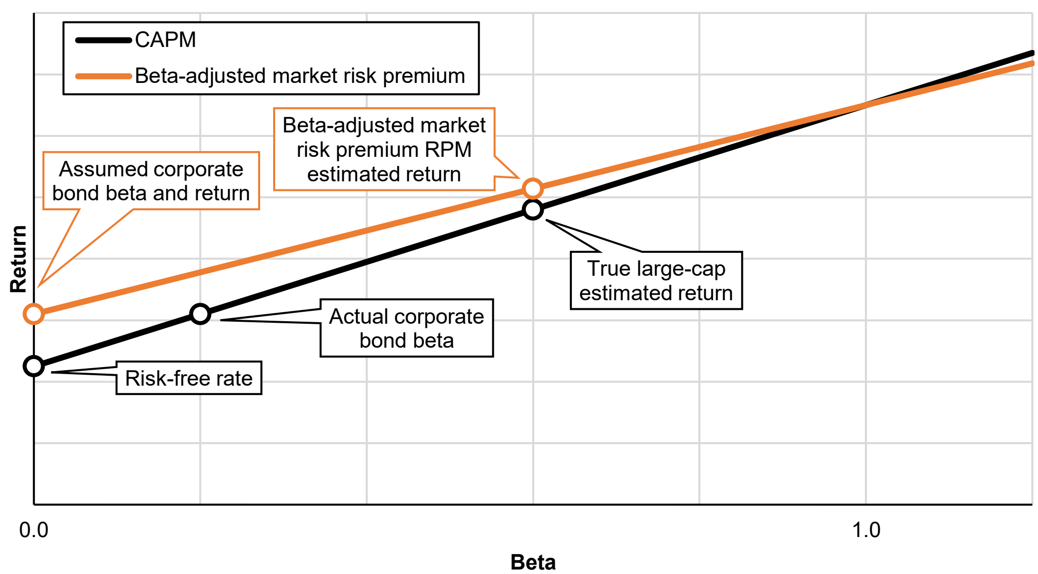
Q. Are Mr. D'Ascendis's two implementations of the risk premium model sound?

A. Both models are conceptually flawed. In addition, there are errors in his estimates of the bond yield and the two risk premia.

Q. What is the conceptual flaw in the beta-adjusted MRP?

A. The beta-adjusted MRP is essentially a modification of the CAPM – which estimates returns as a linear function of the market risk premium and beta, or an asset's non-diversifiable risk – substituting the corporate bond rate for the risk-free rate. A key assumption of the CAPM is that the rate against which the market risk premium is measured has a beta of zero and is risk-free, i.e., has no chance of default, neither of which is true of corporate bonds.[72] As illustrated in Figure 10, assuming corporate bonds have a beta of zero and no default risk effectively raises the floor to which the risk premium is added and reduces the slope of the security market line (the relationship between beta and return). These erroneous assumptions systematically inflate the resulting COE estimate as long as the equity beta is less than 1.0, which is generally true of utilities.

Figure 10. CAPM and (erroneous) beta-adjusted market risk premium security market lines



Q. What is the conceptual flaw in the URP?

A. The conceptual flaw in the URP is its failure to adjust for differences in expected return between the UPG/Aquarion and the utility index arising from differences in their credit

[72] From June 1926 through December 2021, the beta of Aaa- and Baa- rated corporate bonds has averaged 0.05 and 0.15, respectively, while the beta of the 20-year Treasury has averaged 0.01 (and not statistically significantly different from 0). M. Ellis analysis of FRED and FDL data.

quality and/or leverage. While Mr. D'Ascendis adjusts the bond yield to reflect this difference (erroneously, as will be explained below), he neglects to correspondingly adjust the risk premium, in the same manner that he neglects to adjust his DCF and CAPM results for differences in leverage between his proxy groups and Aquarion's target capital structure.

The market capitalization-weighted average credit rating of the utility stock index members is currently 36/64 A3/Baa1.[73] It undoubtedly has varied over time. Consequently, it is not possible to know the credit quality, and risk profile, embedded in the three of the four URP models that use historical data (all but DCF). Not knowing the credit quality and risk profile embedded in these three estimates of the utility risk premium renders them incomparable to the UPG/Aquarion.

In principle, the DCF-based URP could be adjusted for the difference in credit quality between the UPG/Aquarion and the utility index, but Mr. D'Ascendis fails to do. Because the utility index's average credit rating is more than a full grade below the UPG/Aquarion's, its equity is correspondingly riskier and higher-cost. Mr. D'Ascendis's DCF URP therefore overstates Aquarion's COE.

Q. How is the bond yield estimated?

A. Mr. D'Ascendis starts with the Aaa-rated corporate bond rate, for which he uses forecast, not current market, rates. There are several problems with forecast rates; the most critical is that his source, Blue Chip Financial Forecasts (BCFF) has been consistently upwardly biased for over two decades. He also uses forecast rates in his CAPM analysis, so I will cover this issue in more detail there.

[73] M. Ellis analysis of S&P Global Market Intelligence data, as of December 3, 2021.

Mr. D'Ascendis makes two adjustments to the Aaa-rated corporate bond yield: one for the difference between the yields on A2-rated public utility bonds – the benchmark against which the utility risk premium is calculated – and Aaa-rated bonds (0.54%); and a second for the difference between the Utility Proxy Group's assumed average rating (between A2 and A3) and A2-rated public utility bonds (0.06%), for a total of 0.60%.

Q. Are these adjustments correct?

A. The first adjustment is correct mathematically, although, as explained below, it is inconsistent with Mr. D'Ascendis's risk premium calculations.

The second adjustment is incorrect because Mr. D'Ascendis miscalculates the UPG average credit rating. Separate average numerical equivalent ratings for Moody's (6.5) and S&P (5.9) are apparently "eyeballed" to arrive at an average numerical rating of 6.5.[74] Moody's ratings are available for only two of the companies, though, so his calculation effectively gives each a 25% weight in the average, instead of a more appropriate 1/14 (7 companies x 2 ratings per company). Calculating each company's average rating across S&P and Moody's and then averaging across companies yields a numerical rating of 6.07, solidly in the A2 category.

Q. Do you have any other concerns with these adjustments?

A. Yes. The bond yield to which the risk premium is added in the RPM must be equivalent to that used to calculate the risk premium. But Mr. D'Ascendis's A2/A3-equivalent adjusted bond yield does not match the bond yield used to calculate his risk premia. In fact, Mr.

[74] Attachment DWD-4, p. 3. The adjustment is one-sixth of the difference between A2 (numerical rating of 6) and Baa2 (9) bonds.

D'Ascendis calculates the risk premium using *three different* bond yields – Aaa/A2 average and Aaa corporate bonds, and A2 public utility bonds – none equivalent to the adjusted bond yield.

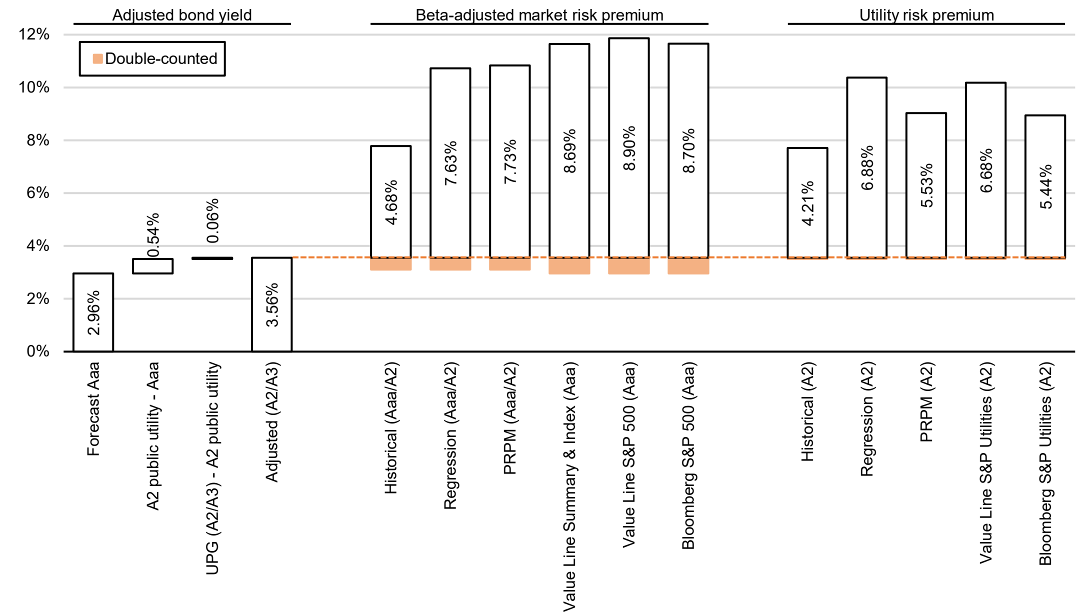
Q. What is the implication of using different rates in his adjusted bond yield, MRP, and URP calculations?

As shown in Figure 11, Mr. D'Ascendis averages six different estimates for his beta-adjusted MRP. Three are calculated relative to the Aaa/A2 average, the other three relative to Aaa. The URP averages five estimates calculated relative to a third rate, the A2-rated public utility yield. No explanation is given for using these different bond rates, but, clearly, their results are not comparable.[75] All of Mr. D'Ascendis's risk premia are calculated relative to a higher-quality, lower-yield bond than the A2/A3 adjusted bond yield, so the differences in yield between the A3/A2 average and these benchmarks, indicated by the light orange bars in Figure 11, are double-counted.

There is an additional error in the regression-based MRP. The regression is based on the historical Aaa/A2 average bond yield, but the MRP is calculated using the forecast Aaa rate.[76] This increases the estimated beta-adjusted MRP from 7.49% to 7.63%.[77]

[75] Mr. D'Ascendis could have calculated all MRP and URP estimates relative to Aaa-rated corporate or A2-rated public utility bonds, for which ample historical data are available, although doing so would still not address both models' conceptual flaws.
[76] Data request response OCA 1-1 Attachment 1, tab MRP ERP WP (Attachment MEE-7).
[77] The forecast Aaa/Aa2 bond yield, 3.10%, is estimated by interpolating between the forecast Aaa and Baa yields provided in data request response OCA 1-1 Attachment 1, tab MRP WP1 (Attachment MEE-8).

Figure 11. TMA bond yield and risk premia calculations[78]



Q. Do you have any concerns with Mr. D'Ascendis's various risk premium models, beyond their inconsistent bond yields?

A. Yes. Mr. D'Ascendis uses four different models to estimate each risk premium: historical average, regression, PRPM, and DCF. For the MRP, the DCF is run using three different sets of input assumptions, for a total of six estimates. I have already discussed my concerns with the PRPM and DCF models. Mr. D'Ascendis also uses all four models in his CAPM analysis. Here, I will give an overview of my concerns with the historical average and regression models. I will provide more detail in my discussion of his implementation of the CAPM.

- *Historical average*: The main shortcomings with Mr. D'Ascendis's historical average risk premium estimates are the use of the arithmetic average for both the equity and bond returns, and the use of income-only returns for the bonds. Geometric returns better reflect long-term investor expectations, and total returns better reflect what investors actually

[78] Attachment DWD 4, pp. 9, 12.

realize on bond investments. Few investors hold long-term bonds to maturity, the only way to realize the income-only return.

- *Regression*: The regression risk premium model also uses income-only, not total, returns, and produces the equivalent of an arithmetic return. It suffers from two further flaws. The modeled causal relationship in which the 12-month trailing return is determined by the bond rate in the 12th month only – e.g., the return from January through December is determined by the bond rate in December only – is simply not plausible. As would be expected from such an invalid causal relationship, the statistical significance of the resulting regression model is no better than random, so its results are not meaningful.
- *PRPM*: As explained above, the PRPM suffers numerous deficiencies. Any risk premium based on this model should be disregarded.
- *DCF*: Mr. D'Ascendis uses the same constant-growth DCF model used to estimate the COE for each of the UPG members. Here, he calculates market capitalization-weighted average COEs for the members of the S&P 500 and Utilities Indexes using Bloomberg and Value Line data, and an additional COE using growth estimates for Value Line's Summary & Index. As explained above, the CG DCF's main shortcoming is the assumption that analysts' three-to-five-year growth estimates can be sustained into perpetuity. His results are therefore significantly upwardly biased.

Q. What is your overall assessment of the total market approach?

A. Both the beta-adjusted MRP and URP models suffer numerous flaws in their overall concept, inconsistent use and consequent double-counting of bond yields, and constituent risk premium models. The results of the TMA should be disregarded.

3. Risk premium model conclusion

Q. And of Mr. D'Ascendis's risk premium model overall?

A. Mr. D'Ascendis's risk premium model is the combination of two models deeply flawed in both concept and implementation, the PRPM and total market approach. His RPM results should be disregarded from consideration.

G. CAPITAL ASSET PRICING MODEL

Q. What is the capital asset pricing model (CAPM)?

A. Mr. D'Ascendis analysis incorporates another well-known COE model, the capital asset pricing model (CAPM). It estimates the cost of equity, k, from the formula:

$$k = r_f + \beta(r_m - r_f)$$

where r_f is the risk-free rate (typically a long-term US Treasury), r_m is the expected return on the market, and β is a measure of risk of the company in question relative to the market. Typically, the market risk premium (MRP), the difference between the market return and the risk-free rate, $r_m - r_f$, is estimated instead of the market return, per se, and then added to r_f.

Mr. D'Ascendis also uses a modified version of the CAPM called the Empirical CAPM (ECAPM). His final CAPM COE is the simple average of the traditional CAPM and ECAPM results.

1. Risk-free rate

Q. How does Mr. D'Ascendis estimate the risk-free rate?

A. Mr. D'Ascendis uses the 30-year Treasury (T30) for his risk-free rate. Given that we are estimating the long-term cost of equity, this is an appropriate choice. Nonetheless, several of his market risk premium estimates use Ibbotson's long-term government bond data, which is based on the 20-year Treasury.[79] Because the T30 tends to have a higher yield than the 20-year – +0.07% on average over the year through December 2021 – his estimated market risk premium will be overstated relative to his chosen interest rate. This upward bias arises as well in his implementation of the PRPM for the individual UPG members, which is also based on the T30.

More critically, as with his risk premium model – PRPM and total market approach – Mr. D'Ascendis uses a forecast, not current market, rate. Specifically, he uses the Blue Chip Financial Forecast (BCFF) consensus, which is based on a survey of approximately forecasters from such firms as Moody's, J. P. Morgan, and Wells Fargo.

Q. What's wrong with using a forecast rate?

There are several concerns with using interest rate forecasts instead of current market rates. First, doing so is inconsistent with the time horizon of the DCF, which is estimated as of today (or, more precisely, as of the end of the trailing price averaging period). The mathematical formula for the present value of a periodic time series upon which the DCF is based discounts the stream of future cash flows to a "time zero" one period before the first payment. The resulting discount rate is as of that time zero. The first payment in the DCF model is typically assumed to occur time step from today; therefore the rate determined by the DCF model is as of today. Using an interest rate expected on some future date in the risk premium model produces an expected return as of that future date, not today, that is not directly comparable to the DCF.

[79] Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), p. 44.

Second, Mr. D'Ascendis provides no explanation for his choices and weightings of the available forecasts. He uses a simple average of six quarterly and two five-year forecasts, all as of some time up to eleven years in the future. How is this weighting linked to our task of estimating the cost of equity for ratemaking purposes? Should the estimated COE reflect expectations as of today, as of the future effective date of the rate case, on average over the interval to the next rate case? If either of the latter two, what dates are assumed? How does Mr. D'Ascendis's specific combination of forecast rates reflect investor expectations for the relevant time horizon? Mr. D'Ascendis does not address any of these questions or provide any rationale for his selection or weighting of the various forecasts available.

Third, there is no reason to believe BCFF in any way represents an aggregate "market" view. BCFF has no more than a hundred thousand subscribers,[80] less than 0.1% of the hundreds of millions of investors who are exposed to Treasury rates through direct investments or as a benchmark for other investments.[81]

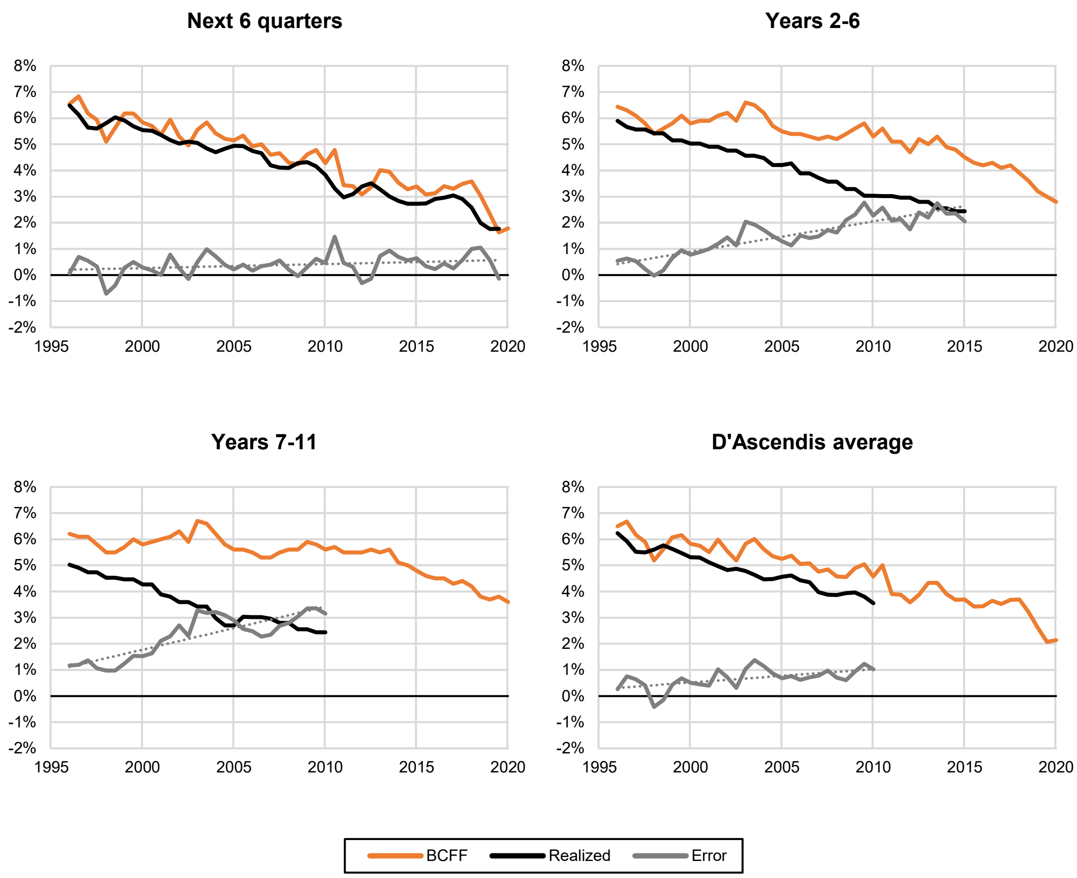
Fourth, and most importantly, BCFF has a multi-decade track record of producing systematically upwardly biased forecasts, and the errors have only increased over time. Figure 12 compares four BCFF forecasts – average of next six quarters, years two to six, years seven to eleven, and Mr. D'Ascendis's unweighted average – to their corresponding future average realized rates, going back to BCFF's first long-range forecast in December 1996. All three have consistently overestimated future rates, and the forecast errors have

[80] In the 2020 annual report of Wolter Kluwers, BCFF's owner, $905 million of revenue was attributed to the Legal & Regulatory segment, of which BCFF is just 1 of 99 offerings (https://www.wolterskluwer.com/en/legal/our-solutions). BCFF costs approximately $2,500/year. Even assuming BCFF accounts for 10% of segment revenue – roughly ten times the segment average – BCFF has no more than 40,000 subscribers.

[81] More than half of US adults and households are invested in the stock market. See, for example, https://www.pewresearch.org/fact-tank/2020/03/25/more-than-half-of-u-s-households-have-some-investment-in-the-stock-market/ and https://news.gallup.com/poll/266807/percentage-americans-owns-stock.aspx.

tended to increase over time. The same analyses of BCFF's Aaa-rated corporate bond forecasts, used in Mr. D'Ascendis's risk premium model, produce similar results.

Figure 12. BCFF 30-year Treasury forecast vs. average realized rate[82]



Q. Is Mr. D'Ascendis aware of BCFF's poor accuracy?

A. Yes. At least one other cost of capital expert has provided similar evidence to mine pointing out the systematic errors in BCFF forecasts.[83]

[82] M. Ellis analysis of BCFF and FRED data. From June 2002 through June 2005, BCFF forecast the long-term average or 20-year Treasury instead of the 30-year. Those forecasts are used in this analysis.
[83] Direct Testimony of Aaron L. Rothschild on behalf of the South Carolina Department of Consumer Affairs, PSC of South Carolina Docket No. 2019-290-WS (January 23, 2020), pp. 18-19.

Q. What is Mr. D'Ascendis's rationale for continuing to use BCFF forecasts despite their poor accuracy?

A. In support of his use of BCFF's forecast discount rates despite their inaccuracy, Mr. D'Ascendis argued in a recent proceeding:[84]

> It is not the accuracy of the forecasts that is relevant, but whether or not investor expectations reflect those forecasts. Investor reaction to analysts' forecasts, whether they be growth rate or interest rate forecasts, can be likened to weather forecasts. For example, typically one prepares for forecasted severe weather, i.e., snowstorms and / or hurricanes, regardless of the historical accuracy of, or any inherent bias in, the weather forecasting. When severe weather is forecasted, those expected to be affected generally begin preparing by storing supplies of food, batteries, candles, etc. If the severe weather does not materialize, apparently that does not stop them from making the same preparations the next time severe weather is predicted.

Later in that testimony, he invokes the efficient markets hypothesis (EMH) – all available information informs investor expectations – as further support for the use of forecast rates. Mr. D'Ascendis further argues that if BCFF's "information were ignored by investors, the publication would have been discontinued."

Q. Are these arguments valid?

A. No, they are not. To begin with, as already mentioned, BCFF subscribers account for a tiny fraction of the market; there is no reason to believe they reflect the market in aggregate. In his weather analogy, how much influence would the forecast have if less than one in a thousand people were even aware of it?

Mr. D'Ascendis uses the BCFF forecasts as-is, with no adjustment for their historical inaccuracy. In doing so, he implicitly insists that investors rely *only* on BCFF forecasts, to the exclusion of all other ways investors might develop their expectations. Yet his two

[84] Rebuttal Testimony of Dylan W. D'Ascendis for Blue Granite Water Company, PSC of South Carolina Docket No. 2019-290-WS (February 6, 2020), pp. 48-51.

arguments in support of this contention – accuracy doesn't matter and EMH – contradict each other. The consistent errors in BCFF forecasts are also public information; the Congressional Budget Office has published reports assessing the accuracy of BCFF and its own interest rate forecasts for nearly twenty years.[85] According to EMH, investors take that information into account, as well. The weather forecast analogy is apt; if the local weathercast is consistently too high – for over twenty years – people eventually learn to dress for cooler weather than forecast.

Mr. D'Ascendis's argument that if BCFF "were ignored by investors, the publication would have been discontinued" also is not compelling. Investment decisions are the result of assimilating multiple types and sources of information and processing them in complex, woften idiosyncratic ways. The small share of investors who purchase BCFF reports might do so fully aware that its bond yield forecasts are biased and adjust them accordingly and/or use them in conjunction with other information.

This argument also ignores the bond yield forecasts' context. BCFF and similar services typically include dozens or hundreds of different forecasts, as well as commentary and analysis. Investors might continue to purchase these services for those offerings, not their bond yield forecasts. Other customers might have a vested interest in optimistic forecasts and be willing to pay for an ostensibly objective third-party source.

Mr. D'Ascendis's contention that BCFF forecasts reflect market expectations is especially egregious with respect to interest rates. There is an inverse relationship between the value of a bond and its interest rate. If investors expected rates to increase, as BCFF has consistently forecast for the last two decades, they would not buy at current prices, as they

[85] Congressional Budget Office, "CBO's Economic Forecasting Record" (November 2002), pp.

would be investing with the expectation of losing money. That investors do buy bonds at current rates is prima facie evidence that their expectations differ from BCFF's.

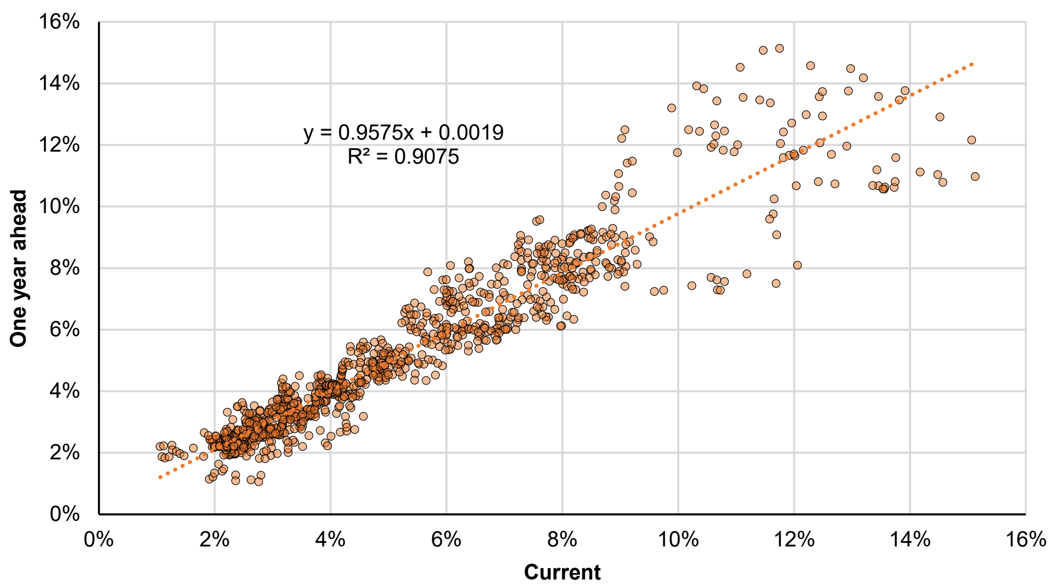
Q. Suppose we ignored the concern about consistency with the DCF and wanted a forecast interest rate. What should we use?

A. It turns out that current rates generally provide an unbiased forecast of future rates. Figure 13 is a cross-plot of the 20-year Treasury rate one year ahead against the current rate. Approximately 91% of the variation in future rates is explained by the current rate; for rates two years in the future, 84% is explained, and for rates in three years, 79%. Regardless of the forecast horizon, the current rate is unbiased – exhibiting no tendency to be systematically too high or too low.[86] Similar predictive validity is obtained for 30-year Treasurys and corporate bonds.[87]

[86] The bias in a forecast can be assessed from the decomposition of the mean square error into bias, inefficiency, and random variation components. See, for example, Mincer and Zarnowitz, "The Evaluation of Economic Forecasts," Economic Forecasts and Expectations: Analysis of Forecasting Behavior and Performance, (NBER, 1969), pp. 3-46; available at: http://www.nber.org/chapters/c1214. For the 20-year Treasury, bias accounts for less than 0.16% of forecast error at all three forecast horizons.

[87] The 20-year Treasury is used here because much more historical data are available.

Figure 13. Twenty-year Treasury rate, one year in the future vs. current[88]
January 1925-December 2021



This finding is consistent with an extensive body of academic research rejecting the "expectations hypothesis," which posits that information about future interest rates can be gleaned from forward rates implied by the yield curve (the plot of interest rate versus bond maturity). Academics have generally concluded that the yield curve does not contain any information about expected changes in interest rates; the difference between long- and short-term rates is due exclusively to the "term premium," or compensation for the uncertainty in future interest rates.[89] In combination with BCFF's poor track record, this finding is also consistent with an extensive body of research on the superiority of simple prediction models to both more complex models and expert judgment.[90]

The predictive validity of current rates has been acknowledged among utility cost of capital experts. Reviewing the academic research, Roger Morin, author of the frequently

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[88] M. Ellis analysis of FRED data.
[89] See, for example, Welch, "A Different Way to Estimate the Equity Premium," manuscript (2007); available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1077876.
[90] See, for example, Kahneman, Sibony, Sunstein, *Noise: A Flaw in Human Judgment* (2021), pp. 111-147.

cited practitioner text, *New Regulatory Finance*, concludes, "The literature suggests that on balance, the bond market is very efficient in that it is difficult to consistently forecast interest rates with greater accuracy than a no-change model."[91]

In summary, if we need to use a forecast rate, the current rate is as good an estimate as we're likely to find. Conveniently, this also entirely skirts the potential concern about horizon inconsistency with the DCF.

2. Beta

Q. How does Mr. D'Ascendis estimate beta?

A. Mr. D'Ascendis uses the average of Value Line's and Bloomberg's adjusted beta values.

Q. How do Value Line and Bloomberg estimate their betas?

A. Their methodologies differ in a number of details, which is why their beta estimates are not identical. Both estimate "raw" betas from a regression of trailing stock returns against the trailing returns of the market, use weekly price-only returns, and adjust their raw betas to correct for their tendency, on average, to regress toward the market mean over time. But the similarities end there. Table 8 summarizes the key differences in Value Line's and Bloomberg's beta estimation methodologies.

[91] Morin, *New Regulatory Finance* (2006), p. 172.

Table 8. Value Line and Bloomberg beta estimation methodologies[92]

Parameter	Value Line	Bloomberg
Return frequency	Weekly (Friday)	Weekly (Friday)
Trailing history	5 years	2 years
Index	NYSE Composite	S&P 500
Return calculation		
Price-only/total	Price-only	Price-only
Excess/absolute	Absolute	Absolute
Simple/logarithmic	Logarithmic	Simple
Blume adjustment parameters	0.65 x raw + 0.37	2/3 x raw + 1/3
Rounding	Nearest 0.05	None
Updating frequency	Approximately quarterly	Daily

I point out these differences between Value Line's and Bloomberg's beta estimation methodologies to highlight that there is no standard, widely accepted method for estimating beta. Table 9 summarizes some of the different methodologies used by academics and data providers.

Table 9. Sample of beta calculation methodology options

Timing	Return calculation	Adjustment
• Return frequency: daily, weekly, monthly • Trailing history: typically one to five years	• Simple or log • Price-only or price-plus-dividend (total) • Absolute or excess relative to the risk-free rate • Market proxy: S&P 500, NYSE Composite, CRSP US universe	• None • Blume • Vasicek • Scholes-Williams • Time decay • Winsorization

Q. What are the main sources of discrepancy among providers of beta estimates?

A. The largest potential differences among data providers' beta estimates arise from their trailing history, return frequency, and adjustment assumptions. Following bouts of high market volatility, such as was experienced in February and March 2020, betas will be affected as long as the trailing history includes the volatile period, even if market conditions

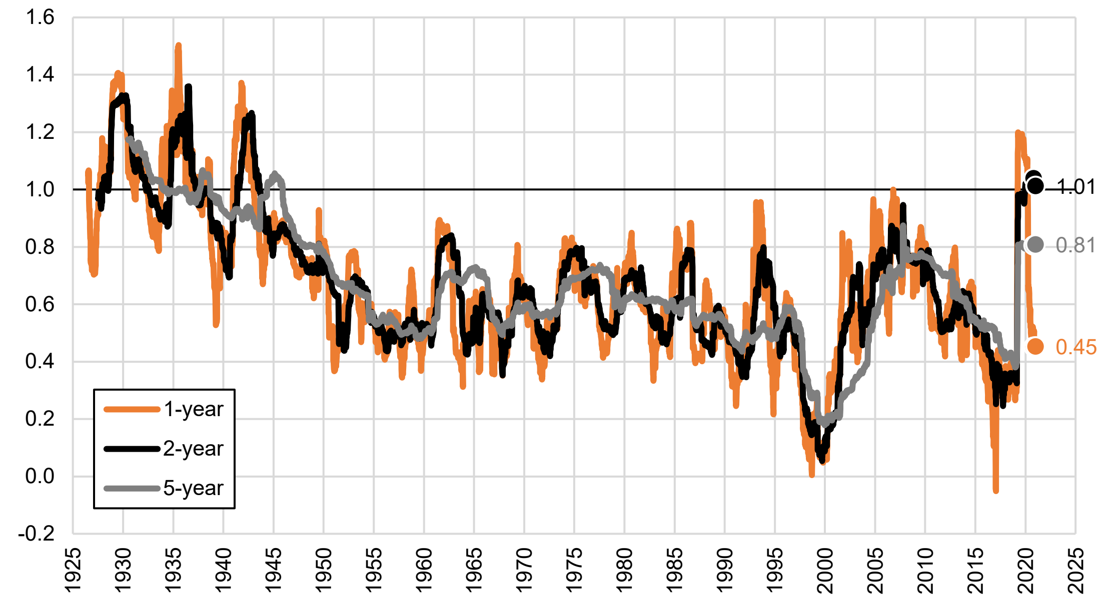
92 Data request response Staff 2-46 Attachments 2 and 3. Simple price-only returns: $r = \frac{P_{t+1}}{P_t} - 1$; logarithmic price-only returns: $r = \ln \frac{P_{t+1}}{P_t}$ (Attachment MEE-9).

have stabilized. For example, S&P Global Market Intelligence Pro (GMI) reports both 1- and 3-year unadjusted betas using simple, price-only, daily absolute returns.[93] As of January 7, 2022, the unweighted average 1-year beta for the UPG, which does not include the volatile period, was 0.55; the average 3-year beta, which does include the volatile period, was 0.89. For comparison, Yahoo! Finance and Zacks Investment Research report 5-year unadjusted betas using simple price-only, monthly absolute returns. Yahoo! Finance's and Zacks's averages on the same day were both 0.34.[94]

Figure 14 plots the utility sector raw beta using 1-, 2-, and 5-year trailing histories of simple weekly absolute returns from June 1926 through December 2021. At any given time, beta can be very sensitive to the trailing history used. As of the end of December 2021, the betas using the 1-, 2-, and 5-year trailing histories were 0.45, 1.01, and 0.81, respectively.

[93] Personal correspondence with S&P Global Market Intelligence (November 2021).
[94] S&P GMI; Yahoo! Finance; Zacks.

Figure 14. Utility sector trailing raw beta – trailing history sensitivity[95]
July 1926-December 2021



Even something as arbitrary as the day of the week on which weekly returns are calculated can materially affect the beta estimate. Figure 15 shows the 5-year trailing beta, i.e., raw Value Line-equivalent, with returns calculated on each weekday. Currently, Friday yields the highest beta, 0.81, but simply changing the calculation day to Tuesday reduces the beta to 0.57, 30% lower. This effect is only partially mitigated by averaging multiple utilities. The same analysis using the unweighted average of the UPG members yields betas ranging from 0.49 to 0.69.[96] These findings further highlight the need for caution in using the mechanically calculated betas provided by Value Line, Bloomberg, and other financial data providers.

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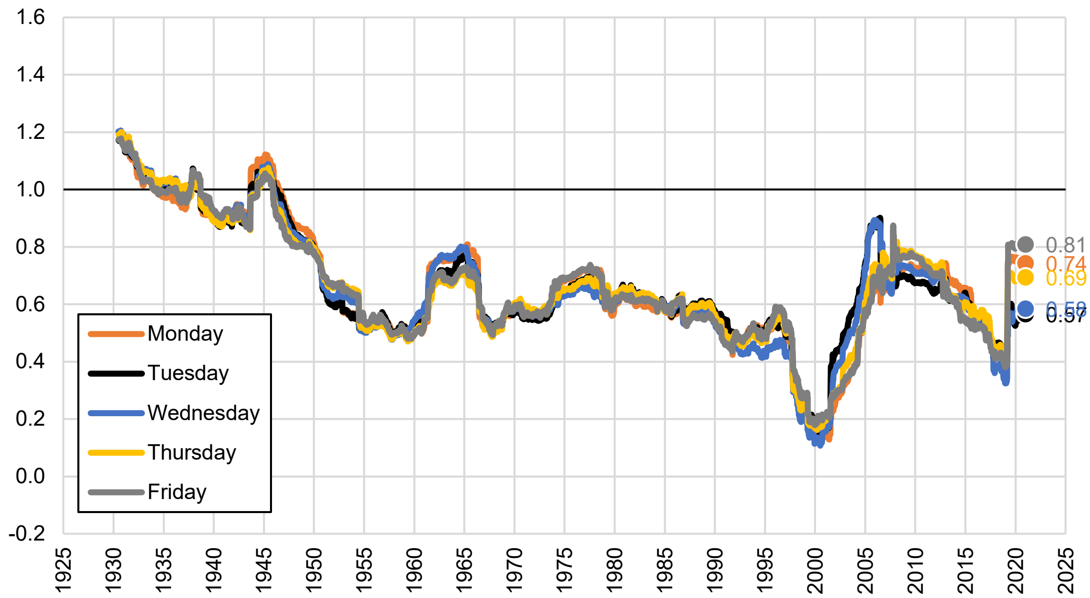
[95] M. Ellis analysis of French Data Library (FDL) data; available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
[96] M. Ellis analysis of S&P GMI data.

Figure 15. Utility sector 5-year weekly trailing beta – return calculation day sensitivity[97]
July 1926-December 2021



Q. What is the third major source of discrepancy in data providers' beta estimates?

A. The third major source of discrepancy in data providers' beta estimates is whether they use the Blume adjustment.[98] The Blume adjustment is frequently used to correct for raw betas' tendency, on average, to regress toward the market mean, 1.0, over time.

Q. What is the origin of the Blume adjustment?

A. The Blume adjustment is based on an analysis by Marshall Blume in the early 1970s using beta-sorted portfolios that found a tendency for betas, on average, to regress toward the

[97] M. Ellis analysis of French Data Library (FDL) data; available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[98] The other listed adjustments are more commonly found in academic research, although the data provider CRSP reports Scholes-Williams betas, and S&P Global Market Intelligence allows users to calculate beta using the Vasicek adjustment.

market mean of 1.0 from one time period to the next.[99] To compensate for this tendency, he recommended adjusting the raw beta based on a relationship derived from a regression of current betas against past betas. "Adjusted" beta is a weighted average of the raw beta and the market beta (1.0).

The most common weighting is 2/3 on the raw beta, 1/3 on the market beta (1.0), basically shifting the raw beta one-third of the way toward 1.0. Bloomberg uses these weights to calculate its adjusted beta. Value Line's weights are 0.67 and 0.35, respectively. Value Line also rounds to the nearest 0.05.[100]

Q. Does Blume's finding apply specifically to utilities?

A. The Blume adjustment is based on an observation of the tendency of betas, *on average*, to regress toward 1.0. Blume's analysis used beta-sorted portfolios, i.e., groups of stocks sorted by beta.

Blume did not look at portfolios sorted on other criteria, such as industry, but others have. Mr. D'Ascendis's former colleague and co-developer of the PRPM, Richard Michelfelder, investigated the validity of the beta adjustment specifically for utility stocks and found no evidence of the tendency observed by Blume in beta-sorted portfolios.[101] This can be observed in Figure 14 and Figure 15, as well. Since the 1950s, the beta for the utility sector as a whole has tended to regress toward 0.55-0.60, not 1.0.[102]

[99] Blume, "On the Assessment of Risk," *The Journal of Finance*, 26:1 (March 1971), pp. 1-10.
[100] Data request response Staff 2-46 Attachments 2 and 3 (Attachment MEE-9).
[101] Michelfelder, Theodossiou, "Public Utility Beta Adjustment and Biased Costs of Capital in Public Utility Rate Proceedings," *The Electricity Journal*, 29:9 (November 2013), pp. 60-68.
[102] One might ask whether the utility sector average reflects the tendency of individual utility stocks. Betas are additive, so a tendency for individual utility stocks to regress toward 1.0, on average, would be reflected in the industry beta. Blume used the same logic to extrapolate from the portfolios he analyzed to individual stocks. See Fama, French, "The Capital Asset Pricing Model: Theory and Evidence," *Journal of Economic Perspectives*, 18: 3 (Summer 2004), p. 31.

Blume speculated as to why betas, on average, tend to regress toward 1.0 over time.[103] High-beta firms tend to be newer and smaller; as they mature and grow, they become more risk-averse. In contrast, low-beta firms tend to run out of low-risk investment opportunities and must accept more risk to stay in business. Neither of these applies to utility operating companies, whose investments tend to have consistent risk profiles over time, regardless of firm size or maturity.

Over the last two-plus decades, utility betas have varied more around the long-term average of 0.55-0.60, likely attributable to their entry, and subsequent exit, from various unregulated lines of business. Even over this period, though, the average beta has remained in this range and was trending below it prior to the covid-related market turmoil in early 2020. In summary, there is no basis for applying the Blume adjustment to utility betas.

Q. Given that betas are so sensitive to the trailing calculation period, how should we estimate beta?

A. The variation in the three most recent beta estimates in Figure 14 suggests we should not simply mechanically average the most recent trailing betas from various data providers, as Mr. D'Ascendis does. It's important to keep in mind that all methodologies are intended to produce *estimates of investors' future expectations*. The elevated current 2- and 5-year betas are artifacts of arbitrary choices of calculation period; there is no reason to believe they reflect investors' current long-term expectations.

I will return to this topic when I discuss my recommended approach. For now, it should be recognized that the betas used by Mr. D'Ascendis are inflated because they are (1) Blume-

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[103] Blume, "Betas and Their Regression Tendencies," *The Journal of Finance*, 30:3 (June 1975), pp. 785-795.

adjusted and (2) incorporate an anomalous period that does not reflect investors' *current, long-term* expectations.

3. Market risk premium

Q. Let's turn to the last component of the CAPM. How does Mr. D'Ascendis estimate the market risk premium?

He uses the same four models used in the total market approach RPM: historical average, regression, PRPM, and DCF.

Q. How is the market risk premium estimated from the historical average?

A. This market risk premium model is the most straightforward: the historical difference between the market and Treasury benchmarks. Nonetheless, there are three flaws in Mr. D'Ascendis's implementation of this seemingly simple analysis. First, the average returns cited are arithmetic, not geometric. Second, he uses income-only, not total, bond returns. Third, the premium should be calculated using real, not nominal, returns.

Previously, I described the difference between arithmetic and geometric returns, how arithmetic returns are always greater than or equal to arithmetic, and that for any given future geometric return, there is only one future investment value. In contrast, for any given arithmetic return, there is an infinite number of potential future outcomes, so the arithmetic return is a poor indicator of investor expectations. I concluded that the geometric return is a better indicator of future investor expectations. I'd like to explain this in more detail.

Q. Why are geometric returns a better indicator of future investor expectations?

A. The choice between arithmetic and geometric returns for estimating investor expectations has been hotly debated among academics and practitioners for decades. Some of the disagreement arises from differences in potential application. For example, in portfolio management, where Monte Carlo simulation is common, arithmetic averages, in combination with return distributions, are appropriate. In corporate finance and valuation, which is more analogous to our objective, the choice depends on the life of the investment under consideration. The widely used finance text *Valuation* summarizes the current status:[104]

> The choice of averaging methodology will affect the results. For instance, between 1900 and 2014, U.S. stocks outperformed long-term government bonds by 6.4 percent per year when averaged arithmetically. Using a geometric average, the number drops to 4.2 percent. This difference is not random; arithmetic averages always exceed geometric averages when returns are volatile.
>
> So which averaging method on historical data best estimates the expected rate of return? Well-accepted statistical principles dictate that the best unbiased estimator of the mean (expectation) for any random variable is the arithmetic average. Therefore, to determine a security's expected return for one period, the best unbiased predictor is the arithmetic average of many one-period returns. A one-period risk premium, however, can't value a company with many years of cash flow. Instead, long-dated cash flows must be discounted using a compounded rate of return. But when compounded, the arithmetic average will generate a discount factor that is biased upward (too high).
>
> There are two reasons why compounding the historical arithmetic average leads to a biased discount factor. First, the arithmetic average may be measured with error. Although this estimation error will not affect a one-period forecast (the error has an expectation of zero), squaring the estimate (as you do in compounding) in effect squares the measurement error, causing the error to be positive. This positive error leads to a multiyear expected return that is too high. Second, a number of researchers have argued that stock market returns are negatively autocorrelated over time. If positive returns are typically followed by negative returns (and vice versa), then squaring the average will lead to a discount factor that overestimates the actual two-period return, again causing an upward bias.

[104] Koller, et al, *Valuation*, 6th ed., p. 853.

Valuation goes on to recommend a widely used weighted average of the geometric and arithmetic averages, weighted more heavily toward arithmetic for short-lived investments, converging toward the geometric average if the investment life equals or exceeds the duration of the historical time series from which the averages are calculated.

NYU finance professor Aswath Damodaran, known for his simple, practical advice to practitioners, reaches a similar conclusion:[105]

> As we move to longer time horizons, and as returns become more serially correlated (and empirical evidence suggests that they are), it is far better to use the geometric risk premium. In particular, when we use the risk premium to estimate the cost of equity to discount a cash flow in ten years, the single period in the CAPM is really ten years, and the appropriate returns are defined in geometric terms. In summary, … the geometric mean is more appropriate if you are using the Treasury bond rate as your risk-free rate, have a long time horizon, and want to estimate the expected return over that long time horizon.

In utility cost of capital proceedings, we are estimating the cost of equity. Equity is a claim on cash flows into perpetuity, i.e., the investment life is infinite, which dictates using a long-term risk-free rate, as is common practice, and the geometric average. The geometric average is also consistent with the results of the DCF model, which produces a continuously compounded, i.e., geometric, average estimated return.

Q. What is the second flaw in Mr. D'Ascendis's calculation of his historical risk premia?

A. The second flaw is his use of only the income component (yield) of long-term bond returns, not capital gains and reinvestment. The analysis uses annual returns, but the long-term bond yield by itself is almost never realizable over a one-year period, as there will be capital gains

[105] http://people.stern.nyu.edu/adamodar/New_Home_Page/AppldCF/derivn/ch4deriv.html.

or losses as interest rates change.[106] The large-cap and utility equity proxies include the *total* return: income (dividends), capital gains/losses, and reinvestment; the bond proxy should, as well.

Q. What is the third flaw in Mr. D'Ascendis's calculation of his historical average risk premia?

A. Historical equity risk premia should be calculated using real, not nominal returns, and then adjusted for expected future inflation. Historical inflation averaged 2.93%, while current expected long-term inflation is 2.28%. Failing to adjust for the difference between historical and forecast inflation inflates the resulting risk premia by a factor of $\frac{1+i_{historical}}{1+i_{forecast}}$.

Q. Please explain Mr. D'Ascendis's regression model for estimating the risk premia.

A. In the regression model, the equity risk premium is expressed as a function of the bond yield:

$$r_e - r_b = \alpha + \beta r_b + \varepsilon$$

where r_e and r_b refer to the returns on equity (large cap or utility index), α and β are the regression coefficients, and ε is estimation error. Rearranging terms, the model can be expressed more simply as:

$$r_e = \alpha + \beta r_b + r_b + \varepsilon = \alpha + \beta' r_b + \varepsilon$$

In other words, the risk premium regression model is simply a regression of equity returns against bond returns.

[106] Although it is possible to invest to achieve only the yield by holding a bond to maturity, few investors do so, and it is unrealistic to assume the returns so achieved are representative of a typical investor or the market as a whole.

With any regression model, we always want to assess the validity and statistical robustness of the relationship being modeled. Mr. D'Ascendis's regression model fails on both counts.

The causal relationship being modeled is the influence of the bond yield on the equity risk premium. To estimate this relationship, i.e., the regression coefficients, Mr. D'Ascendis regresses the trailing 12-month realized total equity return (including dividends and capital gains) less the current bond yield against the current bond yield. As explained above, since the current bond yield is on both sides of the equation, the relationship could equivalently be estimated by simply regressing the trailing 12-month realized total equity return against the current bond yield.

This is clearly not a valid causal relationship. The dependent variable, the trailing 12-month realized return, largely occurs *earlier* in time than the dependent variable, the current bond yield. It is simply implausible, for example, that the returns from January through November of 2020 are influenced in any way by bond yields in December 2020.

Given this implausible causality, the relationship between these two time series is not expected to be strong. As can be seen in the cross-plot in Figure 16, it is no better than random. In this example, the long-term Treasury bond yield explains only 0.00004% of the variation in (mostly prior) large cap equity returns, and the slope coefficient is not statistically meaningful.[107] Similar results are obtained for the other risk premia regressions, large cap vs. Aaa/Aa2-rated corporate bonds and utilities vs. A2-rated public utility bonds.[108]

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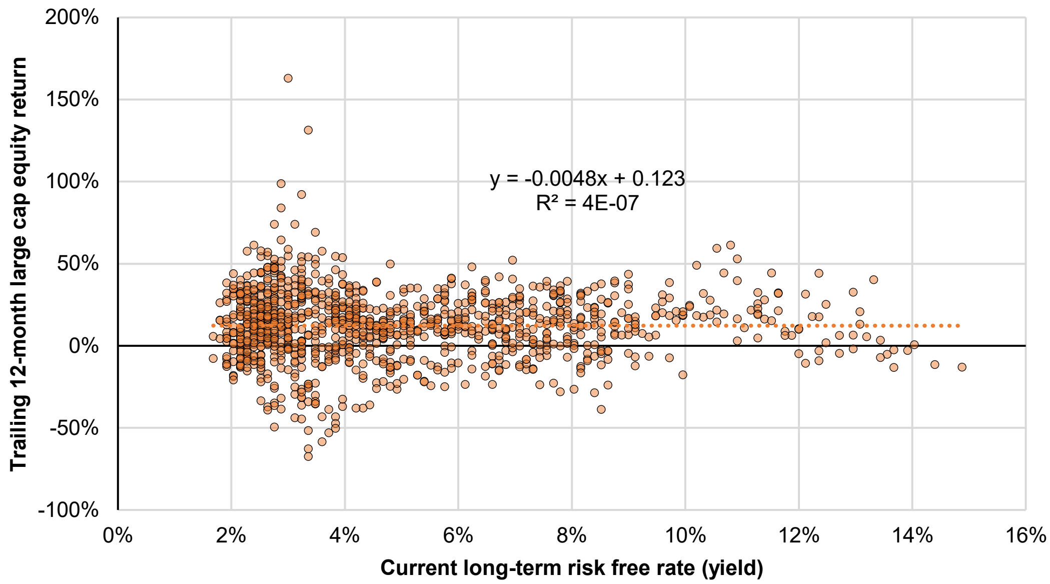
[107] T-statistic: -0.0205; p-value: 0.983.

[108] Mr. D'Ascendis regresses the difference between the trailing equity return and bond yield against the bond yield. Because the independent variable is on both sides of the equation, the resulting R^2 coefficients are higher, but bond yields still explain less than 2.5% of the variation in the risk premium. In data request response DOE 4-1a, Mr. D'Ascendis defended his regressions by pointing to slope coefficient t-statistics significantly different from 0. (Attachment MEE-10). He appears not to realize that the null hypothesis for a regression in which an

Figure 16. Trailing 12-month large cap equity return vs. long-term risk free yield[109]
January 1926-December 2019



Even if the causal relationship is modified to something more plausible, say the relationship between the yield and the subsequent twelve months' return, the statistical significance remains low, with long-term Treasury bond yields explaining only 0.13% of the variation in large cap stock returns and a statistically insignificant slope coefficient.[110] This lack of statistical significance explains why single-factor regression models are typically not used to estimate the CAPM market risk premium. The flatness of the regression line, low R^2 coefficient, and low statistical significance of the slope coefficient indicate that the long-term historical average is a better estimate.

independent variable is on both sides of the equation is the coefficient of that variable on the dependent side, here -1. None of the coefficients is significantly different from -1.

[109] M. Ellis analysis of Ibbotson data via data request response OCA 1-1 Attachment 1, tab MRP ERP WP (Attachment MEE-7).

[110] T-statistic: 1.217; p-value: 0.224.

The regression model for estimating the risk premium suffers other deficiencies. As in the historical analysis, only bond yields, not total returns, are used. Because it is fit to annualized returns, it produces the equivalent of an arithmetic, not geometric, result. While these deficiencies could be addressed, its lack of statistical validity disqualifies it from use.

Q. What is Mr. D'Ascendis's third method for estimating the two risk premia?

A. His third method is the PRPM. As explained above, the PRPM suffers numerous errors and deficiencies that disqualify it from use. Any CAPM inputs based on this model should be disregarded.

Q. What is Mr. D'Ascendis's fourth method for estimating the two risk premia?

A. His fourth method is the same constant-growth DCF model used to estimate the COE for each of the UPG members. Here, he calculates separate, using Bloomberg and Value Line data, market capitalization-weighted average COEs for the members of the S&P 500 and Utilities Indexes. As explained above, the CG DCF's main shortcoming is the assumption that analysts' three-to-five-year growth estimates can be sustained into perpetuity. His results are therefore significantly upwardly biased and should be disregarded.

4. Empirical CAPM

Q. Does Mr. D'Ascendis make any adjustments to his CAPM results?

A. Yes. He averages them with the results of the Empirical CAPM, or ECAPM.

Q. What is the ECAPM?

A. The ECAPM was developed by utility cost of capital consultant Roger Morin. It is based on the empirical observation in various academic studies that low-beta stocks tended to perform better than predicted by the CAPM, and high-beta stocks worse, resulting in a "flattened" security market line (SML), the relationship between beta and return. It modifies the traditional CAPM as follows:[111]

$$k = r_f + 0.25(r_m - r_f) + 0.75\beta(r_m - r_f)$$

Mathematically, the effect of the ECAPM is similar to the Blume beta adjustment, further adjusting beta toward 1.0 by a factor of 0.25.

Q. Is the ECAPM widely used?

A. The ECAPM is used only in utility cost of capital proceedings, particularly by experts testifying on behalf of utilities. It is not used elsewhere. No papers validating or endorsing the ECAPM have been published in any peer-reviewed journals, and it is not included in commonly used finance textbooks for students and corporate finance professionals. It is mentioned only in utility-focused practitioner guides, most notably Mr. Morin's own books.

Q. Is the ECAPM valid for estimating the long-term cost of equity for a utility?

A. The ECAPM is not valid for estimating the long-term cost of equity for a utility, because the academic studies on which it is based are not analogous to how the CAPM is implemented in utility cost of capital proceedings. There are two important differences.

[111] DWD, pp. 30-31.

First, the academic studies cited in support of the ECAPM all use a short-term risk-free rate; utility rate case CAPM COEs typically use a long-term risk-free rate, as we are here. Using a long-term rate implicitly flattens the SML – the risk-free rate is higher, while the market return is unchanged. Because the ECAPM is based on the observation of a flattened slope relative to a short-term rate, it over-compensates.

Second, the academic studies do not examine utilities specifically. As we saw with beta, utilities' regulatory model can affect the behavior of their equity returns relative to the market. When these studies' analyses are re-run using a long-term risk-free rate, the "flatness" in the SML largely disappears for the market as a whole, and completely disappears for utilities.[112]

Figure 17 shows the Fama-French (FF) study cited by Mr. D'Ascendis,[113] which regresses the monthly annualized absolute returns of beta-sorted portfolios against realized beta,[114] overlaid by a replication using the 30-year Treasury instead of the original study's 1-month T-bill and adding the utility index. The data are from March 1977, the earliest complete month of data for the Treasury, through December 2021. While the beta-sorted portfolios lie slightly above the SML, their regression slope and intercept coefficients are not

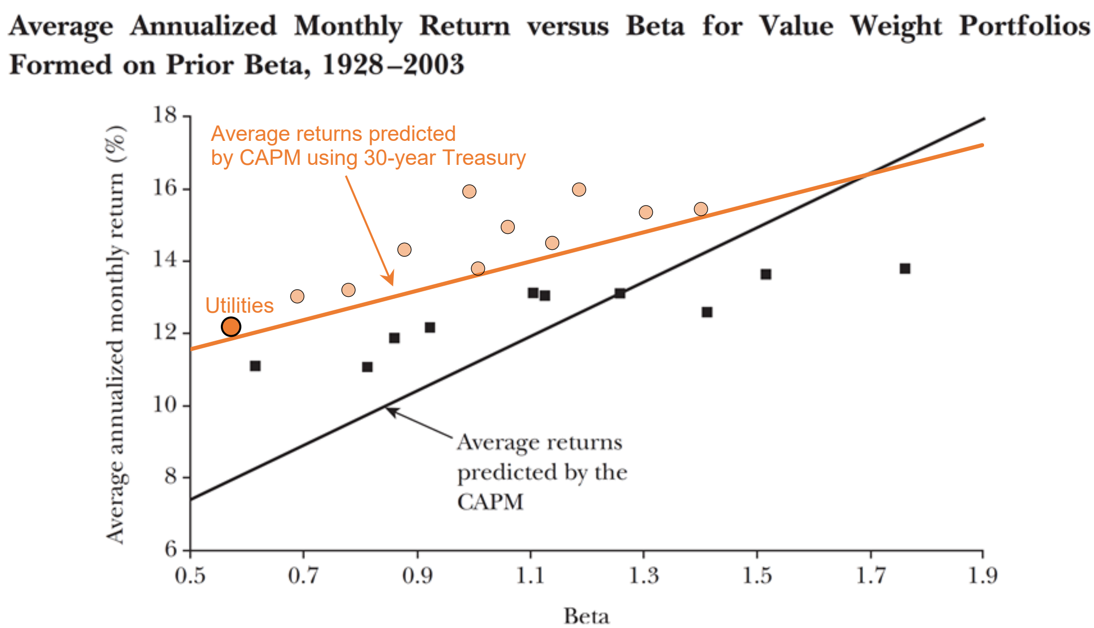
[112] In substituting a long-term Treasury for a short-term risk-free rate, as is typically done in utility cost of capital analyses, analysts are implicitly adopting the zero-beta CAPM developed by Fisher Black, co-creator of the Nobel Prize winning Black-Scholes option pricing equation. This more general version of the CAPM does not require the existence of a risk-free rate (over the long term, the short-term rate is not risk-free, as investors are exposed to inflation and reinvestment risk; the long-term rate is subject to inflation if held to maturity and capital gains or losses due to interest rate changes if not), just an investable asset or portfolio with a beta equal to zero. Long-term government bonds meet this criterion.

[113] DWD, p. 29.

[114] In the replication, realized betas are calculated using excess returns, per the specification of the CAPM model, $k = r_f + \beta(r_m - r_f) + \varepsilon$. It is not clear whether Fama and French use excess or absolute returns to calculate beta.

statistically significantly different than the SML's (t-statistics of 0.412 and 1.170, respectively).[115] The utilities follow the relationship predicted by the CAPM.

Figure 17. Original Fama-French absolute return analysis and replication (March 1977-December 2021) using T30[116]



Another classic test of the CAPM comes from Black, Jensen, and Scholes (BJS).[117] They regress monthly *excess* returns against beta. While BJS's regression returned an intercept and slope statistically significantly different from the SML's, these coefficients are not

[115] The t-statistic is the ratio of the departure of the estimated value of a parameter from its hypothesized value to its standard error. In regression models, t-statistics above 2.0 suggest the null hypothesis, here that the regression slope and intercept are equal to the SML's, is not valid. The t-statistics of the recreated Fama-French analysis are both well below 2.0, indicating that the regression line of the portfolios against their betas is not statistically different than the SML.

[116] Fama, French, "The Capital Asset Pricing Model: Theory and Evidence," *Journal of Economic Perspectives*, 18:3 (Summer 2004), pp. 32-33. Beta-sorted and industry portfolios from French Data Library (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). Betas are calculated using simple monthly excess returns.

[117] Black, Jensen, Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," in Jensen, *Studies in the Theory of Capital Markets*, (1972), pp. 79–121.

significantly different when their analysis is repeated with the 30-year Treasury.[118] As with the Fama-French analysis, utilities fall almost exactly on the SML.

Figure 18. Original BJS excess return analysis and replication (March 1977-December 2021) using T30[119]

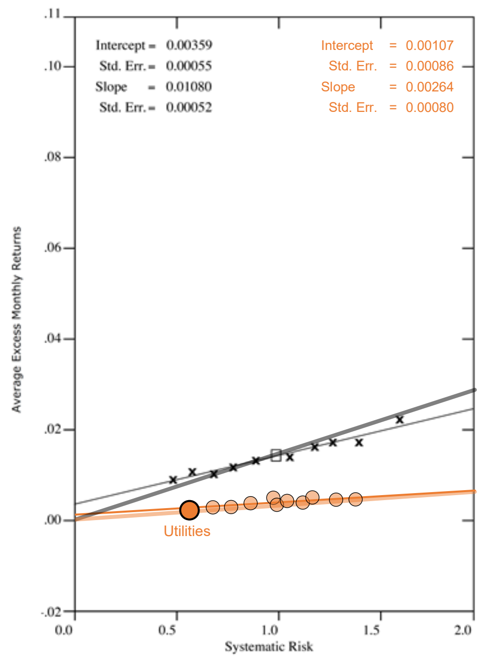


Figure 1 Average excess monthly returns versus systematic risk for the 35-year period 1931-65 for each of ten portfolios (denoted by ×) and the market portfolio (denoted by ☐).

Despite its name, there is no empirical support for using the ECAPM to estimate the long-term cost of equity in utility regulatory proceedings.

[118] Intercept t-statistic (H_0: 0): 1.251, slope t-statistic (H_0: SML slope): 0.498; comparable values for BJS are 6.52 and 6.53, respectively.

[119] Black, Jensen, Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," in Jensen, *Studies in the Theory of Capital Markets* (1972), pp. 79–121. Beta-sorted and industry portfolios from French Data Library (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). Betas are calculated using simple monthly excess returns.

5. CAPM conclusion

Q. What is your overall assessment of the CAPM and Mr. D'Ascendis's implementation of it?

A. The CAPM is conceptually sound and one of the most widely-used COE models in corporate finance. But Mr. D'Ascendis's implementation – use of a forecast, not current, risk-free rate; a mechanically calculated adjusted beta that is not reflective of current market conditions or utilities' long term risk profile; MRP models flawed in their conception and/or application; and averaging with the ECAPM – yields systematically upwardly biased results. His CAPM model results should be disregarded.

H. ADJUSTMENTS

Q. How does Mr. D'Ascendis adjust his COE model results?

A. He makes two adjustments, for size and flotation cost.

Q. Are these adjustments warranted?

A. Neither is warranted. His rationales for them are not valid empirically or logically.

1. Small size

Q. What is Mr. D'Ascendis's rationale for the small size adjustment?

A. Mr. D'Ascendis's rationale for the small size adjustment is based on three arguments. First, Aquarion's cost of equity is higher because small size is inherently more risky, and more risk entails a higher cost of equity. Second, the higher risk of small size is confirmed by academic research finding a public equity "small size effect" in which stocks with a lower market capitalization earn returns higher than can be explained by beta alone. Third, because Aquarion's cost of equity should be considered on a standalone basis, it is appropriate to add a small size premium as if it traded on its own.[120]

Q. Is Mr. D'Ascendis's small size adjustment valid?

A. No, it is not.

Q. What is wrong with it?

A. Like so many of his other analyses, his size adjustment is flawed in both concept and implementation. I will start with the implementation.

Mr. D'Ascendis adjusts his final COE result using a model ostensibly based on the empirical historical relationship between publicly-traded company size and return in excess of what can be explained by beta. If such an effect did, in fact, exist, it would apply only to his CAPM results, not to the results of his other models. For those, he would need another way to estimate the relationship between size and return-above-model; he does not provide one.[121] Also, Mr. D'Ascendis already adjusts his CAPM results for beta not completely explaining returns with the ECAPM. To the extent that some low-beta stocks are also small, whatever small size effect exists is at least partly captured in the ECAPM, so the small size adjustment is double-counted.

[120] DWD, pp. 38-44.

[121] As far as I know, there is no research, for example, on small stocks' returns in excess of what is predicted by the DCF or RPM.

Q. What is wrong with the small size adjustment conceptually?

A. None of his three arguments in support of it is valid.

Q. If small size is inherently more risky, why doesn't it entail a higher cost of capital?

A. Mr. D'Ascendis argues that "smaller companies generally are less able to cope with significant events that affect sales, revenues, and earnings" and this greater risk entails a higher cost of equity.

As discussed previously, it is not total risk that determines the cost of equity, but *non-diversifiable* risk. Investment size is an easily diversified risk factor and, in Aquarion's case, any potential size-related risk has already been diversified by its ownership by the much larger Eversource. Even when considered on a standalone basis, whoever invests in Aquarion can easily diversify its small-size risk by investing in the broader stock market.

Q. What's wrong with the research on the public equity small size effect?

A. First, none of the research on the size effect cited by Mr. D'Ascendis is utility-specific. Where researchers have investigated the size effect in utilities specifically, they have not been able to find one.[122]

Second, all of the research cited by Mr. D'Ascendis is on publicly traded stocks, not the subsidiaries of publicly traded companies. Even if the findings are true and apply to utilities, whether they apply to subsidiaries is unknown.

[122] Wong, "Utility stocks and the size effect: an empirical analysis," *Journal of the Midwest Finance Association* (1993), pp. 95-101.

Third, the research cited by Mr. D'Ascendis is several decades old. As explained by Cliff Asness, founder of factor investing pioneer AQR Capital Management,[123] recent research has concluded, "the simple small firm effect doesn't exist, as small firms do not historically defeat large ones by more than their market beta."[124] He continues:

> A series of cumulative challenges … all have reduced the historic "net of market beta" return to small vs. large, ultimately leaving nothing. Two of the main ones are 1) the original results, through no fault of their own, exaggerated the size effect as the databases at the time overstated the returns to small stocks. You get a smaller size premium today if you run the exact same tests over the exact same databases (updated and improved to fix errors, many of which were more common among small stocks) over the exact same time periods as the original work. And 2) the apparent outperformance of small versus large caps after adjusting for market beta in the original work was biased by misestimated betas due to liquidity differences. Accounting for this misestimation removes the last vestige of a size effect.

In the words of the "Dean of Valuation," NYU finance professor Aswath Damodaran, the size effect is "fiction."[125]

Finally, in the discussion of the ECAPM above, the re-created FF and BJS analyses demonstrated that under the zero-beta CAPM using a long-term risk-free rate, beta is sufficient to explain the variation in returns, particularly for utilities.

[123] "Factor investing is an investment approach that involves targeting quantifiable firm characteristics or 'factors' that can explain differences in stock returns. Security characteristics that may be included in a factor-based approach include *size*, low-volatility, value, momentum, asset growth, profitability, leverage, term and carry" [emphasis added]. https://en.wikipedia.org/wiki/Factor_investing.

[124] Asness, "There Is No Size Effect" (September 2020), p. 2; available at: https://www.aqr.com/Insights/Perspectives/There-is-No-Size-Effect-Daily-Edition.

[125] https://www.bvresources.com/articles/bvwire/size-effect-is-fiction-damodaran-reiterates. Damodaran attributes the persistence of the use of the small size premium in corporate valuation to intuition, inertia, and bias. See Damodaran, "The Small Cap Premium: Where Is the Beef?" *Business Valuation Review*, 34:4 (2015), pp. 153-57.

Q. Should Aquarion be considered on a standalone basis?

A. Aquarion's cost of capital should be considered on a standalone basis, commensurate with its own risk profile. But Mr. D'Ascendis's argument that small size, in and of itself, is a risk factor that should be reflected in individual investments' cost of capital is logically flawed.

Mr. D'Ascendis provides several textbook passages that make the valid point that individual investments should be evaluated at their respective costs of capital, reflecting their specific risk profiles, including the following from Levi and Sarnat:[126]

> The firm's cost of capital is the discount rate employed to discount the firm's average cash flow, hence obtaining the value of the firm. It is also the weighted average cost of capital, as we shall see below. The weighted average cost of capital should be employed for project evaluation… only in cases where the risk profile of the new projects is a "carbon copy" of the risk profile of the firm.

Clearly, though, the smaller size of individual investments does not, by itself, change the cost of capital relative to the investing firm. If it did, why would "carbon copy" projects, which of necessity are smaller than the investing firm, have the same cost of capital?[127]

The entire premise of estimating a corporate cost of capital falls apart if successively smaller investments require increasing costs of capital. Under the value additivity principle, any single investment is the sum of its parts; investing in new meters for an entire utility is equivalent to multiple investments in a single meter for each customer.[128] Yet, under Mr. D'Ascendis's logic, the cost of capital for each single meter would be much higher than for all the meters, which, in turn, would be higher than the utility's. It would be impossible to identify the appropriate cost of capital for any investment.

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[126] Levy, Sarnat, *Capital Investment and Financial Decisions* (1986), p. 465, as cited in DWD, p. 41.

[127] It might be argued that a carbon copy project is one whose risk profile matches the investing firm's *after* adjusting for the project's size effect. A size adjustment for individual projects is not mentioned in any of the finance texts cited by Mr. D'Ascendis.

[128] See, for example, Brealey, Myers, Allen, *Principles of Corporate Finance*, 10th ed. (2011), p. 178.

Q. How has the Commission treated utilities' proposed ROE adjustment for their small size in the past?

A. The Commission has previously denied utilities' requested ROE small-size adjustments, in 2013,[129] 1991,[130] and 1985.[131]

2. Flotation cost

Q. What is Mr. D'Ascendis's rationale for the flotation cost adjustment?

A. His rationale is that Aquarion's parent company, Eversource, incurs real costs to raise equity in public markets, in the form of underwriting fees that reduce the net proceeds from any issuance of equity; investors should be compensated for these costs.

Q. Is the flotation cost adjustment justified?

A. No, it is not justified, for several reasons.

Mr. D'Ascendis's premise that investors in Aquarion's parent should be compensated for flotation costs conflicts with the valid "standalone" premise that he (erroneously) invoked in support of the size adjustment. If Aquarion is to be treated on a standalone basis, which it should, how the parent funds its equity investment, and any costs incurred, are simply not relevant. For example, Aquarion could be funded entirely by its own retained earnings or owned by a private company or pension fund that does not incur issuance costs. Similarly, funds might be raised inefficiently; why should customers bear that burden?

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[129] *Aquarion Water Company of New Hampshire*, Order No. 25,539 (2013).
[130] *Southern New Hampshire Water Company*, Order No. 20,196 (1991).
[131] *Pennichuck Water Works, Inc.*, Order No. 17,911 (1985).

If the Commission does decide that investors in Aquarion's parent should be allowed to recover flotation costs, it is necessary only if investors are not otherwise compensated for them. As explained in the chapter from Morin's *New Regulatory Finance* cited by Mr. D'Ascendis, if the issuer's market-to-book ratio (M/B) is greater than 1/(1 – flotation cost), new equity issuance is accretive, i.e., provides a premium over the cost of capital, including flotation costs.[132] Mr. D'Ascendis estimates a flotation cost of 2.14% of gross equity issuance,[133] so as long as Eversource's M/B is above 1/(1 – 2.14%) = 1.022, accretion from new equity issuance compensates investors for flotation costs. As of December 31, 2021, Eversource's M/B is 2.17 and has been above 1.022 for over a decade.[134] Any flotation cost adjustment would merely further enrich shareholders at customers' expense.

Mr. D'Ascendis's flotation cost adjustment is small, 0.04%, and is overwhelmed by the imprecision in his various models – less than one-half the difference between the medians and means of his various COE models, for example.[135] To add it is akin to the elementary school student, who, upon being asked what they learned during a field trip to the science museum, proudly says, "Earth is 4.5 billion years and [glancing at a clock] six hours and forty-three minutes old."

[132] Morin, *New Regulatory Finance* (2006), pp. 330-33.
[133] Attachment DWD-10, p. 1.
[134] S&P Global Market Intelligence.
[135] Attachments DWD-3, p. 1; DWD-4, p. 2; DWD-5, p. 1; DWD-7, pp. 1, 2, 6.

Q. How has the Commission treated utilities' proposed ROE adjustment for flotation costs in the past?

A. The Commission has previously denied utilities' requested ROE flotation cost adjustments, in 2009,[136] 2005,[137] and 1985.[138]

I. OTHER CONCERNS

Q. Do you have any other concerns with Mr. D'Ascendis's analysis.

A. An additional, albeit not material, concern is his use of the average of the mean and median for the final result in several of his models. The mean is generally accepted as the best unbiased estimator of the expected value of any random variable, because it includes all the values in the data set for its calculation, and any change in or addition to those values will affect the mean. The median is typically used only when there is a concern that outliers or a skewed distribution may distort the mean such that it no longer reflects the expected value.[139]

Mr. D'Ascendis's use of the median is inconsistent and duplicative. He uses it only for his final model results,[140] but not for intermediate results, such as his estimates of the equity and market risk premia.[141] He already excludes outliers from the mean and median calculations,[142] and he presents no evidence that the return distribution is skewed, so there is no basis for using the median.

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136 *EnergyNorth National Gas, Inc.*, Order No. 24,972 (2009).
137 *Public Service Company of New Hampshire*, Order No. 24,473 (2005).
138 *Pennichuck Water Works, Inc.*, Order No. 17,911 (1985).
139 https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php.
140 Attachments DWD-3, p. 1; DWD-4, p. 2; DWD-5, p. 1; DWD-7, pp. 1-2, 6.
141 Attachments DWD-4, p. 8 (ERP); DWD-5, p. 2 (MRP).
142 Attachment DWD-4, p. 2.

Curiously, the median is lower than the mean in most of his calculations – one of the few instances where an error leads to a lower ROE estimate.[143]

J. CRITIQUE CONCLUSION

Q. What is your overall assessment of Mr. D'Ascendis's rate of return analysis?

A. Mr. D'Ascendis's rate of return analysis is rife with errors, in both concept and implementation. The numerous constituent analyses are unnecessarily complicated, redundant, and inconsistently implemented. At virtually every opportunity, his methods and assumptions introduce upward bias in his final result.

As component parts of a holistic assessment, their substantial overlap in both methodology and data is an additional infirmity. For example, the novel PRPM, which tends to produce the highest results, is used repeatedly throughout the assessment – first for the Utility Proxy Group as (1) half of the risk premium model on a standalone basis; (2) to develop one of the risk premia used in the second half of the RPM; and (3) for one of the CAPM MRPs – and then again for the same purposes with the Non-Price Regulated Companies. Similarly, the same historical time series data are used repeatedly in the PRPM, RPM, and CAPM, and the same betas in both the total market approach RPM and the CAPM. Intermingling methodologies and data in this manner sacrifices the constituent analyses' independence; to the extent there are errors or biases, they propagate throughout his analysis. Rather than canceling out as intended in a composite approach, they compound.

I am not the first to reach such a conclusion about Mr. D'Ascendis's rate of return methodology and implementation. In a recent water utility rate case and subsequent appeal,

[143] Median lower than mean: Attachments DWD-3, p.1; DWD-4, p. 2; DWD-7, pp. 1-2. Median higher than mean: DWD-5, p. 1; DWD-7, p. 6.

both the South Carolina PSC and Supreme Court rejected Mr. D'Ascendis's testimony as lacking "analytical transparency" and "statistical coherence."[144] I believe the foregoing assessment demonstrates that Mr. D'Ascendis's testimony in this proceeding is likewise opaque and incoherent, and I recommend the New Hampshire Public Utilities Commission take similar action and reject his testimony in its entirety.

III. RECOMMENDED APPROACH

A. OVERVIEW

Q. Please provide an overview of your recommended approach.

A. Table 10 provides an overview of my recommended approach to estimating Aquarion's cost of capital. As explained above, the capital structure and ROE must be estimated jointly, because a utility's desired capital structure is determined to a large extent by its return on equity. At the same time, its return on equity is influenced by its capital structure (higher debt increases the cost of equity). Thus, they cannot be estimated in isolation but must be determined together. I use an integrated approach that does so.

I first estimate each UPG member's levered cost of equity under two different models, the multi-stage DCF and CAPM. I adjust for differences in capital structure across the peer companies to arrive at the average unlevered COE. The unlevered COE is then used in a model based on how rating agencies evaluate credit risk that solves for the capital structure and levered ROE that minimizes customer costs. The model incorporates a valuation

[144] *In re Blue Granite Water Co.*, 28055 (S.C. Sep. 1, 2021), p. 7.

component, to ensure the ROE is sufficient to attract equity investment, as well. Finally, the result return is adjusted to account for year-to-year variability in realized ROEs. This model ensures the interests of all key stakeholders – creditors, shareholders, and customers – are satisfied.

Table 10. Recommended Aquarion capital structure and rate of return

Component	Rate (%)	Weight (%)	Value ($)
Multi-stage discounted cash flow model	3.49%	50.00%	
Capital asset pricing model	3.52%	50.00%	
Unlevered cost of equity	3.50%		
Target credit rating	6.5		
Book equity ratio		57.32%	
Target M/B ratio		1.10	
Market equity ratio		59.64%	
Levered cost of equity	4.62%		
Market-to-book premium	0.23%		
Geometric to arithmetic adjustment	0.10%		
Book equity	4.95%	57.32%	20,705,212
Preferred stock	6.00%	0.01%	2,300
Short term debt	2.42%	3.32%	1,200,000
Existing long-term debt	6.47%	16.33%	5,900,000
New long-term debt	3.31%	23.01%	8,311,714
Total long-term debt	4.62%	39.35%	14,211,714
Rate of return	4.74%	100.00%	36,119,226

B. MULTI-STAGE DCF

1. Model overview

Q. What is the multi-stage DCF model?

A. The multi-stage DCF model is an enhancement on the CG DCF that allows for different dividend growth rates over time. As we saw previously, analysts' estimated 3-to-5-year growth rates are too high to be sustained in perpetuity, and may be biased, but that doesn't mean we should ignore them completely. They provide useful information about the relative expected growth across companies. Over the long-term though, it is reasonable to assume investors expect growth rates, in real terms, to revert to their long-term historical trends. The MS DCF explicitly models different growth rates over time.

The MS DCF can incorporate any number of stages. For equity valuation, a three-stage model is commonly used, in which the initial stage uses analysts' estimates over their 3-to-5-year forecast horizon, and the terminal stage uses the long-term real historical growth rate plus current long-term inflation expectations. In between is a transition phase, typically 5 to 15 years, in which the growth rate is the simple average of the initial and terminal rates. The MS DCF model can be expressed as:

$$1 = d\,\frac{1+g_1}{k-g_1}\left(1-\left(\frac{1+g_1}{1+k}\right)^{t_1}\right) + d\left(\frac{1+g_1}{1+k}\right)^{t_1}\frac{1+g_2}{k-g_2}\left(1-\left(\frac{1+g_2}{1+k}\right)^{t_2}\right) + d\left(\frac{1+g_1}{1+k}\right)^{t_1}\left(\frac{1+g_2}{1+k}\right)^{t_2}\frac{1+g_3}{k-g_3}$$

where d is the current dividend yield; g_1, g_2, and g_3 are the initial, transition, and terminal growth rates, respectively (where $g_2 = \sqrt{(1+g_1)(1+g_3)} - 1$);[145] t_1 and t_2 are the initial and transition stage durations; and k is the cost of equity such that the equation is true. There is substantial precedent for the MS DCF model, in both its two- and three-stage forms, in corporate finance and regulatory contexts.[146]

For the UPG, I assume an initial growth stage of three years – the low end of analysts' EPS growth rate forecast horizon, to mitigate the effect of their upward bias – and a 10-year

[145] The geometric mean of g_1 and g_3 is used to ensure consistency between annual and quarterly versions of the model.

[146] See, for example, Brealey, Myers, Allen, *Principles of Corporate Finance*, 10th ed. (2009), pp. 83-88; Surface Transportation Board, "Use of a multi-stage discounted cash flow model in determining the railroad industry's cost of capital" (2009); available at: https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/39443?OpenDocument. FERC also uses a multi-stage DCF model, but it is a simplified version that substitutes a weighted average of the initial and terminal growth rates into the constant-growth DCF model. There are a number of problems with FERC's implementation of the MS DCF. It assumes a terminal growth rate equal to forecast GDP, not GDP per capita. The weights on the initial and terminal growth rates are not differentiated by company, as they would be in an exact model like the one described here. The composite rate is too heavily weighted toward the initial growth rate (75/25 initial/terminal); the exact DCF model can be used to demonstrate that the weights should be closer to 10/90.

transition. To account for the quarterly distribution of dividends, I convert the reported rates to quarterly and multiply the number of periods in the initial and transition phases by 4.[147] The dividend yield is the most recent quarterly dividend divided by the average price over December 2021.

2. Initial growth rate

Q. How do you estimate the initial growth rate for the UPG MS DCF?

A. I use an average of analysts' EPS growth estimates from S&P Global Market Intelligence (GMI), Yahoo! Finance, and Zacks plus a DPS growth rate estimated from Value Line's (VL) '24-'26 DPS forecast relative to dividends paid over the preceding 12 months.[148]

3. Terminal growth rate

Q. How do you estimate the terminal growth rate for the UPG MS DCF?

A. The terminal growth rate is intended to reflect a sector-wide dividend growth rate toward which all stocks in the peer group are expected to converge over time. The long-term historical average EPS growth rate of a proxy group, such as presented in Table 6, is typically not used to estimate a sector-average terminal growth rate. This is due to survivorship bias: the proxy group only includes companies that exist today, not those that failed or were acquired in the past. A sector-wide average should reflect the weighted average of all market participants, including those that were absorbed or declined out of existence. Because the proxy group is composed only of "survivors," the average of its

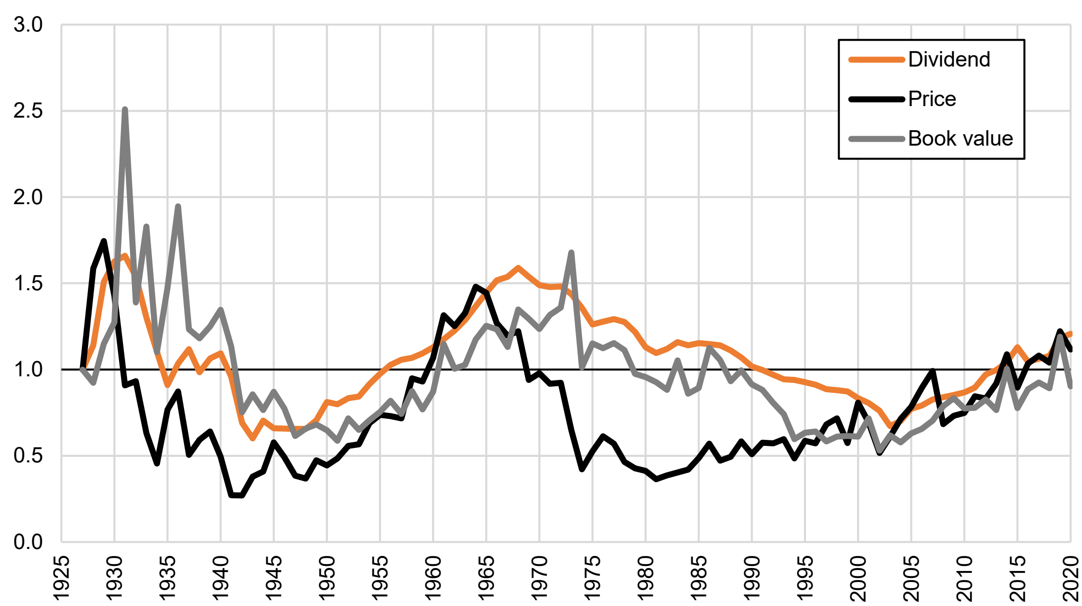
[147] All rates are converted from annual (r_a) to quarterly (r_q) using the formula: $r_q = (1 + r_a)^{\frac{1}{4}} - 1$.

[148] As described above, Value Line's growth rate forecast horizon extends backward several years, so it is not comparable to the other growth estimates which are more recent.

members' historical EPS growth rates is an upwardly biased estimate of expected sector-average future growth.

Figure 19 shows real utility-sector dividend, price, and book value per share from 1927 through 2020. While there have been periods of growth and decline, the long-term trend for both has been in-line with inflation for over 90 years. For comparison, for the market as a whole, real per-share dividend and book value have both increased by over 5.5 times, and price by 18 times, over the same period. Based on this long-term history, the terminal growth rate in the UPG MS DCF is assumed to be equal to inflation.

Figure 19. Utility sector real dividend and book value per share, 1927-2020[149]
1927=1.0



To some, this growth rate may seem low. In context, though, it is not surprising. For the market as a whole, long-term real DPS growth has tracked GDP per capita, about 1.8% per year.[150] At any given time, some sectors grow faster, some slower. The technology and

[149] M. Ellis analysis of French Data Library and BLS data.
[150] See, for example, Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), pp. 157-160. Analysis is for total payout, to account for the effect of net stock repurchases.

healthcare industries, for example, have sustained DPS growth rates higher than the market average for decades. Utilities are a mature industry, and end-use demand for electricity, gas, and water has grown more slowly than GDP for decades, so it is not unreasonable for utility companies' per-share dividend growth to lag the market as whole.

Q. How do you estimate expected inflation?

For expected long-term inflation, I use Treasury-TIPS spreads. TIPS are Treasury Inflation-Protected Securities, which provide investors a return equivalent to inflation plus the quoted TIPS yield. The difference in yield between Treasurys and TIPS of equal maturity is a current measure of the market's forward-looking inflation expectation over the life of the bonds. As with interest rates, market-based inflation forecasts are generally considered superior to "expert" forecasts, for the reasons described there.

The UPG MS DCF uses inflation for the terminal, not initial or transition, growth rate, so we want to estimate expected inflation into perpetuity at the end of the transition phase, not from today. I use the expected inflation, i_{lt}, rate over the period from 20 to 30 years from now, as implied by the difference in the 30-year and 20-year Treasury-TIPS spreads:

$$i_{lt} = \left(\frac{(1+i_{30})^{30}}{(1+i_{20})^{20}}\right)^{\frac{1}{10}} - 1$$

Using average Treasury yields for the month of December 2021, the long-term inflation estimate is 1.79%.[151]

[151] M. Ellis analysis of FRED data.

4. Leverage adjustment

Q. Do you make any adjustments to your MS DCF results?

A. The MS DCF yields a levered cost of equity. To account for differences in capital structure between the UPG and Aquarion, I unlever the MS DCF results to arrive at an unlevered cost of capital, assuming 100% equity financing.[152] The unlevered cost of equity, k_u, is typically expressed as an adjustment to beta in the CAPM:[153]

$$k_u = r_f + \beta_u(r_m - r_f)$$

where the unlevered beta, β_u, is expressed in terms of the levered equity beta, β_e:[154]

$$\beta_u = \frac{E}{D+E}\beta_e$$

For consistency and comparability, I apply the same methodology – unlevering relative to the risk-free rate, not the company's cost of debt – to the MS DCF model results:

$$k_u = r_f + \frac{E}{D+E}\beta_l(r_m - r_f)$$

$$k_e - r_f = \beta_l(r_m - r_f)$$

$$k_u = r_f + \frac{E}{D+E}(k_e - r_f)$$

$$k_u = \frac{D}{D+E}r_f + \frac{E}{D+E}k_e$$

where D and E refer to debt and equity, respectively. Best practice is to use market, not book, values for both debt and equity as market reflects investors' actual exposure; they buy and

[152] The unlevered cost of equity differs from the weighted average cost of capital ("WACC"). The unlevered cost of capital assumes 100% equity financing; the WACC assumes the company's current capital structure. While under the Modigliani and Miller theorem of capital structure independence, the cost of capital should be the same regardless of capital structure, the WACC typically overstates the unlevered cost of equity because the *expected* return on corporate debt is lower than the yield due to default risk.

[153] See, for example, Damodaran, *Damodaran on Valuation*, 2nd ed. (2006), p. 129.

[154] Unlevered beta is sometimes adjusted for taxes (the "Hamada" adjustment). As explained in *Valuation*, pp. 790-93, when the capital structure is constant over time, as it is with utilities, then the value of tax shields tracks the value of operating assets. Thus, the risk of tax shields will mirror the risk of operating assets and have the same discount rate, i.e., the unlevered cost of equity.

sell securities at market value, not book.[155] Market values for all the debt carried by these companies is not readily available, though, so book value is assumed. Table 11 summarizes the UPG members' capital structures.

Table 11. Utility Proxy Group capital structure[156]
$ million, December 2021

		Equity			
Water utility company	**Debt**	Preferred	Common	Market	**Market equity ratio** (%)[157]
American States Water	614	0	679	3,679	86
American Water Works	11,174	0	6,866	32,683	75
California Water	1,185	0	1,116	3,618	75
Essential Utilities	5,780	0	5,128	12,929	69
Middlesex Water	329	2	362	1,879	85
SJW Group	1,568	0	1,001	2,092	57
York Water	134	0	151	632	82
Mean					**75**

Q. What do you assume for the risk-free rate?

A. Like Mr. D'Ascendis, I use the 30-year Treasury for the risk-free rate, although I use a current rate, in this case, the average over the month of December 2021, 1.85%.

5. Results

Q. What are your MS DCF unlevered COE results?

A. Table 12 summarizes the MS DCF results. The average unlevered COE is 3.49%. Note that, in contrast to Mr. Ascendis's CG DCF results, which have a mean of 9.19% and standard

[155] See, for example, *Valuation*, p. 309: "To determine the company's current capital structure, measure the *market value* of all claims against enterprise value." [emphasis added].
[156] M. Ellis analysis of S&P Global Market Intelligence data. Book values as of 2021Q3; market equity based on December 2021 average.
[157] For this analysis, preferred equity is treated as debt. Only Middlesex Water has a small amount of preferred equity, less than 0.1% of its total capitalization.

deviation of 2.54% (0.27x), the dispersion of my unlevered COE results is much narrower – 3.49% mean and 0.32% standard deviation (0.09x) – reflecting our models' respective accuracy and robustness.

Table 12. Utility Proxy Group MS DCF unlevered COE
As of December 2021

			Yield	Initial growth rate (%)					E/C	COE (%)	
Water utility company	**Price**	**DPS**	(%)	GMI	Yahoo!	Zacks	VL	Average	(%)	Levered	Unlevered
American States Water	99.60	1.46	1.47	6.00	6.70	NA	9.33	7.34	86	4.00	3.69
American Water Works	180.04	2.41	1.34	7.72	8.20	8.08	7.08	7.77	75	3.87	3.35
California Water	68.78	0.92	1.34	11.40	11.70	NA	5.74	9.61	75	4.13	3.57
Essential Utilities	51.15	1.07	2.10	6.16	6.40	6.22	7.77	6.64	69	4.77	3.87
Middlesex Water	107.37	1.16	1.08	NA	2.70	NA	5.07	3.89	85	3.08	2.89
SJW Group	70.15	1.36	1.94	8.00	5.70	NA	6.05	6.58	57	4.55	3.39
York Water	48.25	0.78	1.62	NA	4.90	NA	7.20	6.05	82	4.02	3.64
Mean										**4.06**	**3.49**
Standard deviation										0.54	0.32

Q. Do you use the MS DCF elsewhere in your analysis?

A. Yes. I use it as one of two methods to estimate the market risk premium for the CAPM.

C. CAPM

Q. Please explain your implementation of the CAPM.

A. There are three components to the CAPM: the risk-free rate, the market risk premium, and beta. As explained above, I use the current, not forecast, T30 for the risk-free rate. My market risk-premium is the average of the long-term historical average and a forward-looking estimate based on the MS DCF. Also as explained above, beta is the most subjective of the three CAPM parameters. Based on my review of the latest research literature, I estimate beta using five years of trailing monthly returns in excess of the T30.

1. Market risk premium

Q. How do you estimate the market risk premium?

A. I use the average of two methods, one historical, the other forward-looking.

Q. How do you estimate the historical MRP?

A. I use the long-term historical difference in the geometric average real total returns on the market and long-term Treasury bond. As explained previously, the geometric average better reflects investors' long-term expectations for equity returns, and bond returns should include capital gains, not just yield, which is only achievable if the bond is held to maturity.[158]

Figure 20 shows the long-term historical real returns on the market and 20-year Treasury bond, as well as the implied MRP, from June 1926 through December 2021. Over the last 95+ years, stocks have outperformed the T20 by 4.84% per year. Many analysts and investors believe the long-term historical average is not representative of future expectations.[159] Most of stocks' historical average premium over long-term bonds occurred before 1982. This can be seen clearly in the two trend lines in Figure 20. Returns on the T20 basically tracked inflation through mid-1981, while stocks outperformed the T20 by an average of 6.29% per year. Since then, stocks have outperformed the T20 by only 2.74%. This has been referred to as the "term premium puzzle."[160] While the specific reasons why the realized market risk premium has compressed so dramatically over the last forty years are

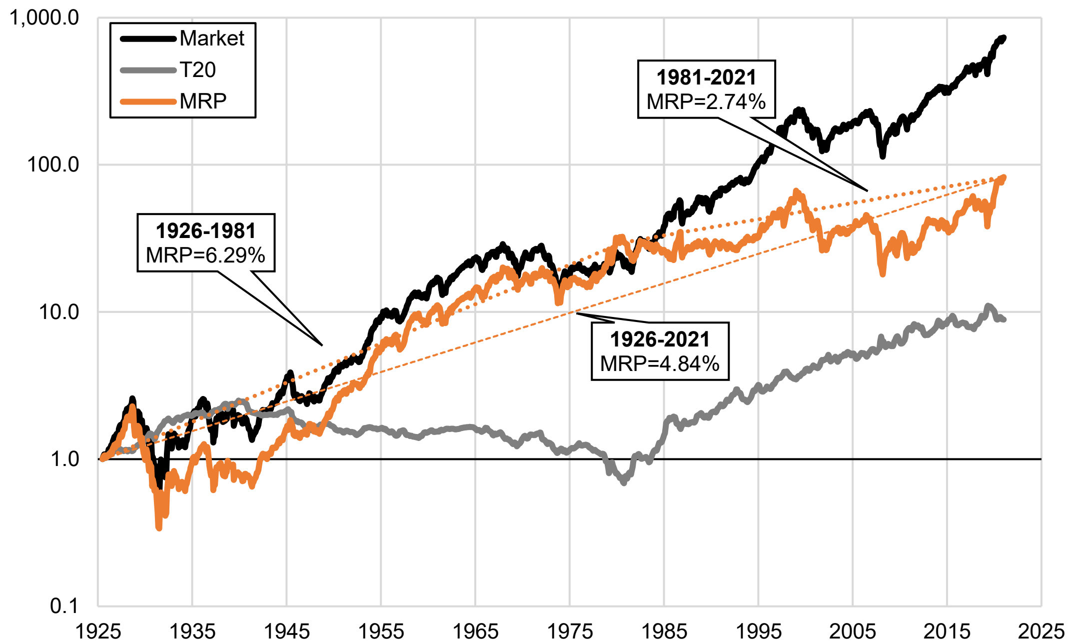
158 Total bond return is the monthly interest (the yield divided by 12) plus any capital gain or loss, estimated as the change in value from discounting the remaining interest payments (i.e., the previous time period's interest rate) and outstanding principal at the current time period's interest rate. This method is widely used, for example, by NYU finance professor Aswath Damodaran (e.g., http://people.stern.nyu.edu/adamodar/pc/datasets/histretSP.xls) and UCLA finance professor Ivo Welch (e.g., https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1077876).

159 See, for example, Dimson, Marsh, Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* (2002), p. 9.

160 Welch, *Corporate Finance*, p. 198.

the subject of debate, there is no disputing that it has done so. For this reason, I use a historical market risk premium equal to the average of the MRPs – the difference in geometric average market and T20 returns – over the entire time series, 4.84%, and over the last 40 years, 2.74%, or 3.79%.

Figure 20. Market, 20-year Treasury, and MRP real total return index[161]
June 1926=1.0 (log scale)



The historical MRP is calculated using the 20-year Treasury because that is the most extensive Treasury bond data set available.[162] Since we are using the T30 in our analysis, though, the premium is reduced by the current difference in the real 20- and 30-year Treasurys (TIPS), 0.19%, for a 30-year real MRP of 3.68%.

Q. How do you estimate the forward-looking MRP?

[161] M. Ellis analysis of French Data Library data. Available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[162] The early historical monthly data available for long-term Treasurys is not specifically for the 20-year. A simple regression model is used to adjust the long-term Treasury data to reflect an estimated 20-year yield.

A. I apply the same multi-stage DCF model I use for the UPG to the market as a whole, represented by the S&P 500 Index, and subtract the current 30-year Treasury.

Q. How do you estimate the current dividend yield for the S&P 500 Index?

A. I use the same methodology I use for the UPG members: the dividend paid in the last three months, through December 2021, divided by the average price of the index over the most recent month. I use the composite data reported by S&P. The current annualized yield is 1.35%.[163]

Q. How do you estimate the initial growth rate for the S&P 500 Index?

A. For each company in the S&P 500, I multiply the most recent dividend by the number of float-adjusted shares outstanding.[164] The sum is the total current dividend payment for the index members. I then project each company's total dividend out three years at its average analysts' estimated EPS growth rate and sum the total. Only companies for which there are analyst estimates are used. The CAGR between the current and future total S&P 500 dividend is the market-weighted average dividend growth rate, currently 14.06%.

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[163] All S&P 500 Index data is from S&P Global Market Intelligence, as of December 30, 2021.

[164] Float-adjusted market capitalization counts only shares available for purchase on open markets, excluding shares that are not available due to regulation, cross-shareholding, and strategic holdings (e.g., by insiders or family). Most major stock indexes now use float-adjusted market capitalization. The S&P 500's current market capitalization-weighted float is 94%. See: https://www.marketwatch.com/story/sp-move-to-float-adjusted-indexes-will-create-turnover.

Q. How do you treat non-dividend-paying stocks?

A. Non-dividend paying stock are included in the current yield calculations, because they are included in the index return data reported by S&P. The dividend growth rate calculation is based on the sum of total dividends paid, so it includes only dividend-paying stocks.

Q. How do you estimate the terminal growth rate for the S&P 500 Index?

A. Many analysts assume long-term dividend growth equal to nominal GDP growth. This is incorrect. Historically, per-share payout growth, whether measured as dividends or dividends plus net share buybacks, has tracked GDP per capita.[165] I assume a terminal growth rate based on forecast real long-term per-capita GDP plus the current market forecast for long-term inflation.

For long-term per-capita GDP growth, I use the average of the most recent long-term CPI-adjusted forecasts from three government agencies: the Congressional Budget Office (CBO),[166] the Energy Information Administration (EIA),[167] and the Social Security Administration (SSA).[168] I use the compound annual growth rate from 2041 to remove any near-term transitory effects, such as post-covid economic recovery, and to align with the time period used to estimate long-term inflation (years 21 through 30 from today).

TIPS payouts are tied to CPI, so the Treasury-TIPS spread is a forecast of consumer price inflation. In contrast, real GDP forecasts are deflated by the GDP deflator, which reflects the

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[165] See, for example, Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), pp. 157-160. Analysis is for total payout, to account for the effect of net stock repurchases.

[166] Congressional Budget Office, "The 2021 Long-Term Budget Outlook" (March 2021); data available at: https://www.cbo.gov/system/files/2021-03/57054-2021-03-Long-Term-Economic-Projections.xlsx.

[167] Energy Information Administration, "Annual Energy Outlook 2021" (February 2021); data available at: https://www.eia.gov/outlooks/aeo/excel/aeotab_20.xlsx.

[168] Social Security Administration, "The 2021 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds" (August 2021); data available at: https://www.ssa.gov/oact/TR/2021/SingleYearTRTables_TR2021.xlsx.

prices of all domestic expenditures, including by businesses and government. For consistency with the CPI forecast derived from the Treasury-TIPS spread, I use each agency's nominal GDP forecast deflated by its CPI forecast, rather than its GDP deflator forecast. Table 13 summarizes the three agencies' real long-term per-capita GDP forecasts.

Table 13. Real long-term per-capita GDP forecasts
Percent

		GDP				Nominal		CPI-deflated
Forecast	**Horizon**	Real	Deflator	Nominal	Population	**GDP pc**	CPI	**GDP pc**
CBO	2051	1.52%	1.95%	3.50%	0.27%	3.22%	2.23%	0.97%
EIA	2050	1.93%	2.57%	4.56%	0.40%	4.14%	2.48%	1.62%
SSA[169]	2100	NA	NA	4.09%	0.42%	3.65%	2.40%	1.22%
Mean		1.73%	2.26%	4.05%	0.37%	3.67%	2.37%	**1.27%**
+ Treasury-TIPS long-term inflation						3.08%	1.79%	

The average of the agencies CPI-deflated long-term per-capita GDP growth rates is 1.27%. Adding the same long-term inflation expectation used in the UPG terminal growth rate, 1.79%, gives a nominal rate of 3.08%.[170] The agencies' corresponding rates average 3.67%. I use the market-implied long-term inflation rate rather than the agencies' for two reasons. First, although all three forecasts are the agencies' most recent, they are stale in comparison to the December 2021 average Treasury rates used to estimate inflation. Second, as demonstrated by the analysis of BCFF forecasts, market-derived data are generally considered less biased and more accurate indicators of investor expectations than expert forecasts.

[169] SSA does not forecast real GDP or the GDP deflator, only nominal GDP and CPI.
[170] Because these are compound growth rates, the geometric sum is used, $(1 + g)(1 + i) - 1$.

Q. What is your forward-looking MRP?

A. The S&P 500 MS DCF yields a forecast return of 5.97%. Subtracting the current T30, 1.85%, gives an MRP of 4.12%, 0.44% higher than my historical MRP of 3.68%.

Q. And your combined MRP?

A. The average of my historical and forward-looking MRPs is 3.90%.

2. Beta

Q. How do you estimate beta?

A. As explained above, there is no single, widely used approach to estimating beta. Beta estimates can vary substantially depending, in particular, on the historical trailing period used, return calculation frequency, and adjustment for long-term trend reversion. I do not use betas from providers like Value Line, Bloomberg, or Yahoo! Finance because their betas are calculated using absolute returns and are therefore not appropriate for the zero-beta version of the CAPM we are using, where the security market line is defined relative to the T30.

Based on my review of the research literature, my own analysis of utility betas, and the context of this specific analysis – in which stock price information for the target utility itself is not available, and a peer group average is used instead – I believe the most appropriate methodology for estimating water utility betas for regulatory cost of capital purposes is to use five years of trailing simple monthly returns in excess of the T30 return, adjusted 60/40 toward the long-term sector average. The rationale for each element is explained below.

- *Five-year trailing history*: Longer trailing histories reduce the impact of short-term events like the market turmoil of early 2020 and better reflect long-term trends. Five years of trailing monthly returns is used in much of the academic literature on the CAPM (e.g., Blume, FF, BJS) and is also used by Yahoo! Finance.

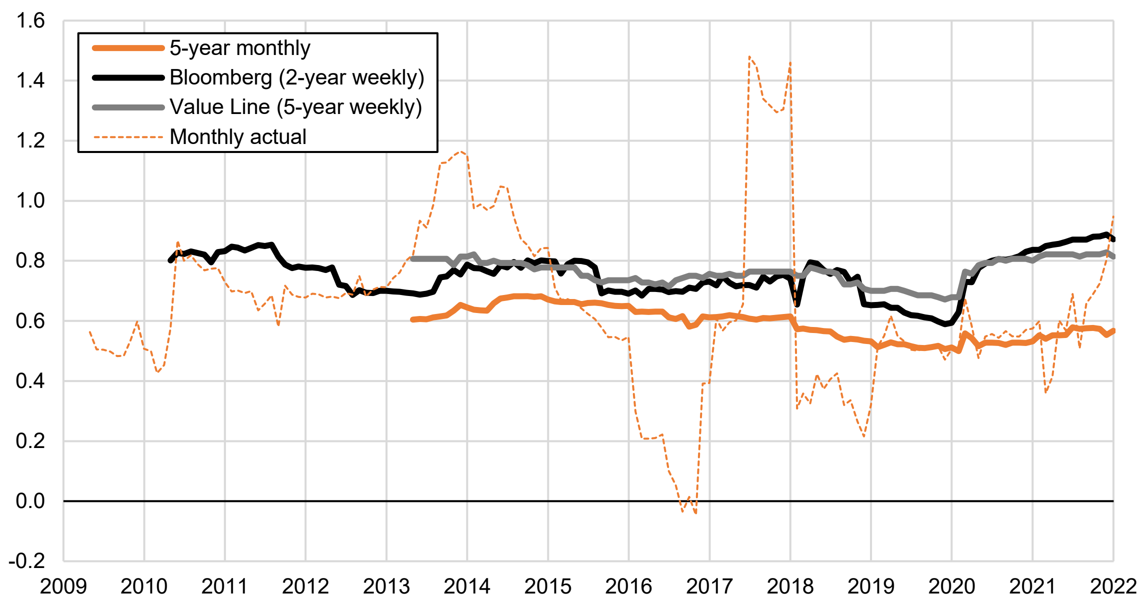
- *Monthly return frequency*: Monthly returns are less volatile and tend to better reflect a longer-term risk profile. We are interested in capturing the long-term risk profile of utilities, not exposure to short-term market fluctuations.
- *Excess returns*: Data service providers' betas are generally not calculated using excess returns, because subtracting the short-term risk-free rate has negligible impact on the calculated beta. As the FF and BJS study replications demonstrated, though, the choice of risk-free rate materially changes the slope of the security market line. Betas using returns in excess of the long-term Treasury, therefore, more accurately reflect the relationship modeled by the CAPM as used in utility cost of capital proceedings. In general, betas thus calculated tend to be higher for low-beta stocks like utilities and lower for high-beta stocks.
- *Adjustment toward long-term trend*: While the rationale for the Blume adjustment is generally sound – overall, betas do trend toward the market average – it does not apply to utilities. Rather, utilities tend to trend toward a long-term average of 0.55-0.60. UCLA finance professor Ivo Welch, who has perhaps published more research investigating beta than anybody else, suggests, for long-term investments, a 60/40 weighting of current and long-term average betas.[171]

Figure 21 compares the evolution over time of the UPG average beta calculated: (1) using five years of trailing monthly excess returns and adjusted 60/40 toward the long-term average

[171] Welch, *Corporate Finance*, 4th ed. (2017), pp. 222.

(0.56);[172] (2) comparably to the adjusted Bloomberg and Value Line 2- and 5-year trailing weekly return betas used by Mr. D'Ascendis;[173] and (3) using one year of trailing monthly excess returns, i.e., actual beta.

Figure 21. UPG average beta – 5-year trailing monthly, Bloomberg and Value Line analogs, and actual



As seen in the chart, several characteristics recommend the 5-year trailing adjusted monthly beta. It is less volatile. While the long-term risks of stocks can evolve over time, they should not change appreciably day-to-day or month-to-month, especially for utilities. It also more closely tracks actual beta over time. In contrast, the Bloomberg and Value Line betas are systematically too high and less stable. Both are also inordinately sensitive to the

[172] Because the UPG data series extends back to only April 2008, the utility-sector average, 0.57, is used, plus an adjustment, -0.01, for the difference in average monthly beta between the UPG and utility sector since April 2008.

[173] The analogs are not exactly the same; Bloomberg and Value Line use price-only, not total, returns, and Value Line uses the NYSE Composite, not the S&P 500, for its market proxy. These differences do not materially change the results.

market volatility of early 2020, continuing to increase despite calmer market conditions that have led to a 74% average increase in the UPG members' stock prices since then.[174]

3. Results

Q. What is the result of your CAPM analysis?

A. Table 14 summarizes my CAPM results. The average levered and unlevered betas are 0.57 and 0.43, respectively. The unlevered COE is 3.52%, very close to the MS DCF result of 3.49%.

Table 14. Utility Proxy Group CAPM results[175]
As of December 2021

	Levered		Market equity	Unlevered	
Water utility company	Beta	COE (%)	**ratio** (%)	Beta	COE (%)
American States Water	0.45	3.62	86	0.39	3.37
American Water Works	0.51	3.84	75	0.38	3.33
California Water	0.51	3.84	75	0.39	3.35
Essential Utilities	0.61	4.24	69	0.42	3.50
Middlesex Water	0.64	4.35	85	0.55	3.98
SJW Group	0.62	4.27	57	0.35	3.23
York Water	0.62	4.27	82	0.51	3.85
Mean	**0.57**	**4.06**	76	**0.43**	**3.52**
Standard deviation	0.07	0.29		0.07	0.28

As with the DCF, the results vary considerably less across companies than Mr. D'Ascendis's corresponding analysis, with an unlevered COE standard deviation-to-mean ratio 0.08x (0.28%/3.52%), compared to Mr. D'Ascendis's 0.12x.

[174] From their respective lows in March 2020 through December 31, 2021.
[175] M. Ellis analysis of S&P Global Market Intelligence data. Market equity based on December 2021 average.

D. UNLEVERED COE RESULTS

Q. And the average of your MS DCF and CAPM results?

A. The average of the MS DCF and CAPM unlevered COEs, 3.49% and 3.52%, respectively, is 3.50%. This result will need to be relevered at Aquarion's target capital structure.

The unlevered cost of equity estimates are likely conservative – overstating the actual cost – because the market value of debt is almost certainly higher than the book value assumed, due to the nearly continuous decline in interest rates over the last several decades. For example, Aquarion's weighted average long-term interest rate is currently 5.90%[176] At its current customer rates and capital structure, its credit rating would be between A2 and A3, and its cost of debt approximately 3.15%. The present value of remaining coupon payments discounted at the current rate is roughly 17% higher than book value. A lower equity ratio would reduce the weight of the levered cost of equity and, therefore, the calculated unlevered cost of equity. An 18% premium over book value would reduce the average unlevered COE to 3.43%.

E. COE BENCHMARKING

1. Investment firms

Q. The results of your COE analyses, even on a levered basis, seem high relative to typical authorized ROEs. Are there any independent analyses that support your estimates?

A. Utility regulatory proceedings are not the only venue in which expected returns are estimated. Investment firms, such as JP Morgan, BlackRock, and T. Rowe Price, regularly publish their capital market assumptions (CMAs), which are return forecasts for various

[176] The coupon rate investors receive, not the 6.14% cost rate grossed-up for issuance costs. Schedule No. 4D.

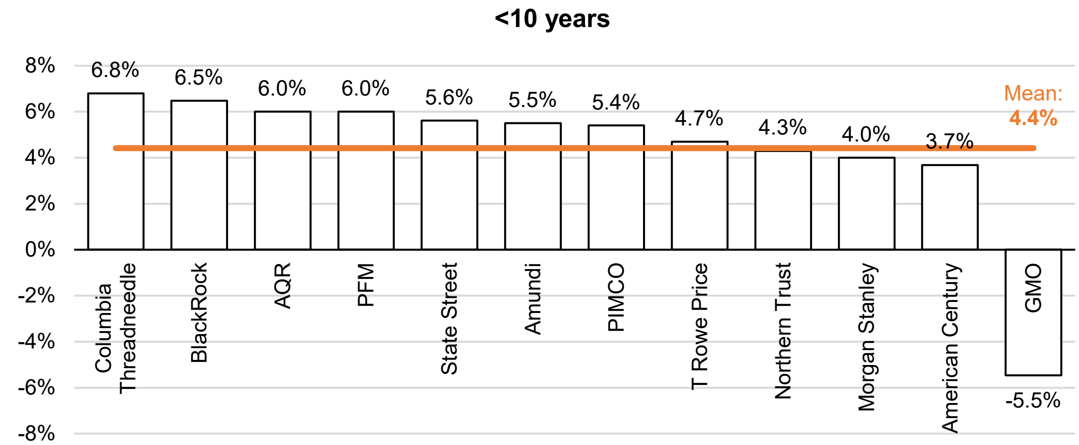
assets classes. Figure 22 summarizes the most recent (nominal, geometric) US equity market return forecasts from over thirty firms, grouped by assumed investment horizon: less than ten years, ten years (the most common), and more than ten years.[177] The average across the longer-term 10-year and more-than-10-year horizons, 5.7%, is nearly equal to the 5.8% average implied MS DCF and CAPM total market returns. Not a single one of the forty-seven forecasts reviewed[178] is within 4.2% of the six market return measures used in Mr. D'Ascendis's market risk premium calculations, the lowest of which is 12.10%.[179]

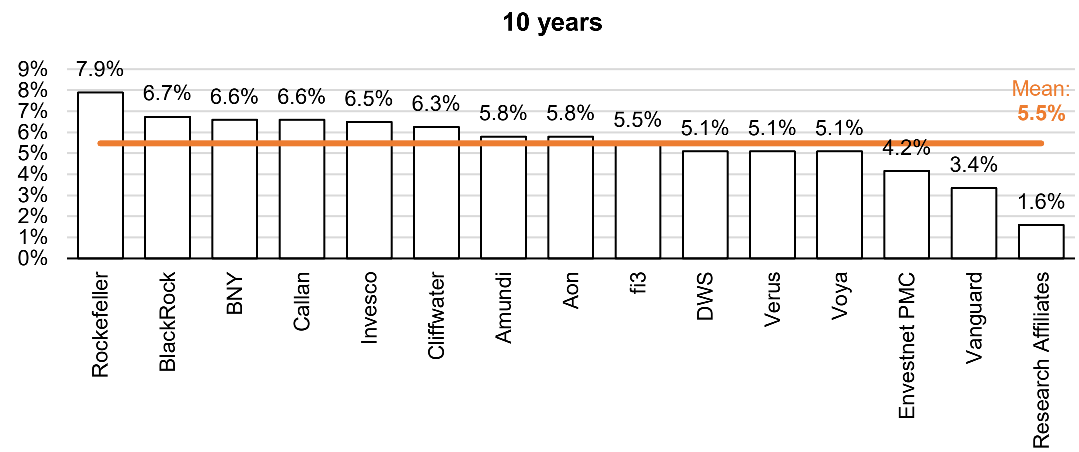
[177] Thirty-four CMA reports were reviewed in the fourth quarter of 2021, of which two were excluded for insufficient data on investment horizon, return type (geometric or arithmetic). Forecasts are for the entire US equity market where available; otherwise for large-capitalization stocks only, which account for ~90% of the market.

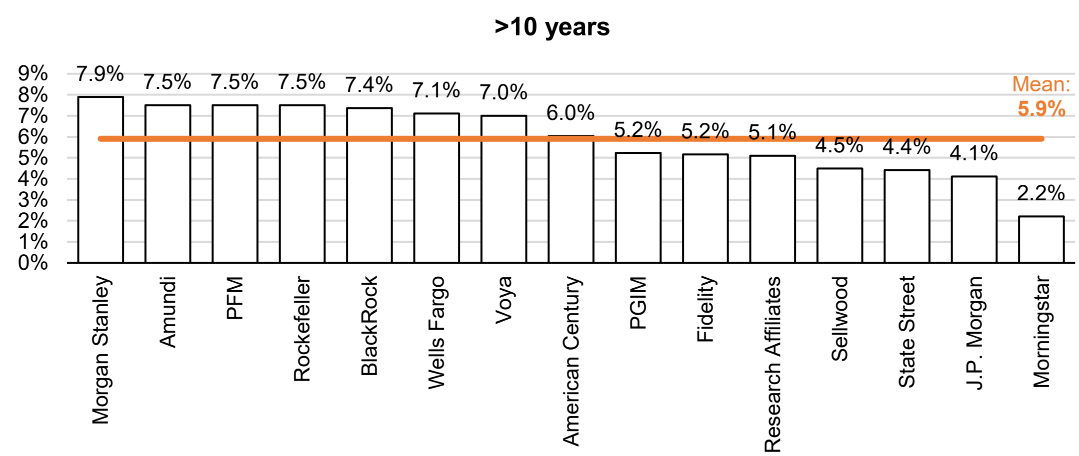
[178] Some CMAs included forecasts for multiple time horizons.

[179] Ibbotson arithmetic mean MRP. Attachment DWD-5, p. 2.

Figure 22. US equity market expected returns[180]
Nominal, geometric







180 Investment firm CMA reports. Forecasts are for US large-capitalization equities or total market.

Q. But aren't analyst forecasts biased?

A. The analysts providing the individual stock forecasts that go into the consensus estimates reported by Bloomberg, Zacks and Yahoo! Finance, and others all come from the "sell side" of the securities industry. The sell side engages in the creation, promotion, and selling of securities offerings. Their clients are not the institutional or public investors that ultimately buy the securities, but the companies, like utilities, seeking to raise money. They are in the business of transactions, not picking the best investments. Hence the ever-present suspicion of optimism bias in their forecasts: they are trying to curry favor with their existing and potential clients and to present the securities they market in the most favorable light.

CMAs come from the "buy side" – the institutional investors and asset managers that buy securities on behalf of others. They are in the business of trying the find best investments. Until a few years ago, few firms publicly distributed their CMA reports, so there is not sufficient data to determine whether they suffer from bias to the same extent as sell-side EPS estimates. But given their objectives, they would appear to be incentivized to produce unbiased and accurate forecasts: pessimism risks losing clients, while optimism risks disappointing them.

2. Market-to-book ratio

Q. Is there other evidence that authorized ROEs are too high?

A. It has long been recognized that the market-to-book ratio provides insight into the relationship between authorized return and the true cost of capital. Legendary regulatory economist Alfred Kahn[181] called attention to this phenomenon over fifty years ago in his 1970 classic *The Economics of Regulation: Principles and Institutions*:[182]

> [T]he sharp appreciation in the prices of public utility stocks, to one and half and then two times their book value during this period, reflected … a growing recognition that the companies in question were in fact being permitted to earn considerably more than their cost of capital. … The source of the discrepancy between market and book value has been that commissions have been allowing *r*'s [returns on equity] in excess of *k* [market cost of equity]; if instead they had set *r* equal to *k*, or proceeded at some point to do so … the discrepancy between market and book value … would have disappeared, or would never have arisen.

Kahn was referring to the period of the late 1940s to 1965, but the observation that utilities trade above book value is equally valid today. As seen in Figure 23, the utility sector average M/B ratio has exceeded 1.0 for nearly thirty years and, except for a short period after the global financial crisis, has exceeded 1.5 since 1995. The current average M/B ratio of the members Utility Proxy Group is even higher, at 3.9.[183]

Of course, valuation differences will arise due to parent company leverage and business mix, particularly the move into non-utility lines of business in the late '90s. For the sector as a whole, though, the vast majority of its valuation comes from traditional utilities. That the sector has traded at 1.5 to 2.0 times book value for decades is a clear indication that authorized ROEs have exceeded the cost of equity.

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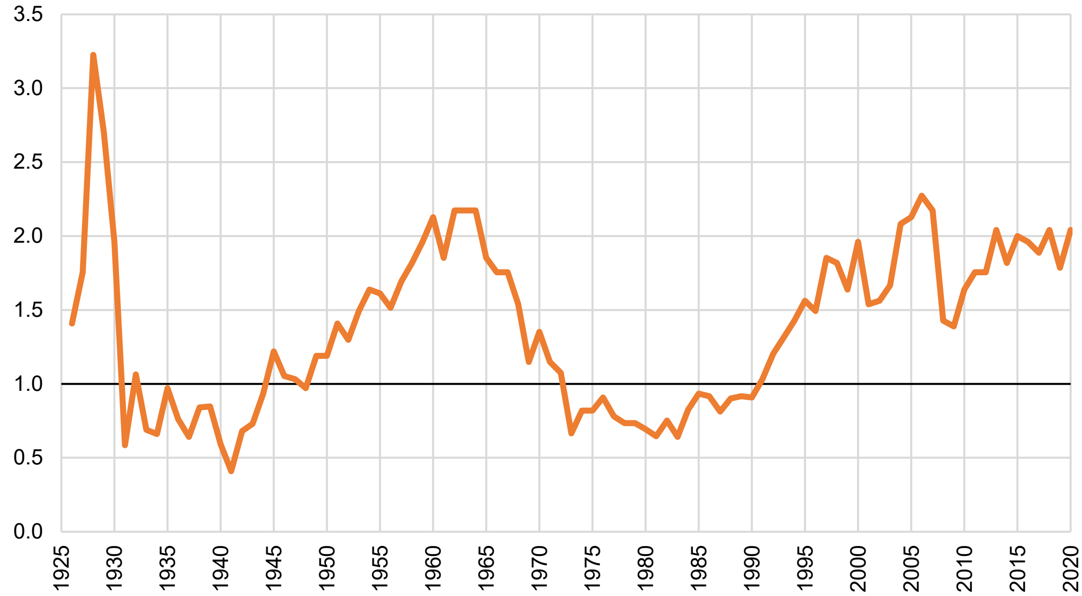
[181] See, for example, https://en.wikipedia.org/wiki/Alfred_E._Kahn.
[182] Kahn, *The Economics of Regulation: Principles and Institutions* (1970), p. 48, note 60, p. 50.
[183] S&P Global Market Intelligence, as of December 31, 2021.

Figure 23. Utility sector average market-to-book ratio[184]
Year-end



In another commonly referenced source, Kolbe, Read, and Hall's *The Cost of Capital: Estimating the Rate of Return for Public Utilities*, the authors recommend using a M/B ratio of 1.0 as a "guide for regulators" in setting the cost of capital:[185]

> The market-to-book ratio expresses the market value of the firm's outstanding common stock to the book value of its equity. If the two are equal the expected return on the book will equal the expected return on the market value of the company, which in turn will equal the cost of capital for a company of that degree of risk.

Kahn and Kolbe, et al, draw their conclusion from a basic financial concept: a positive net present value (NPV), i.e., value net of investment, is the signature indicator of a return above the cost of capital.[186] That utilities trade at a premium to book value (i.e., invested capital), is

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[184] Year-end. M. Ellis analysis of FDL data.
[185] Kolbe, Read, Hall, *The Cost of Capital: Estimating the Rate of Return for Public Utilities* (1984), p. 25.
[186] Curiously, Kolbe and another set of co-authors walk back this argument in a later book, arguing that market inefficiency could account for persistently high utility market-to-book values and citing the Nobel Prize lecture of Robert Shiller, awarded for his work on market inefficiencies:

> Professor Shiller holds instead that market prices are materially affected by human traits that are not always in accord with pure economic rationality. Among other things, *Professor Shiller has shown that the standard present value formula does not explain stock prices, which are too volatile for that model to hold true.* If stock prices are

prima facie evidence that they are earning more than their cost of capital.[187] In practical terms, this means that, for every dollar of equity the UPG members invest, shareholders receive back not just their investment plus a reasonable return (which would be the case when M/B = 1.0), but additional value equivalent to nearly three times their investment (3.9 – 1.0 = 2.9). Such high returns are not necessary to attract capital and needlessly increase rates.

3. Authorized ROE-Treasury spread

Q. Why do you think regulators have continued to approve authorized ROEs in excess of utilities' actual cost of equity?

A. I do not have any insight into regulators' thought processes or motivations, but mathematicians have developed a model to explain such behavior, known as the Pólya urn.[188] We can think of historical cost of capital decisions as balls in an urn. To decide on a new case, the regulator draws a ball from the urn. The ball is then replaced, along with a new ball with the same value. This process of sampling with replacement plus duplication has a self-reinforcing property sometimes called the rich-get-richer or Matthew effect.

> nonetheless rationally priced, it is in accord with a formula that we do not yet know. [Villadsen, Vilbert, Harris, *Kolbe, Risk and Return for Regulated Industries* (2017), p. 295; emphasis added.]

Yet in that very same speech Shiller points out:

> These conclusions about the aggregate stock market, however, do not carry over fully to individual stocks. … In individual firms there is sometimes a lot of action in the ratios, and the action in fact often reflects real knowledge about future cash flows. That is an example of the kind of idiosyncratic knowledge about individual firms that makes the efficient markets model a useful approximation of reality for individual firms. [Shiller, "Speculative Asset Prices" (2013), p. 478; available at: https://www.nobelprize.org/uploads/2018/06/shiller-lecture.pdf.]

Shiller also cites another Nobel laureate economist, Paul Samuelson:

> The market is] micro efficient but macro inefficient. That is, individual stock price variations are dominated by actual new information about subsequent dividends, but aggregate stock market variations are dominated by bubbles. [p. 476.]

The market-to-book ratio is a valid and robust indicator of the market's perceived value of utilities.

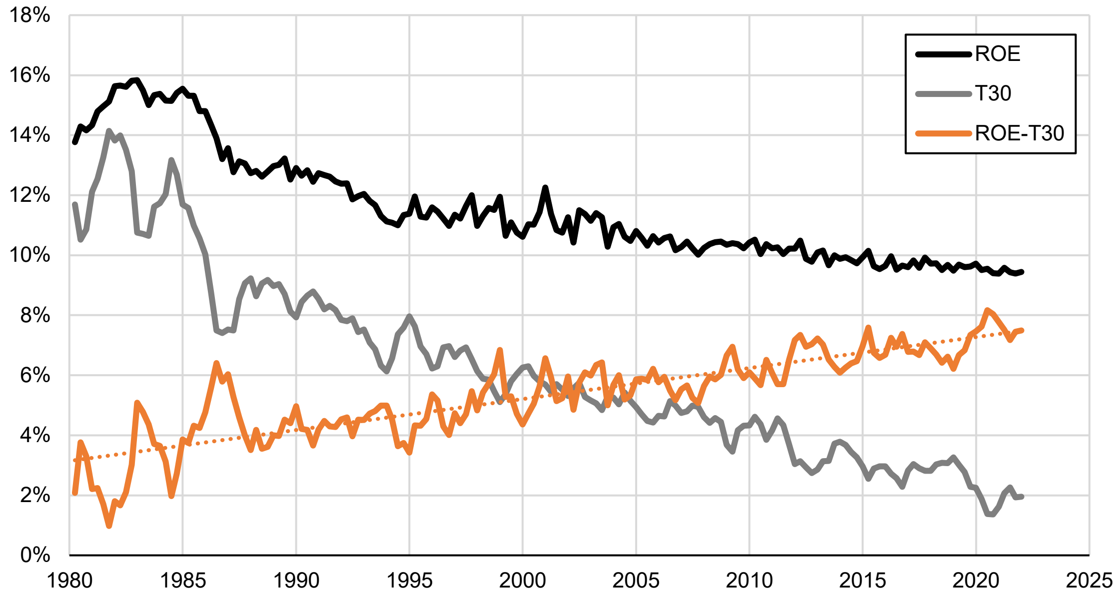
[187] Rate base can differ slightly from book value, typically due mostly to the deduction of deferred income taxes, an interest-free loan from the government, from rate base. The argument is equally valid if rate base is substituted for book value.

[188] https://en.wikipedia.org/wiki/P%C3%B3lya_urn_model.

Of course, this model is over-simplified. Regulators look at other information besides past authorized ROEs. The basic model can be modified to include additional balls in the urn representing new information, such as the estimated current cost of equity. Nonetheless, as long as regulators look at past ROEs, the authorized ROE will lag the true cost of equity. In a market in which interest rates and, assuming a relatively stable equity risk premium, the cost of equity have been trending downward for decades, authorized ROEs will consistently exceed the actual cost of equity, and the spread will widen over time.

This is exactly what we see in the data. Figure 24 shows the quarterly average authorized ROE, 30-year Treasury rate, and their difference. Both Treasury rates and ROEs have been declining steadily since the mid-1980s, but ROEs have declined much more slowly, such that the ROE-Treasury spread has more than doubled, from approximately 3.8% in the 1980s to 7.7% over the last two years. It can be estimated that, even under very conservative assumptions, regulators, on average, assign no more than a 25% weight to the current cost of equity and at least 75% to recent ROEs.

Figure 24. Quarterly average authorized ROE and 30-year Treasury rate[189]



Earlier, in my discussion of Mr. D'Ascendis's Non-Price Regulated Companies proxy group, I drew an analogy between estimating the cost of equity and developing a calorie intake recommendation. That analogy is apt here, as well. Looking at *actual* authorized ROEs to estimate the *required* ROE is akin to developing a calorie intake recommendation based on how much people *actually* heat, not what they need to maintain a healthy weight.

Others have made similar observations about the growing divergence between authorized ROEs and utilities' actual COEs. In a study published in 2019 exploring potential explanations, Carnegie Mellon researchers David Rode and Paul Fischbeck concluded:[190]

> It would appear that regulators are authorizing excessive returns on equity to utility investors and that these excess returns translate into tangible profits for utility firms. … In the end, we may observe simply that what regulators *should* do, what regulators *say* they're doing, and what regulators *actually* do may be three very different things [emphasis in original].

[189] M. Ellis analysis of S&P Global Market Intelligence and FRED data.
[190] Rode, Fischbeck, "Regulated equity returns: A puzzle," *Energy Policy*, 133 (2019).

F. INTEGRATED ROE-CAPITAL STRUCTURE MODEL

1. Overview

Q. How do you determine Aquarion's capital structure?

A. As discussed previously, the capital structure should be based on a target credit rating, but credit rating is a function of capital structure, ROE (via FFO), and cost of debt (via interest) so capital structure and ROE need to be determined jointly. The integrated capital structure-ROR model (ICSRM) simultaneously solves for the book equity ratio (e_b), levered cost of equity (k_e), and cost of debt (r_d) based on the relationships between credit rating, capital structure, cost of debt, and ROE, expressed as equations in Table 15, given the known inputs of Aquarion's unlevered COE (k_u), depreciation and amortization (DA), and deferred taxes (T_d), and the risk-free rate (r_f).

Table 15. ICSRM capital structure, cost of equity, and cost of debt equations

Equation	Terms	
$CR = f_M\left(\frac{D}{C}, \frac{FFO}{D}, \frac{FFO + Dr_d}{Dr_d}\right)$	CR $f_M()$ C D FFO r_d	: credit rating : Moody's rating methodology : total book capitalization (debt and equity) : debt : funds from operations : cost of debt
$D = C(1 - e_b)$	e_b	: book equity ratio
$FFO = k_e e_b C + DA + T_d$	k_e DA T_d	: levered COE (MS DCF/CAPM average) : depreciation and amortization : deferred taxes
$k_e = \frac{k_u - r_f(1 - e_b)}{e_b}$	k_u r_f	: unlevered COE (MS DCF/CAPM average) : risk-free rate
$r_d = f_d(CR)$	$f_d()$	: empirical relationship between utility bond credit rating and interest rate (binomial regression)

2. Short-term debt amount

Q. How do you determine the amount of short-term debt?

A. According to Aquarion's most recent annual report, its total short-term debt was $2,833,281 as of the end of 2020, including $33,281 of intercompany accounts payable – more than twice the $1.2 million in its application. This increase in short-term debt may be in anticipation of the pending maturity of $8 million of long-term debt through June 2023 and will be replaced by long-term debt. I therefore assume that Aquarion's short-term debt will be kept at a fixed $1.2 million.

3. Market value adjustment

Q. Are the resulting relevered COE and capital structure your recommendations?

A. No. The cost of equity is a breakeven figure – the return that would make an investor indifferent between investing or not. Recognizing the need to attract investors, the ROE should be set to ensure a positive net present value, i.e., M/B ratio greater than 1.0. Although a market-to-book ratio of 3.7, the UPG's current average, is clearly excessive – there's no need to return to investors nearly four times the value of their investment in low-risk infrastructure – it should exceed 1.0.

The ICSRM adjusts the ROE and capital structure to achieve a valuation target, as reflected in the M/B ratio. An alternative approach might simply add a spread to the ROE, e.g., 1%. But the choice of any such spread without understanding its implications for shareholder value would be arbitrary. A target M/B ratio enables the regulator to accurately assess how much incremental *value* they are providing investors. Relatively small changes in ROE, on the order of 0.1%, create significant value for shareholders.

The model used to estimate the M/B ratio is based on the *sustainable-growth DCF* (SG DCF):

$$M = \frac{Br(1-b)}{k_e - br}$$

where M is the market value of equity (the value to shareholders), M is book equity value, r is the return on equity (ROE), k_e is the levered cost of equity, and b is the earnings retention ratio. A reformulation of the constant-growth DCF model described above, the SG DCF attributes growth to reinvestment of the fraction of earnings that are not distributed as dividends, i.e., br is equal to g, and $Br(1 - b)$ to $D_0(1 + g)$. This form of the DCF is called "sustainable-growth" because the growth rate is what can be sustained by internal cash flow generation without additional equity issuance. The retention ratio, b, will be determined by investment needs, i.e., growth, and ROE, so it must be solved for, as well. Rearranging terms, b drops out, and ROE can be expressed:

$$r = \frac{M}{B}(k_e - g) + g$$

Implementing the SG DCF therefore requires a long-term growth assumption.

4. Aquarion long-term growth rate

Q. How do you estimate Aquarion's long-term growth rate?

A. Aquarion's estimated long-term growth rate is based on a time-weighted, inflation-adjusted average of Aquarion's 2007-20 historical total capitalization growth rate (3.24% in real terms[191]) and the long-term sector average (0% real). Aquarion is assumed to continue growing at its historical rate for ten years, and then transition to the industry average over the next ten years. In each phase, the relevant market-based inflation rate, calculated from Treasury-TIPS spreads is added. The weighted average is 2.32%.[192]

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[191] Per Aquarion's annual reports, 2007 and 2020 total capitalization were $19.4 million and $36.6 million, respectively, for a CAGR of 5.02%. Inflation over that period was 1.72%.

[192] This growth assumption is conservative; the lower the long-term growth rate, the higher the ROE needed to achieve any target M/B ratio.

5. ROE volatility adjustment

Q. Are any other factors considered in the ICSRM?

A. Yes. Earlier, I discussed the difference between arithmetic and geometric returns, why the historical geometric average is a better indicator of investor expectations for future equity returns, and the need for consistency between the type of returns produced by the DCF and CAPM. There is one additional consideration.

Expected return and cost of capital are frequently used interchangeably, as explained in *Valuation*:[193]

> The cost of capital is the price charged by investors for bearing the risk that the company's future cash flows may differ from what they anticipate when they make the investment. The cost of capital to a company equals the minimum return that investors expect to earn from investing in the company. That is why the terms *expected return* to investors and *cost of capital* are essentially the same. The cost of capital is also called the discount rate, because you discount future cash flows at this rate when calculating the present value of an investment, to reflect what you will have to pay investors [emphasis in original].

The ROE authorized in utility regulatory proceedings is not identical to the cost of capital, for two reasons. First, regulators may deliberately set the ROE higher than the cost of capital in order to attract investors and ensure the utility's financial integrity, per *Hope*. Second, the cost of capital is a compounded average, while ROE, even for the best managed utilities, will undoubtedly vary from year to year. The authorized ROE should therefore be expressed in terms of an expected arithmetic return. There is a mathematical relationship that allows us to convert the geometric average (k_g) return into an arithmetic (k_a) average:

$$k_a = k_g + \frac{\sigma^2}{2}$$

[193] Koller, et al, *Valuation*, 5th ed. (2010), p. 35.

where σ is the standard deviation of the expected return on the utility operating company's equity. Assuming the future standard deviation will be equal to Aquarion's historical realized ROE standard deviation from 2008 through 2020 – 4.50% – the geometric estimate should be increased by 0.10%.

Q. Why don't you use the standard deviation of shareholder returns in public equity markets?

A. It is not appropriate to use the standard deviation of shareholder returns in public equity markets, which is driven almost entirely by changes in price. Publicly traded utility stocks are subject to many factors outside the control of regulators and utilities, like changes in interest rates, inflation expectations, and investor risk appetite, that cause prices, and therefore the value of the underlying investment, to fluctuate. Even a "risk-free" government bond is subject to daily changes in its value as interest rates change. Such changes in underlying asset value, i.e., price, are the primary drivers of investment return volatility.[194]

For utilities, the underlying asset – rate base – is not subject to revaluation risk; only the income is, which significantly reduces the volatility of returns relative to publicly traded securities. In adjusting the geometric ROE, the relevant standard deviation is therefore that of realized ROEs, not shareholder returns. Essentially, the ROE should be determined in answer to the question, "What is the *arithmetic* return required to provide the operating utility company a *geometric* return equal to the market-based geometric cost of equity?"

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[194] From June 1926 through December 2021, the utility sector average annualized standard deviation of both total and price-only returns was 19.0%.

Q. How do the ICSRM model equations change with the incorporation of valuation and return volatility considerations?

A. Incorporating the valuation model and ROE volatility, the ICSRM simultaneously solves the equations in Table 16.

Table 16. ICSRM capital structure, valuation, ROE, and cost of debt equations

Equation	Terms
$CR = f_M\left(\frac{D}{C}, \frac{FFO}{D}, \frac{FFO + Dr_d}{Dr_d}\right)$	CR : credit rating $f_M()$: Moody's rating methodology C : total book capitalization (debt and equity) D : debt FFO : funds from operations r_d : cost of debt
$D = C(1 - e_b)$	e_b : book equity ratio
$FFO = k_e e_b C + DA + T_d$	k_e : levered COE (MS DCF/CAPM average) DA : depreciation and amortization T_d : deferred taxes
$r = \frac{M}{B}(k_e - g) + g$	$\frac{M}{B}$: target market-to-book ratio k_e : levered COE g : Aquarion's assumed long-term growth rate
$k_e = \frac{k_u - r_f(1 - e_m)}{e_m} + \frac{\sigma_r^2}{2}$	k_u : unlevered COE (MS DCF/CAPM average) r_f : risk-free rate e_m : market equity ratio σ_r : standard deviation of Aquarion historical ROE
$e_m = \frac{\frac{M}{B} e_b}{\frac{M}{B} e_b + (1 - e_b)}$	
$r_d = f_d(CR)$	$f_d()$: empirical relationship between utility bond credit rating and interest rate (binomial regression)

6. Results and recommendations

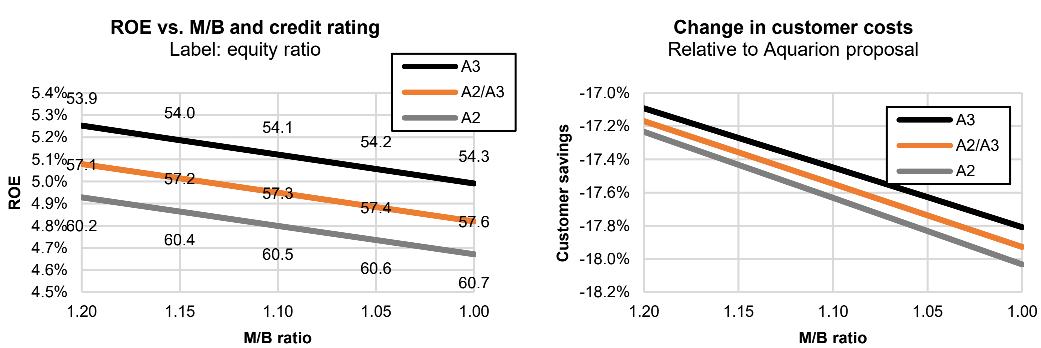
Q. What are the results of the ICSRM?

A. The model allows us to examine the capital structure and ROE under a range of credit rating and M/B targets. We can also supplement it with data from Aquarion's rate case to estimate the impact on customers relative to Aquarion's proposed $8.96 million revenue.[195]

[195] Schedule No. 1, p. 2.

Figure 25 shows the sensitivity of the required ROE and equity ratio to changes in credit rating and M/B ratio. A higher credit rating requires more equity, but that equity is less risky, so it has a lower cost. For a half-grade improvement in credit rating, ROE drops 0.15%-0.17%, while a 0.05 increase in the M/B ratio equates to a 0.06% bump in ROE. In contrast, customer savings are relatively insensitive to credit rating – less than 0.1% per half-grade credit rating improvement – but more sensitive to M/B ratio and ROE – 0.17-0.19% per 0.05 bump in M/B or 0.06% in ROE. For comparison, Aquarion's proposed 10.25% ROE and 52.36% equity ratio would give the company a M/B ratio of 5.4.

Figure 25. ICSRM ROE, equity ratio, and customer cost sensitivity to credit rating and M/B targets



The foregoing analysis assumes Aquarion's existing debt is the $8.9 million outstanding after the maturation of $5 million in July 2022 and $3 million in June 2023. The first $5 million will likely be retired by the time new rates go into effect, or very shortly thereafter, so it is reasonable to exclude it from the forward-looking capital structure and average cost of debt.

The second $3 million is excluded, as well, for two reasons. First, if its interest rate is included in the average rate used to calculate the rate of return, shareholders will receive an ongoing windfall of ~$139,000 per year once the debt is refinanced in 2023 at a rate likely to be less than half the current one, ~3.3% vs. 7.87%.[196] This is equivalent to a ~0.5% bump in ROE and +0.4 bump in M/B ratio – a substantial unearned increase in value at the unnecessary expense of customers. Second, assuming the higher interest rate remains in place over the long-term would result in an artificially conservative capital structure.

Aquarion would have to pay the higher interest rate on the outstwanding $3 million for approximately one year (a net increase of ~$138,000). But its total incremental interest cost, relative to an authorized cost of debt based on current market rates plus expected issuance costs,[197] can be reduced to less than $90,000 (approximately $65,000 after tax) by waiting to refinance the first $5 million, plus any incremental debt required to reach the target capital structure, until after the second $3 million matures, and using lower-cost short-term debt in the interim. Aquarion appears to have already implemented just such a short-term financing strategy, issuing $1.6 million of additional short-term debt in 2020.[198]

Q. What are your recommended credit rating and M/B ratio targets?

A. I recommend a target credit rating equivalent to that implied by Aquarion's proposal, midway between A2 and A3. A M/B ratio of 1.10, representing a 10% premium *in addition to* a fair and reasonable return, is appropriate and will more than compensate for flotation costs and the first-year interest shortfall.

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[196] These calculations assume any incremental long-term debt beyond Aquarion's existing $13.9 million is financed at current rates (~3.3%). The windfall would be even larger if the rate was assumed equal to Aquarion's existing cost of debt, as proposed by Aquarion.

[197] As explained above, current rates are a reasonable and unbiased predictor of future rates.

[198] "Annual Report of Aquarion Water Company of New Hampshire, Year ended December 31, 2020," p. 17.

Q. What are your capital structure and rate of return recommendations?

A. My recommendations, based on the results of the ICSRM at the target credit rating and M/B ratio, are summarized in Table 17. They would yield customer savings of 17.5% relative to Aquarion's proposal.

Table 17. Recommended rate of return summary
Percent

Capital source	Amount ($)	Weight	Cost rate	Weighted cost rate
Common equity	20,705,212	57.32	4.95	2.84
Preferred equity	2,300	0.01	6.00	0.00
Short-term debt	1,200,000	3.32	2.42	0.08
Long-term debt	14,211,714	39.35	4.62	1.82
Total	**36,119,226**	**100.00**	**4.74**	**4.74**

This recommendation is conservative, in terms of its favorability to Aquarion. I previously identified two assumptions in my analysis that work in Aquarion's favor: estimating Aquarion's credit rating solely from financial metrics, ignoring a favorable regulatory environment and potential corporate parent support; and calculating the UPG's capital structure using the book, not market, value of debt, which tends to increase the unlevered COE.

My recommended ROE is higher than the UPG average COE estimated from the MS DCF and CAPM (both 4.06%). The UPG members trade at a significant premium to book value, 3.9 times, so their equity ratio on a market value basis is high – 76% on average – reducing their levered cost of equity. In contrast, Aquarion's target market-based equity ratio is lower, and its cost of equity is correspondingly higher.

IV. CLOSING REMARKS

Q. Does this conclude your testimony?

A. Yes. Thank you.