Docket No.: A.22-04-008 et seq.
Exhibit No.: PCF-01
Witness: Mark E. Ellis

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Authority to Establish Its Authorized Cost of Capital for Utility Operations for 2023 and to Reset the Cost of Capital Adjustment Mechanism.	Application 22-04-008 (Filed April 20, 2022)
And Related Matters.	Application 22-04-009 (Filed April 20, 2022) Application 22-04-011 (Filed April 20, 2022) Application 22-04-012 (Filed April 20, 2022)

DIRECT TESTIMONY OF MARK E. ELLIS

ON BEHALF OF THE PROTECT OUR COMMUNITIES FOUNDATION

ERRATA - REDLINE VERSION

AUGUST 8, 2022

September 8, 2022 (errata)

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I. INTRODUCTION

Q. Please state your name and professional affiliation.

A. My name is Mark E. Ellis. I am an 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 Protect Our Communities Foundation (PCF).

Q. Do you certify under penalty of perjury that, to the best of your knowledge, the testimony you will give in this proceeding is true and correct?

A. Yes.

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 estimation process. This critical corporate finance function entailed thorough and ongoing research of the academic and practitioner literature on the historical cost of capital and the various cost of capital estimation methodologies and models; creating a process to estimate, quarterly, the forward-looking, risk-adjusted cost of capital for Sempra's portfolio of companies spanning a variety of geographies and lines of business; and calibrating the results against historical data and reputable, objective third-party estimates.

Previously, I held various positions in strategy, project development, and engineering with McKinsey, ExxonMobil, Southern California Edison, and Sanyo Electric. Last year, I provided expert testimony on behalf of The Utility Reform Network (TURN) before the California Public Utilities Commission in PG&E's application (A.21-20-04-23) for a $7.5-

billion wildfire cost securitization. Earlier in 2022, I provided expert testimony on behalf of The Protect Our Communities Foundation (PCF) before the California Public Utilities Commission in the three California Utilities' application (A.21-08-013 et seq.) to suspend the Cost of Capital Mechanism (CCM). I am currently working on or have completed other utility regulatory cases in New Hampshire, Hawaii, Georgia, and Wisconsin. Attachment MEE-1 contains more detail on my background.

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

A. I have been asked by PCF to assess the test year 2023 cost of capital applications of San Diego Gas & Electric Company's (SDG&E) and Southern California Gas Company (SoCalGas), with respect to the following questions set forth in the Scoping Memo: (1) What is the appropriate capital structure; (2) What is the appropriate cost of long term debt; (3) What is the appropriate cost of preferred stock; (4) What is the appropriate cost of common equity; (5) What is the appropriate rate of return on the utility rate base.[1]

A. Summary of Findings

1. SDG&E's and SoCalGas's cost of capital testimony employs flawed models and assumptions that systematically produce upwardly biased ROE estimates for SDG&E and SoCalGas.

Q. Please summarize the main findings of your review of SDG&E's and SoCalGas' ROE and capital structure testimony.

A. SDG&E's and SoCalGas's (collectively, the "Sempra Utilities") cost of capital expert, Mr. James Coyne, uses four models in developing his recommended return on equity (ROE) for SDG&E and SoCalGas. Two of those models, the Risk Premium Analysis (RPA) and Expected Earnings Analysis (EEA), both suffer a severe, invalidating conceptual flaw: they confuse the cost of equity and the return on equity. Thus, these models are deeply flawed in their basic concept: they are circular, in that they are based on utilities' authorized or forecast *return on equity*, not their actual *cost of equity*. Thus, while frequently used by utility cost of capital experts, these two models are not commonly used elsewhere in finance outside utility

[1] A.22-04-008 et seq., Assigned Commissioner's Ruling Consolidating Four Applications and Scoping Memo and Ruling (July 12, 2022), p. 3.

regulatory proceedings. These models are akin to developing a diet recommendation based on what people *actually* eat, not on what they *should* eat to maintain a healthy weight.

Although the other two – the discounted cash flow model (DCF) and capital asset pricing model (CAPM) – are widely used throughout finance to estimate the cost of capital, Mr. Coyne's implementations of each suffer numerous flaws which bias his results upward. In implementing the DCF, Mr. Coyne uses unnecessarily long trailing price histories to calculate the dividend yield, which bias his figures upward, and assumes demonstrably unrealistic, economically impossible long-term dividend growth rates.

In implementing the CAPM, he uses an interest rate forecast long and widely known to be systematically upwardly biased. He cherry-picks a beta calculation methodology that does not reflect current investor risk perceptions and applies the "Blume" adjustment that is not valid for utilities, both of which upwardly bias his results. He fails to examine other, more robust beta estimation methodologies, investigate whether the pandemic-related changes in market conditions and investor perceptions of utility risk were temporary or have been sustained, or compare his results to the long-term history of utility betas.

Mr. Coyne's chosen methodology hardly reflects the wide range of ways beta could be estimated, each of which could produce dramatically different results. As Nobel laureate Fischer Black, one of the pioneers of empirical testing of beta and the CAPM, famously admonished, "Watch out for data mining!"[2] – running an analysis several different ways but reporting only the outcomes that support one's conclusions.

Finally, Mr. Coyne estimates the market risk premium using the same flawed implementation of the DCF used for his proxy groups, again producing an economically impossible result.

The Sempra Utilities' capital structure recommendations are more difficult to assess because, while they refer to key metrics used in assessing their credit quality, they do not provide any analysis or calculations demonstrating how ROE affects those metrics, and how the impact of ROE on those metrics influences the Sempra Utilities' proposed equity ratios. Regulators in other states have authorized ROEs that are substantially lower than those requested by SDG&E and SoCalGas, with comparable or lower equity ratios, without

[2] Black, *Beta and Return*, The Journal of Portfolio Management (Fall 1993).

adversely impacting the utilities' credit ratings. Thus, the Commission can substantially reduce the ROEs requested by SDG&E and SoCalGas, and thereby customer costs, while still maintaining their respective target credit ratings.

2. More rigorous, fact-based implementation of the DCF and CAPM yields ROEs roughly one-half the level of Mr. Coyne's recommendations.

Q. Please summarize the main findings of your ROE analyses for SDG&E and SoCalGas.

A. Like Mr. Coyne, I use the DCF and CAPM, two models that are widely used throughout finance to estimate the cost of capital. Unlike Mr. Coyne, I am careful to use realistic and rigorously supported assumptions – about long-term dividend growth rates, current interest rates, and risk profiles and premia. I base my ROE recommendations on each Sempra Utility's actual, fact-based cost of equity.

Figure 1 summarizes the key findings of my review of Mr. Coyne's analysis, the modifications required to correct its deficiencies, and the resulting ROE estimates. More rigorous, fact-based, and accurate analyses result in substantially lower recommendations for SDG&E's and SoCalGas's ROEs: 5.45~~0~~% and 5.40~~35~~%, respectively, roughly one-half Mr. Coyne's recommended 10.55% and 10.75%.

Based on my analysis of SDG&E's and SoCalGas's general rate case filings, their proposed ROEs, grossed up for taxes, account for 22% of each utility's revenue requirement. Assuming no change in their capital structure or cost of debt, adopting my recommended ROEs instead of SDG&E's and SoCalGas's proposed ROEs would reduce average costs by 11% for both SDG&E and SoCalGas customers.

Figure 1. Comparison of Coyne and Ellis ROE methodologies and results[3]

	Coyne COE (%)		Ellis COE (%)		
Model	SDG&E	SoCalGas	SDG&E	SoCalGas	**Comment**
DCF	**8.81**	**9.72**	**~~6.00~~5.98**	**5.83~~72~~**	
Dividend yield	3.59	3.57	3.51	3.24~~1~~	Coyne: excessively long trailing price histories (up to 180 trading days) introduces upward bias Ellis: one-month trailing price history (~21 trading days)
Constant growth rate	5.14	6.04	NA	NA	Coyne: extrapolates DPS using analysts' 3-to-5-year EPS growth forecasts • Estimates are upwardly biased • Low correlation between EPS and DPS forecasts • Inconsistency between EPS and DCF forecast starting periods • Results are inconsistent with analysts' own return forecasts • Economically impossible • Range of results too wide for companies with similar risk profiles
Initial growth rate	NA	NA	5.20	5.93	Analysts' EPS growth rates for three years to mitigate upward bias
Terminal growth rate	NA	NA	1.41~~83~~	1.41~~83~~	Based on long-term historical utility DPS growth rate equal to inflation
CAPM	**13.99-14.13**	**13.43-13.62**	**4.90~~3~~**	**4.90~~3~~**	
Risk-free rate (30-year Treasury) • Current • Forecast	 2.20 3.20	 2.20 3.20	 NA 3.10~~25~~	 NA 3.10~~25~~	Coyne: current (30-trading day average) and forecast from source known to provide systematically upwardly biased estimates for decades Ellis: current (one-month trailing average) rate
Beta	0.87-0.88	0.82-0.85	0.45	0.45	Coyne: 5-year weekly; inflated due to early-2020 market turmoil and not reflective of current market conditions Ellis: 5-year monthly; balances long-term historical trend and current market conditions
Market risk premium • Historical • Forward	15.62 NA 15.62	15.62 NA 15.62	~~3.73~~4.00 4.~~8~~79 ~~2.57~~3.20	~~3.73~~4.00 4.~~8~~79 ~~2.57~~3.20	Coyne: forward-looking using flawed CG DCF Ellis: average of forward-looking using MS DCF and long-term historical average; MS DCF long-term growth rate equal to pre-capita GDP
Risk Premium Analysis	**9.47-9.99**	**9.47-9.97**	**NA**	**NA**	Conceptually invalid: equates COE to ROE
Expected Earnings Analysis	**10.72**	**9.77**	**NA**	**NA**	Conceptually invalid: equates COE to ROE
Mean	**10.72-10.89**	**10.60-10.77**	**5.44~~6~~**	**5.37~~3~~**	
Recommended ROE	**10.55**	**10.75**	**5.45~~0~~**	**5.40~~35~~**	

[3] A.22-04-008 et seq., Exhibit No. SDG&E-04, Prepared Direct Testimony of James M. Coyne – Return on Equity on Behalf of San Diego Gas & Electric Company (May 2022) (hereafter "SDG&E-04"), Exhibits JMC-

B. Organization of Testimony

Q. How is your testimony organized?

A. First, I review a few key conceptual issues related to the cost of capital, capital structure, and the Sempra Utilities' embedded costs of the debt. Next, I provide a detailed assessment of Mr. Coyne's cost of equity analysis methodology and implementation. For the DCF and CAPM, the two of Mr. Coyne's four cost of equity models that are valid, I explain various modifications to his methodology and assumptions to correct for the deficiencies in Mr. Coyne's assumptions and analyses and then provide the resulting ROE estimates. I then estimate the potential savings to customers from adopting my recommended ROEs instead of the Sempra Utilities' proposals.

II. CONFUSION BETWEEN THE *RATE OF RETURN ON* CAPITAL AND *COST OF* CAPITAL HAS LED TO EXCESSIVE AUTHORIZED RETURNS.

A. *Rate of Return on* Capital and *Cost of* Capital are not the same: Rate of Return on Capital is a Financial Performance Metric; Cost of Capital is a Measure of Economic Cost.

Q. What is the goal of a cost of capital proceeding?

A. A cost of capital proceeding authorizes the rates of return on utilities' various sources of capital that utilities are allowed to recover in customer rates. The goal of a cost of capital proceeding is to determine an authorized return on each source of capital – common equity, preferred equity, and debt – that is as close as possible to the actual cost of each source of capital. The common name of the proceedings in which authorized returns are determined, including in California – *cost* of capital – reveals this intention that the financial return should match the economic cost. The questions articulated in of the Scoping Memo implicitly acknowledge this goal, referring to the "cost" of various sources of capital.[4]

2, JMC-4, JMC 5.2, JMC-6, JMC-7; A.22-04-008 et seq., Exhibit No. SCG-04, Southern California Gas Company Prepared Direct Testimony of James M. Coyne (Return on Equity) (hereafter "SCG-04"), Exhibits JMC-2, JMC-4, JMC 5.2, JMC-6, JMC-7.

[4] A.22-04-008 et seq., Assigned Commissioner's Ruling Consolidating Four Applications and Scoping Memo (July 12, 2022), p. 3.

Q. How does the rate of return on capital differ from the cost of capital?

A. The rate of return on capital, often shortened to "rate of return," is a measure of financial performance, calculated by dividing the value *returned* to investors – e.g., interest, preferred dividend, net income – by the amount of capital invested. The cost of capital is the return investors *expect* on their investment. It is referred to as a cost because it reflects what investors demand in return for assuming the risk of the investment and, therefore, what companies must pay for that investment. The *rate of return* on each form of capital, whether calculated retrospectively or estimated prospectively, may or may not equal its respective *cost of capital*.

Q. Why is the distinction between the cost of capital and rate of return important?

A. The cost of capital and rate of return (on capital) are entirely different concepts. The rate of return is a financial performance metric. The cost of capital is an economic concept. Nonetheless, they are frequently referred to interchangeably in utility regulatory proceedings, perhaps in part because finance professionals commonly refer to the cost of capital as the *expected* return (on capital).[5]

The muddling of the difference between the cost of capital and the rate of return is not just of semantic concern, particularly for the return on equity. Unlike outstanding debt and preferred equity, whose costs of capital can be directly observed from their respective market rates of return (interest and dividend, respectively), which in turn can be used to accurately estimate the cost of any future issuances,[6] the cost of equity, both existing and to-be-issued, cannot be directly observed and must be estimated using various models.

This confusion between the *cost of* capital and the *return on* capital has infiltrated some of the models commonly used in utility cost of capital proceedings to estimate the cost of

[5] *See, e.g.,* Koller, et al, *Valuation*, 5th ed. (2010), p. 35 ("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).

[6] As explained in Section IV below, though, despite the relative transparency of the cost of debt, SoCalGas's and SDG&E's authorized costs of debt have systematically exceeded their actual costs for many years.

equity. These models' wide use and apparent influence on regulatory decisions, though, does not make them correct or mean they provide a suitable basis for estimating the cost of equity.

Models that rely exclusively on historical or forecast utility rates of return on equity, without reference to utilities' actual cost of equity should be rejected outright. Mr. Coyne uses two such models, one relying exclusively on historical authorized ROEs, the other on forecast ROEs. These models incorporate no information about the actual cost of equity and are therefore inherently flawed and produce invalid results. Only models that estimate the *cost* of equity should be used to determine the authorized ROE.

B. Multiple, Diverse Sources of Evidence Demonstrate that Utilities' Authorized ROEs Far Exceed Their Cost of Equity.

Q. Do authorized ROEs reflect the actual cost of equity?

A. Substantial, robust evidence suggests that authorized ROEs for nearly all US utilities exceed their cost of equity. ROEs in California, including for SDG&E and SoCalGas, follow this national pattern. As I discuss and analyze below, the evidence that should be assessed in this proceeding includes expected return forecasts produced by investment professionals, utility market-to-book ratios, and the increasing spread between authorized ROEs and interest rates.

1. Investment firms' expected return forecasts for the US equity market as a whole – which is riskier, on average, than utilities – are consistently lower than utilities' authorized ROEs.

Q. Are there other public sources for cost of equity estimates outside utility regulatory proceedings?

A. Utility cost of capital proceedings are not the only purpose for which expected returns on equity are estimated. Investment firms, such as JP Morgan, BlackRock, and T. Rowe Price, regularly publish capital market assumption reports (CMAs) – expected return forecasts for various assets classes. Figure 2 summarizes a survey of US equity market return forecasts published by over thirty firms in 2021.

The CMA forecasts shown in Figure 2 are grouped by assumed investment horizon: less than ten years, ten years (the most common), and more than ten years.[7] The average across the longer-term 10-year and more-than-10-year horizons, 5.7%, is approximately 40% less than the average ROE authorized for regulated utilities throughout the United States in 2021, 9.5%.[8] Not a single one of the forty-two expected return forecasts reviewed[9] is as high as the average ROE yielded by any of Mr. Coyne's models.

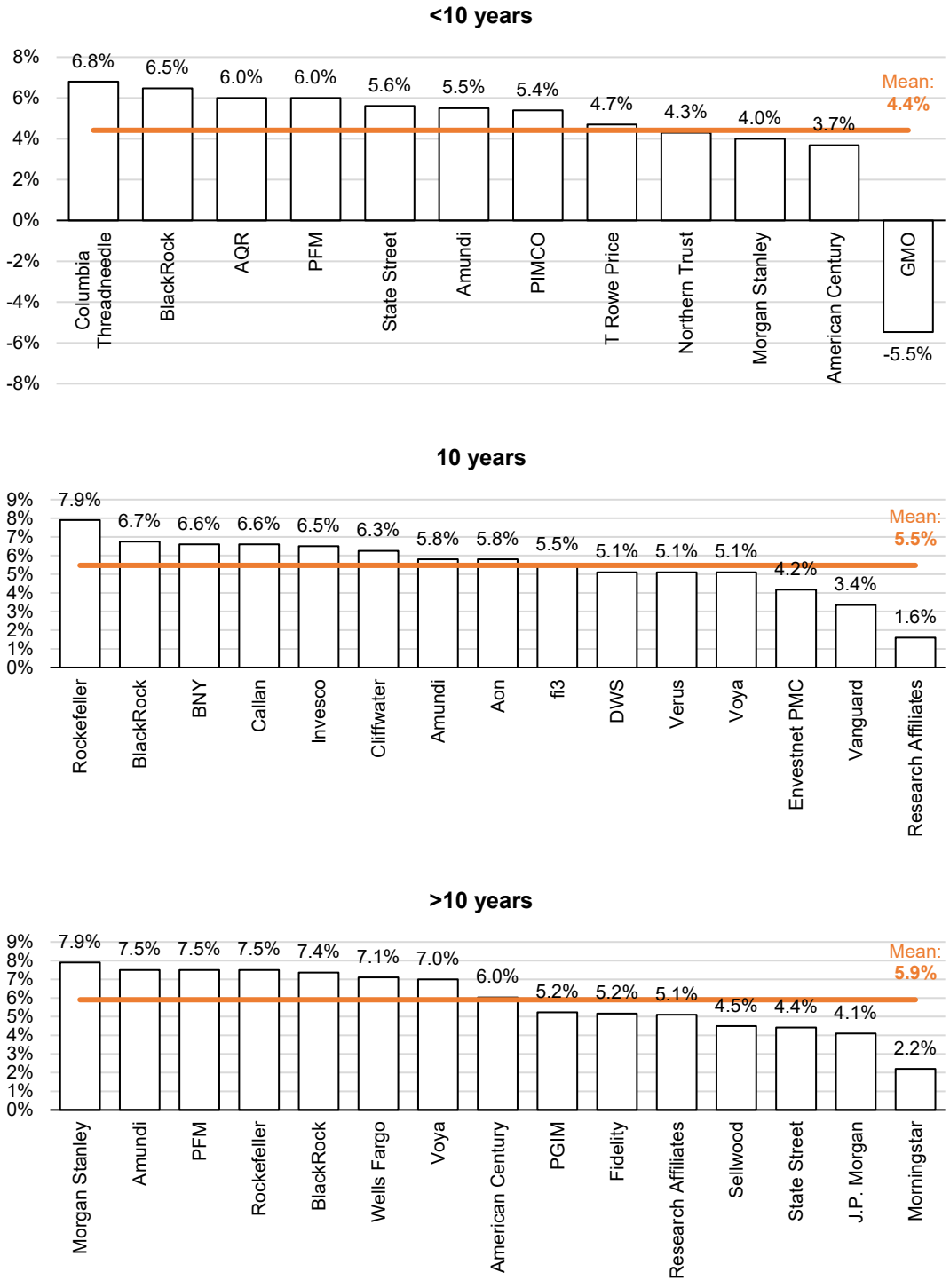
CMA equity market return forecasts are a relevant and useful benchmark for utility ROEs because US utilities, including SDG&E and SoCalGas, are lower-risk – both historically and prospectively – than the market as whole, and therefore have *lower* expected returns than the market as a whole. That authorized utility ROEs are so much higher than the expected returns on the higher-risk overall market is a compelling indicator that authorized ROEs far exceed utility investors' expected returns, i.e., utilities' actual cost of equity.

[7] Thirty-four CMA reports were reviewed, of which two were excluded due to insufficient data on investment horizon or return type (geometric or arithmetic).

[8] M. Ellis analysis of S&P Global Market Intelligence (S&P GMI) data, available at https://www.spglobal.com/marketintelligence/en/ [last accessed July 27, 2022]

[9] Some CMAs included forecasts for multiple time horizons, so the number of forecasts exceeds the number of reports.

Figure 2. US equity market expected returns[10]
Nominal, geometric



[10] M. Ellis analysis of investment firm CMA reports.

2. Market-to-book ratios reveal that utilities' cost of equity is substantially lower than authorized ROEs.

Q. What do utility stock market-to-book ratios reveal about ROEs relative to utilities' cost of equity?

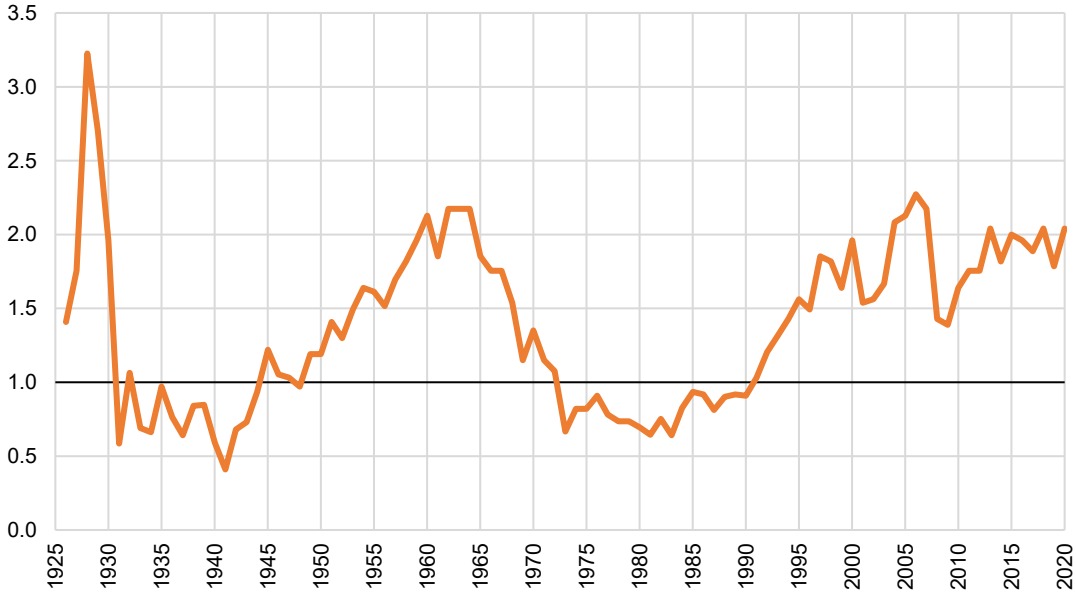
A. It has long been recognized that utilities' market-to-book (M/B) ratios provide insight into the relationship between authorized return and the true cost of capital. Legendary regulatory economist Alfred Kahn[11] called attention to this phenomenon over fifty years ago in his 1970 classic *The Economics of Regulation: Principles and Institutions*:[12]

> [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 3, 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 Mr. Coyne's proxy groups for SDG&E and SoCalGas are even higher, at 2.0 and 1.9, respectively.[13] As Kahn observed, the utility sector trading at 1.5 to 2.0 times book value for decades clearly demonstrates that utilities have once again been "permitted to earn considerably more than their cost of capital."

[11] *See, e.g.,* https://en.wikipedia.org/wiki/Alfred_E._Kahn.
[12] Kahn, *The Economics of Regulation: Principles and Institutions* (1970), p. 48, fn. 60, p. 50.
[13] M. Ellis analysis of S&P GMI data [last accessed July 27, 2022].

Figure 3. Utility sector average market-to-book ratio[14]
Year-end



Another commonly referenced textbook on utility regulation, Kolbe, Read, and Hall's *The Cost of Capital: Estimating the Rate of Return for Public Utilities*, recommends using a M/B ratio of 1.0 as a "guide for regulators" in setting the cost of capital:[15]

> 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, drew their conclusions from a basic financial concept: a positive net present value (NPV), i.e., value net of investment, is the signature indicator of a rate of return that exceeds the cost of capital. NPV is equal to investment multiplied by (M/B – 1.0), so M/B exceeding 1.0 indicates that NPV is positive. That utilities trade at a premium to book value (i.e., invested capital), is prima facie evidence that they are earning more than their cost of capital.

[14] M. Ellis analysis of French Data Library (FDL) data, available at https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html [last accessed July 30, 2022].
[15] Kolbe, Read, Hall, *The Cost of Capital: Estimating the Rate of Return for Public Utilities* (1984), p. 25.

In practical terms, this means that, for every dollar of equity a utility invests, 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 their equity investment multiplied by (M/B – 1.0). At current M/B ratios near 2.0, authorized ROEs effectively double the value of utilities' equity investments, *on top of* returning their cost of equity. Such high returns are not necessary to attract capital and needlessly increase customer costs.

3. Authorized ROEs and interest rates have diverged without a corresponding increase in utilities' risk profile.

Q. Why do regulators approve authorized ROEs in excess of utilities' actual cost of equity?

A. A mathematical model called the Pólya urn can provide insight into why regulators have continued to approve authorized ROEs in excess of utilities' actual cost of capital.[16] Historical return on equity decisions can be thought of 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 – representing the current ROE decision – 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.

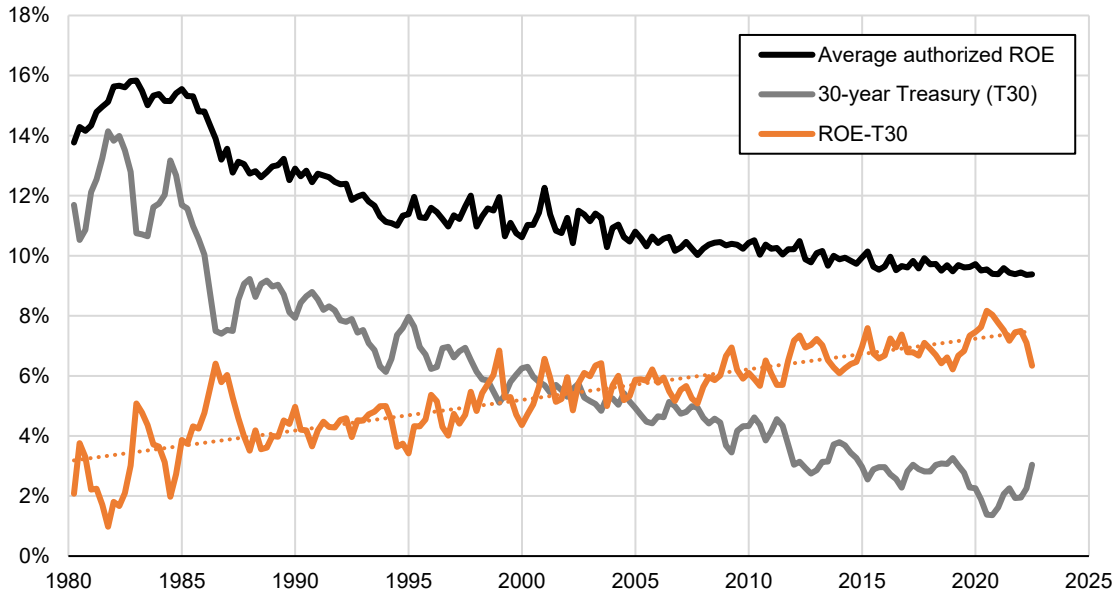
Of course, this model is over-simplified because regulators look at other information besides past authorized ROEs. The basic model can be modified to include additional balls in the urn representing new information, such as the estimated current cost of equity. Nonetheless, as long as regulators look at, much less rely on, past ROEs, changes in authorized ROEs will lag changes in the current true cost of equity.

The basic utility regulatory model and risk profile have not changed significantly for decades, so the utility equity risk premium – the spread of the cost of capital over risk-free government interest rates – has remained stable. The Pólya urn model predicts that, in a market in which interest rates and, assuming a relatively stable utility equity risk premium, utilities' 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.

[16] *See* https://en.wikipedia.org/wiki/P%C3%B3lya_urn_model.

The data confirm the Pólya urn model's prediction of such a widening spread between authorized ROEs and the actual cost of equity. Figure 4 shows the quarterly average authorized ROE for all US utilities, the 30-year Treasury rate, and their difference. While interest rates have declined steadily since the mid-1980s, authorized ROEs have not kept pace. As a result, the ROE-Treasury spread has more than ~~doub~~tripled, from approximately 2.3~~.8~~% in the 1980s to 7.7% over the last two years. It can be estimated from the Pólya urn model described above that, even under 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. No evidence suggests that utilities' risk profile has substantially increased over this period, so setting ROEs so much higher than utilities' actual cost of equity unnecessarily raises rates and costs to customers.

Figure 4. Quarterly average authorized ROE and 30-year Treasury rate[17]



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:[18]

[17] M. Ellis analysis of S&P GMI data [last accessed July 22, 2022]; Federal Reserve Bank of St. Louis Economic Data (FRED) data, available at https://fred.stlouisfed.org/categories/115 [last accessed July 22, 2022].

[18] Rode, Fischbeck, *Regulated equity returns: A puzzle*, Energy Policy 133 (2019), p. 1, 16 (emphasis in original).

> 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.

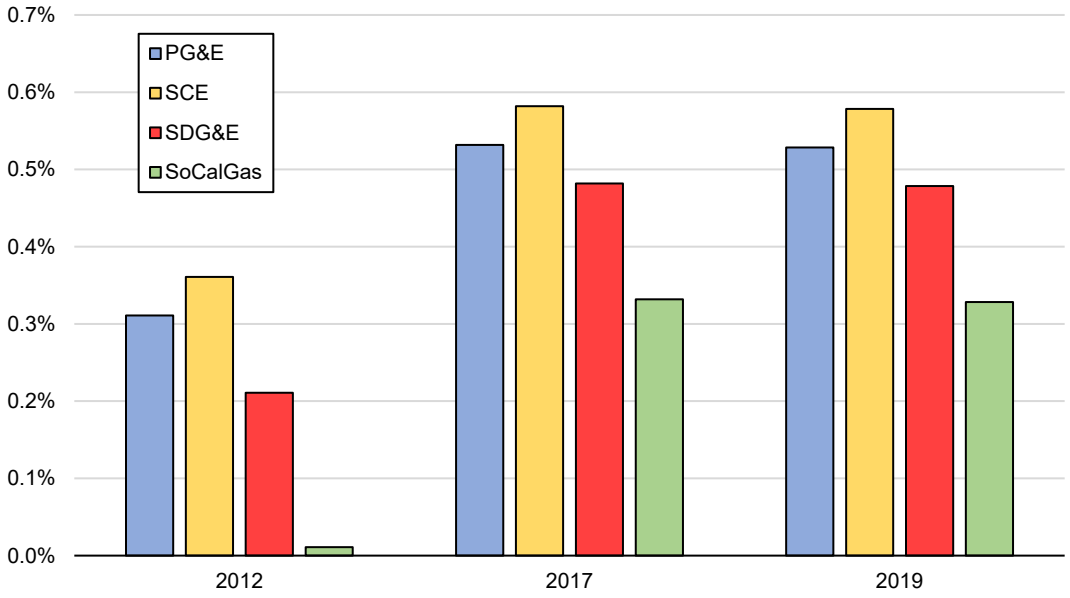
An analogy can be drawn between estimating the cost of equity and developing a calorie intake recommendation. Looking at *actual* authorized ROEs to estimate the *required* ROE is akin to developing a calorie intake recommendation based on how much people *actually* eat, not what they need to maintain a healthy weight.

4. The "Premium California ROE" reveals that these nationwide trends have been even more pronounced in California.

Q. Do these national trends apply to California?

A. Yes. Authorized ROEs for PG&E, Southern California Edison, SDG&E, and SoCalGas (collectively, the "California Utilities") have been set substantially higher than the national average for the last decade, as seen in Figure 5, which shows the difference between the California Utilities' authorized ROEs and the corresponding ~~annual~~quarterly national average ROE in their last three cost of capital proceedings. On average, the California Utilities' authorized ROEs have been 0.4% higher than the national average.

Figure 5. California Utilities' ROE premium over the US average in last three cost of capital proceedings[19]



Southern California Edison has referred to this difference between ROEs authorized by the CPUC and the national average as the "Premium California ROE" in its investor presentations since at least July 2020, as seen in the excerpt in Figure 6.

Figure 6. Excerpt from Edison International investor presentation[20]

5. Excess ROEs create a cycle of upward spiraling growth in rate base and customer rates.

Q. Why is the gap between authorized ROE and the cost of equity so important?

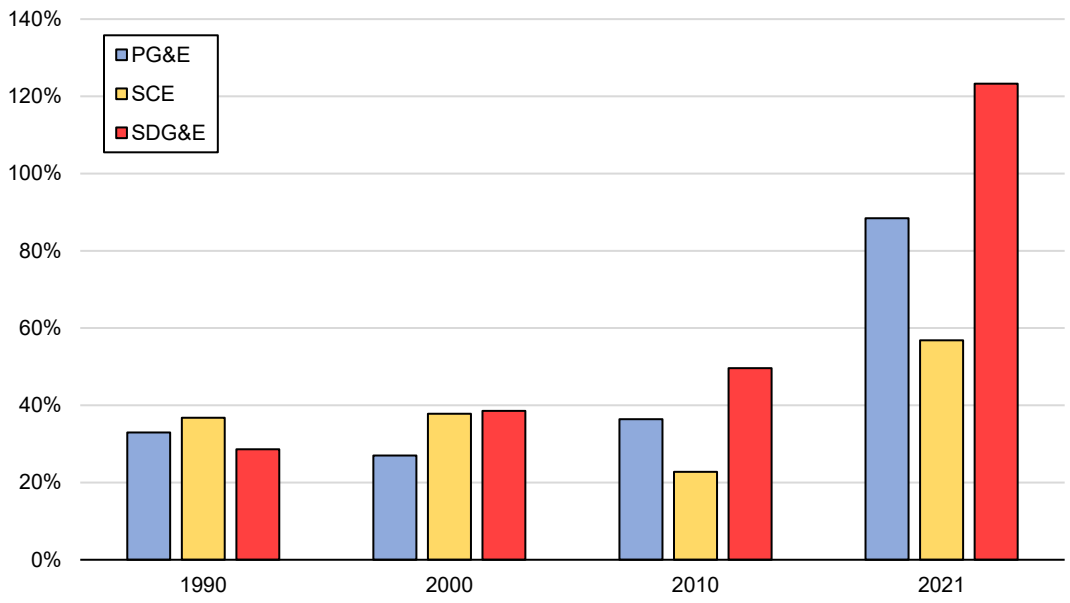
A. The gap between authorized ROE and the cost of equity has set in motion a cycle of upward spiraling growth in rate base and customer rates, particularly in California. The California Utilities' electric rates have been higher than the national average for many years, but in the

[19] M. Ellis analysis of S&P GMI data [last accessed July 30, 2022].
[20] Edison International, *Business Update* (November 2021), p. 6 (emphasis added).

last decade the difference between the California Utilities and the rest of the country has widened considerably. For example, Figure 7 shows the difference, in percentage terms, between each of the California Utilities' average residential electric rate and the national average (with the national average rate equal to 0%). While the California Utilities' residential electric rate premia ranged between 23% and 50% above the national average from 1990-2010, in the last decade, the rate premia have ballooned to 55%-123%.

Since 2010, the California Utilities' residential electricity rates have grown at 2-3 times the rate of inflation, while the average US residential electricity rate has declined by 5% in real terms.[21] In just the two years since the last cost of capital proceeding, from 2019 to 2021, PG&E's, SCE's and SDG&E's residential rates have increased by 16%, 33%, and 19%, respectively, compared to 5% for the industry overall and 6% for inflation.

Figure 7. Premium of California Utilities' residential electric rate over US average[22]
Percent



[21] From 2010 through 2021, cumulative inflation was 24%. PG&E's, SCE's, and SDG&E's residential rates increased 64%, 52%, and 78%, respectively. The US average increased 19%. M. Ellis analysis of Energy Information Administration (EIA) data, available at https://www.eia.gov/electricity/data/eia861m/ [last accessed July 30, 2022]; Bureau of Labor Statistics (BLS) data, available at https://www.bls.gov/cpi/data.htm [last accessed July 30, 2022].

[22] M. Ellis analysis of EIA data [last accessed July 30, 2022].

Q. Please explain the dynamics of how excess authorized ROEs result in upward spiraling growth in rate base and customer rates.

A. The executive management teams of the California Utilities, like the leadership of all publicly traded companies, seek to maximize shareholder value. The primary driver of the value of a utility stock its expected future earnings. Earnings, in turn, are directly linked to the authorized ROE. So the most straightforward way to sustain or increase a utility's stock price is to sustain or increase its ROE.

But the relationship between ROE and stock value is not linear, i.e., a 10% increase in ROE, from, say 10% to 11%, does not result in an increase in the stock price of 10%, but of 12% to 20%.[23] So utility executives face strong incentives to keep ROEs as high as possible.

The other key lever to boost utility stock prices is investment in new capital projects. As explained above, with M/B ratios of roughly 2.0, every dollar of equity invested creates two dollars of shareholder value.

The cycle doesn't end there. The most senior leaders at utilities often *personally* gain from high ROEs and investment because their compensation is often directly linked to earnings and the stock price, i.e., to ROE and investment. At SDG&E and SoCalGas, for example, officer compensation consists of roughly one-quarter base salary, one-quarter performance-based bonus, and one-half stock grants.[24] For Sempra corporate officers, ~~Eighty percent~~80% of the performance-based bonus, in turn, is tied to earnings, with only 20% tied to safety, environmental, social, and governance performance,~~.~~[25] while ~~F~~for SDG&E and SoCalGas officers, 27% of the bonus is tied to earnings.[26] With roughly 40% to 85~~70~~% of their personal compensation, equivalent to hundreds of thousands to millions of dollars per year, tied to ROE and rate base growth – directly through the earnings component of their annual performance-related bonuses, or indirectly through their annual stock grants ~~–based~~

[23] Based on a sustainable growth DCF model, $P = B$ x (ROE – g) / (COE – g) with COE = 6.0% and g = 2%-5%.
[24] M. Ellis analysis of San Diego Gas & Electric Company Independent Accountant's Report On Applying Agreed-Upon Procedures General Order No. 77-M For the Year Ended December 31, 2020, available at https://www.cpuc.ca.gov/-/media/cpuc-website/industries-and-topics/reports/2020-sdge-annual-go-77m-redacted.pdf and Southern California Gas Company Pursuant to CPUC General Order No. 7-M For the Year Ended December 31, 2020, available at https://www.socalgas.com/sites/default/files/SoCalGas_Annual_2020_REDACTED_GO-77-M.pdf.
[25] Sempra, 2022 Notice of Annual Shareholders Meeting and Proxy Statement (May 13, 2022), p. 38.
[26] SoCalGas Notice of Annual Shareholders Meeting; SDG&E 2021 Wildfire Safety Division (WSD) executive compensation compliance letters and WSD approval letters.

~~on earnings and the stock price~~ the senior leadership at Sempra, SDG&E, and SoCalGas face powerful incentives to sustain ROEs and capital investment as high as possible.

Figure 8 demonstrates how these dynamics have played out. Since 2000, While SDG&E's and SoCalGas's total deliveries of electricity and natural gas have declined by 30% and 22%, their rate bases have grown by factors of 5.5x and 4.0x, respectively (3.5x and 2.6x after adjusting for inflation). Net income has grown nearly in lockstep. On a per-unit-delivered basis, SDG&E's and SoCalGas's rate bases have grown by 7.9 and 5.2 times (5.1x and 3.3x after adjusting for inflation). The increase in SDG&E's capital costs – return on and of capital expenditures – is equivalent to more than the *entire* increase in its inflation-adjusted revenue since 2000 (119%); SoCalGas's capital costs account for 76% of the increase in its real revenue.

These figures are staggering and reflect a capital inefficiency that is likely unmatched by any other industry in the economy. The net result: SDG&E's average electric rates have grown 70% more than inflation and 65% more than the national average over the last two decades. Recent average rates for SoCalGas are not available, but stripping out volatile natural gas prices, its average revenue per unit delivered has increased by 3.6x (2.3x after inflation).

High ROEs create the powerful incentives – directly through their impact on earnings and indirectly through their non-linear effect on the stock price – that have contributed to the rapid escalation of SDG&E and SoCalGas's costs and rates over the past two decades.

Figure 8. Growth in SDG&E and SoCalGas operating and financial metrics[27]
2021 value expressed as a multiple of 2000 value

	SDG&E		SoCalGas	
Metric	Nominal	Real	Nominal	Real
Deliveries[28]	0.70		0.78	
Electricity	0.89			
Natural gas	0.60		0.78	
Revenue	2.06	1.31	1.93	1.23
Electricity	2.14	1.36		
Natural gas	1.72	1.09	1.93	1.23
Revenue less purchased energy	3.91	2.49	2.78	1.76
Less purchased fuel/power	4.19	2.66		
Less purchased gas	2.79	1.77	2.78	1.76
Rate base	5.54	3.52	4.02	2.56
Net income[29]	5.42	3.45	3.48	2.21
Capital cost[30]				
Excluding tax	5.07	3.22	3.29	2.09
Including tax	4.24	2.70	~~3.00~~2.68	1.70
Per unit delivered				
Revenue	2.96	1.88	2.48	1.58
Electric	2.40	1.52		
Gas	2.85	1.81	2.48	1.58
Revenue less purchased energy	5.62	3.57	3.57	2.27
Less purchased fuel/power	4.71	2.99		
Less purchased gas	4.61	2.93	3.57	2.27
Rate base	7.95	5.05	5.17	3.28
~~Revenue~~	~~2.96~~	~~1.88~~	~~2.48~~	~~1.58~~
Net income	7.79	4.95	4.47	2.84
Capital cost				
Excluding tax	7.28	4.63	4.23	2.69
Including tax	6.09	3.87	3.44	2.19
Average electric rate				
Residential	2.69	1.71	NA	NA
US residential	*1.67*	*1.06*	*1.58*	*1.00*
All customers	2.64	1.68	NA	NA
US average	*1.64*	*1.04*	*NA*	*NA*
Inflation (CPI)	1.57	1.00	1.57	1.00

[27] M. Ellis analysis of Sempra annual statistical reports, available at https://investor.sempra.com/annual-reports-and-proxy-statement [last accessed July 30, 2022]; EIA data [last accessed July 30, 2022]; BEA data [last accessed July 30, 2022].
[28] For SDG&E, assumed energy equivalent is 293 kWh per mcf of natural gas.
[29] For SoCalGas in 2021, Aliso Canyon costs are added back and taxes are deducted at the average rate in 2019 and 2020 (16%).
[30] Return on and of capital, both debt and equity, excluding and including income tax.

III. ROE AND CAPITAL STRUCTURE ARE INTERRELATED AND CANNOT BE DETERMINED SEPARATELY.

A. ROE and Capital Structure Are Interrelated Through ROE's Impact on Funds from Operations.

Q. Please explain the relationship between ROE and capital structure.

A. In their applications, SDG&E and SoCalGas each analyze their capital structure and ROE separately, with recommendations provided by different experts. Yet the testimony of SDG&E's and SoCalGas' capital structure experts, Ms. Maritza Mekitarian and Ms. Shirley Arazi, respectively, reveals that ROE and capital structure are inextricably linked.

Both Ms. Mekitarian and Ms. Arazi describe the importance of the ratio of funds from operations (FFO) to total debt in rating agencies' assessments of utility credit quality.[31] FFO measures the cash available to pay debt interest and principal. What they fail to clarify is that net income is a key component of FFO.[32] Net income, in turn, is the product of rate base, equity ratio, and ROE. Consequently, ROE and equity ratio are key determinants of FFO. Because credit rating is based on FFO, and FFO is based on ROE and equity ratio, the optimal capital structure – one that balances the interests of shareholders, lenders, *and customers* – cannot be determined independently of ROE.

Q. How should a utility's capital structure be determined?

A. The appropriate capital structure can be determined more rigorously by using the analytical methods employed by credit rating agencies. Because FFO, a key determinant of a utility's creditworthiness, is based on net income, and net income is based on ROE, for any given credit rating and its corresponding FFO/debt ratio, the level of debt that can be accommodated in the capital structure will vary with ROE.

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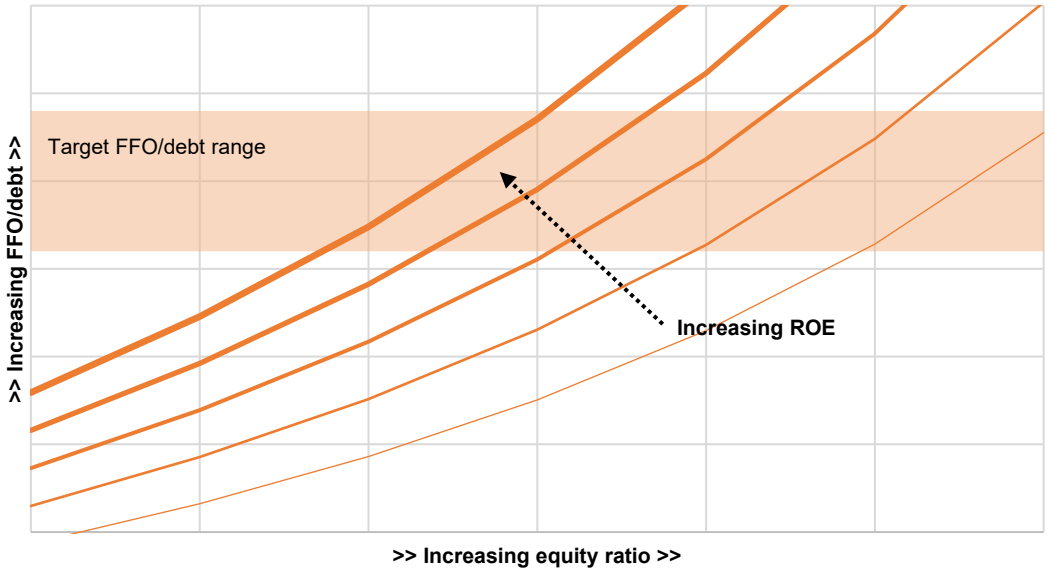
[31] A.22-04-008, et al., Exhibit No. SDG&E-02, Prepared Direct Testimony of Maritza Mekitarian – Authorized Capital Structure on Behalf of San Diego Gas & Electric Company, p. 4; Exhibit No. SCG-02, Prepared Direct Testimony of Shirley Arazi (Authorized Capital Structure and Embedded Cost of Debt and Preferred Equity), p. 9.

[32] The basic definition of FFO is net income plus depreciation and amortization. *See, e.g.,* https://corporatefinanceinstitute.com/resources/knowledge/accounting/funds-from-operations-ffo/.

Figure 9 illustrates the relationships between equity ratio, ROE, and FFO/debt. The horizontal axis is the equity ratio; the vertical axis is FFO/debt. The light orange horizontal band represents the range of FFO/debt that corresponds to the utility's desired credit rating. The dark orange arcing lines correspond to different levels of authorized ROE, with increasing line thickness representing increasing ROE. Holding the equity ratio constant, FFO/debt declines as the ROE is reduced (moving down from a thicker ROE line to a thinner line). But the decline in FFO/debt when ROE is reduced can be reversed by increasing the equity ratio (moving along the thinner ROE line up and to the right). Any number of combinations of ROE and equity ratio can meet the level of FFO/debt needed to maintain the utility's credit rating. A higher ROE requires less equity to maintain the same FFO/debt and credit rating; a lower ROE can maintain the same FFO/debt and credit rating if it is paired with a higher equity ratio.

Figure 9. Illustrative relationships between equity ratio, ROE, and FFO/debt



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. As explained above, current authorized ROEs far exceed utilities' actual cost of equity, so ample scope exists for the Commission to reduce the California Utilities' ROEs without adversely affecting their ability to raise equity. At typical utility credit ratings,

savings from a lower ROE, after grossing up for taxes, generally more than make up for the incremental cost of any additional equity required in the capital structure. For example, based on analysis of 2020 data provided in Moody's May 2021 SDG&E credit opinion,[33] every 1% reduction in ROE reduces total customer costs by 1.5%-2.0%, *even after* accounting for the 1.5%-2.0% increase in equity ratio needed to maintain SDG&E's target FFO/debt ratio.

Total customer costs can be reduced by reducing the ROE while increasing the equity ratio to maintain the utility's creditworthiness (i.e., its FFO/debt) because the trade-off is not one-for-one. Net income accounts for about 50% of the Sempra Utilities' FFO; other items, such as depreciation and amortization, account for the rest. Consequently, a relatively large reduction in net income due to a sharp cut in ROE would reduce FFO by roughly half as much in percentage terms. In addition, ROE is grossed-up for taxes, which are not included in FFO, so the savings to customers from a lower ROE is amplified. Rather than "lever up" at current ROEs to reduce rates, it is more cost-effective to reduce the Sempra Utilities' ROEs, even if more equity is required in the capital structure.

Reducing ROE and increasing the equity ratio has two additional benefits. Increasing the equity ratio improves another key credit metric, debt-to-capitalization. More importantly, reducing ROE mitigates the ROE-rate spiral cycle, helping to reduce costs over the long term, as well.

B. SDG&E's and SoCalGas's Capital structure Proposals Do Not Address the Interaction Between ROE and Capital Structure.

Q. Do SDG&E's and SoCalGas's capital structure proposals take into account the interaction between ROE and capital structure?

A. The Sempra Utilities' ROE and capital structure proposals appear to have been developed separately. Neither SDG&E nor SoCalGas provides any analysis or calculations demonstrating how FFO/debt interacts with ROE and how that interaction influences their proposed equity ratios, despite their experts' identifying FFO as the critical metric in determining creditworthiness. As a result, how much their proposed ROE and/or the equity

[33] M. Ellis analysis of data provided in SDG&E response to EPUC data request EPUC-SDG&E-DR-01, Q01-04 (Moody's Investors Service, San Diego Gas & Electric Company: Update to credit analysis following upgrade to A3 (May 10, 2021), p. 12, Exhibits 7 and 8).

ratio could be reduced to reduce customer costs while still maintaining their desired investment-grade credit ratings cannot be assessed from the testimony and data the Sempra Utilities provided. Their applications should have included a detailed analysis of the relationships between ROE, equity ratio, and creditworthiness and the impact of different combinations of equity ratio and ROE on customers, lenders, and shareholders so that the Commission could examine the ability of the Sempra Utilities to obtain sufficient capital while minimizing customer costs. The Commission should require SDG&E and SoCalGas each to provide a detailed analysis of the relationships between ROE, equity ratio, and creditworthiness so that the Commission possesses the facts it needs to come to fact-based conclusions about the Sempra Utilities' authorized capital structures.

C. SDG&E's and SoCalGas's ROEs and equity ratios can be modified to reduce customer costs without adversely affecting their ability to raise capital

Q. Can the Sempra Utilities' proposed ROEs and/or equity ratios be modified in a way that reduces customer rates while maintaining their creditworthiness?

A. Evidence from other states suggests both the ROEs and equity ratios proposed by the Sempra Utilities can be reduced while maintaining their creditworthiness. Figure 10 summarizes recent utility rate cases in which the authorized ROE was 9% or less. All of the equity ratios are below the 54% proposed by both SDG&E and SoCalGas, yet all of the companies listed in Figure 10 below nonetheless also have comparable or better credit ratings, maintaining their ability to attract capital.

Figure 10. Recent authorized ROEs at or below 9%[34]

Company	State	Service type	Date	ROE (%)	Equity ratio (%)	Credit rating S&P	Credit rating Moody's	Credit rating Fitch
Orange & Rockland	NY	E/G	3/19	9.00	48.0	A-	Baa2	A-
Otter Tail Power	SD	E	5/19	8.75	52.9	BBB+	A3	BBB
Consolidated Edison	NY	E/G	1/20	8.80	48.0	A-A	Baa1A2	A-BBB+
Central Maine Power	ME	E	2/20	8.25	50.0	AA-	A2Baa1	BBB+A-
NY State E&G	NY	E/G	11/20	8.80	48.0	A-NR	Baa1NR	BBB+NR
Rochester G&E	NY	E/G	11/20	8.80	48.0	A-NR	Baa1Baa2	BBB+BBB
Corning Natural Gas	NY	G	5/21	8.80	48.0	NRBBB+	NRBaa1	NRA-
El Paso Electric	NM	E	6/21	9.00	49.2	NRA	Baa2NR	BBBNR
Brooklyn Union Gas	NY	G	8/21	8.80	48.0	BBB+A-	Baa2Baa1	A-BBB+
KeySpan Gas East	NY	G	8/21	8.80	48.0	BBB+A-	Baa1	A-BBB+
Green Mountain Power	VT	E	8/21	8.57	50.4	ABBB+	NRA3	NR
Arizona Public Service	AZ	E	11/21	8.70	54.7	A-BBB+	A2Baa2	BBB+A-
Central Hudson G&E	NY	E/G	11/21	9.00	50.0	A-	Baa1A2	A-BBB+
Commonwealth Edison	IL	E	12/21	7.36	48.7	BBB+	A3	BBB+
Ameren Illinois	IL	E	12/21	7.36	51.0	BBB+A-	A3Baa1	NRA-
Niagara Mohawk	NY	E/G	1/22	9.00	48.0	BBB+	Baa1	NR

IV. SDG&E'S AND SOCALGAS'S EMBEDDED COSTS OF DEBT HAVE BEEN SYSTEMATICALLY OVER-ESTIMATED FOR OVER A DECADE.

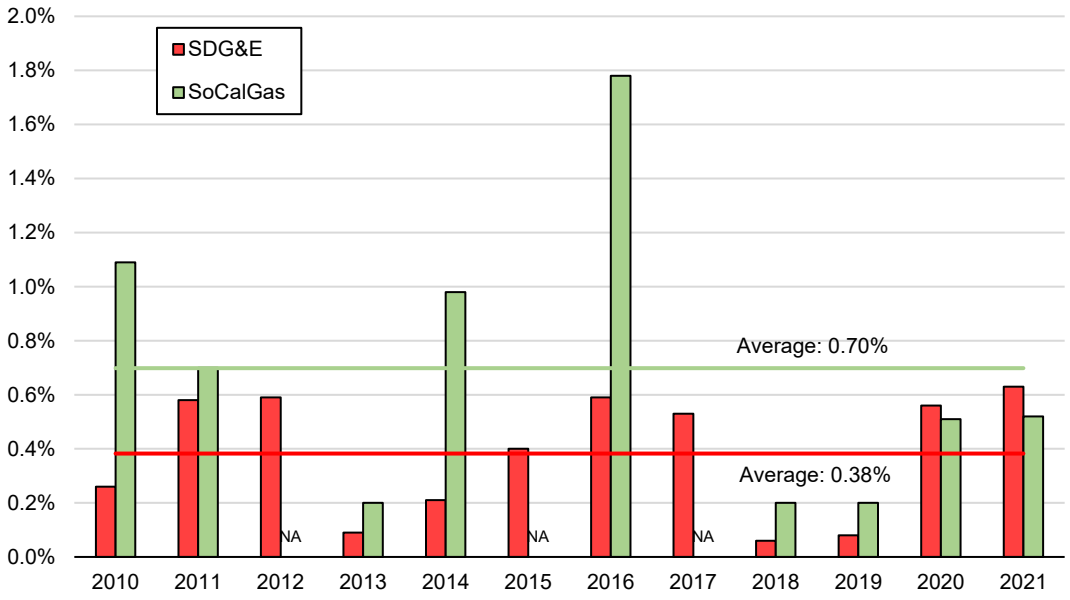
Q. The SDG&E's and SoCalGas's capital structure testimony also covers the embedded cost of debt. Have you identified any concerns about the Sempra Utilities' embedded cost of debt estimates?

A. Both SDG&E's and SoCalGas's embedded costs of debt have systematically exceeded their actual costs of debt for at least a decade, by 0.4% and 0.7% on average for SDG&E and SoCalGas, respectively, as shown in Figure 11. In the two years since the last cost of capital proceeding, 2020 through 2021, excess embedded interest has cost SDG&E and SoCalGas customers on average approximately $37 million and $25 million per year, respectively.[35]

[34] Credit ratings are issuer or senior unsecured. M. Ellis analysis of S&P GMI data [last accessed July 30, 2022]; company websites; Moody's data, available at https://www.moodys.com/ [last accessed July 30, 2022]; S&P Global Ratings data, available at https://www.spglobal.com/ratings/en/ [last accessed July 30, 2022]; Fitch Ratings data, available at https://www.fitchratings.com/.

[35] M. Ellis analysis of data provided in A.22-04-008 et seq., SDG&E response to EDF data request EDF-DR-001, Question 3 (a-b, e-f); SoCalGas responses to EDF DR-01 Question 1 and EDF DR-01, Question 3.

Figure 11. SDG&E and SoCalGas embedded cost of debt minus actual cost of debt[36]



It remains unclear why the actual cost of debt has so systematically exceeded the embedded cost. One factor contributing to the excess embedded cost of debt is the interest rate forecast used by the Sempra Utilities to estimate the cost of new debt that will be issued in the future. Both use forecasts provided by economic forecasting service Global Insight, primarily the one-year forward 30-year Treasury yield. From 2014 through 2021, Global Insight's one-year forward 30-year Treasury yield has exceeded the actual yield by 0.8%.[37] Because the Sempra Utilities' embedded cost of debt forecasts rely on a source, Global Insight, whose forecasts have systematically overestimated actual interest rates, the Sempra Utilities' embedded cost of debt forecasts have systematically overestimated their actual costs of debt.

Q. Are third-party forecasts used to estimate interest elsewhere in the Utilities' testimony?

A. Yes. Mr. Coyne uses forecast interest rates from a different economic forecast provider in his ROE analysis. I will discuss my concerns with those forecasts and recommended alternatives

[36] SDG&E response to EDF data request EDF-DR-001 Question 3 (e-f); SoCalGas response EDF DR-01, Question 3.

[37] M. Ellis analysis of data provided in SDG&E response to PCF data request PCF-SDGE-02, Question 2; FRED data [last accessed July 30, 2022].

in more detail in Section V.D.1 of my testimony where I assess the risk-free rate used in his CAPM analysis.

Q. How should the Sempra Utilities estimate future interest rates in their embedded cost of debt forecasts?

A. As I will explain in more detail in Section V.D.1 below, the current interest rate should be used to estimate future interest rates. Empirical research, supported by economic theory, demonstrates that the current interest rate provides an unbiased predictor of future interest rates, unlike the forecasts used by the Sempra Utilities and Mr. Coyne.

V. MR. COYNE EMPLOYS FLAWED MODELS AND ASSUMPTIONS THAT SYSTEMATICALLY PRODUCE UPWARDLY BIASED ROE ESTIMATES FOR SDG&E AND SOCALGAS.

A. Mr. Coyne's Methodology Relies, in Part, on Conceptually Flawed Models.

Q. How does SDG&E and SoCalGas Witness Coyne estimate SDG&E's and SoCalGas's ROEs?

A. Mr. Coyne employs four different models to estimate SDG&E's and SoCalGas's ROEs: (1) constant-growth discounted cash flow model (CG DCF); (2) capital asset pricing model (CAPM); risk premium analysis (RPA); and expected earnings analysis (EEA). In the CG DCF, CAPM, and EEA, Mr. Coyne estimates ROEs for a number of proxy group companies, separately selected for SDG&E and SoCalGas, and bases his recommended ROEs on the proxy group averages.

Q. What is your overall assessment of Mr. Coyne's approach?

A. Although two of Mr. Coyne's models, the CG DCF and CAPM, are widely used by financial professionals to estimate the cost of equity, his implementations are deeply flawed. They rely on unrealistic, systematically upwardly biased assumptions that invalidate their results. I describe these deficiencies in more detail in Sections V.B and V.D below.

The other two models, RPA and EEA, while frequently used by utility cost of capital experts, are not commonly used elsewhere in finance outside utility regulatory proceedings, and both suffer a severe, invalidating conceptual flaw.

Q. What is the invalidating conceptual flaw in the RPA and EEA?

A. Both the RPA and EEA confuse the cost of equity and the return on equity. The RPA consists of a linear regression model of historical quarterly-average authorized ROE against historical quarterly-average 30-year Treasury yield. Mr. Coyne's EEA estimates the cost of equity using ROE forecasts provided by investment research firm Value Line. The primary drivers of Value Line's ROE forecasts for the proxy group companies, in turn, are the companies' most recent authorized ROEs.

Both the RPA and EEA are essentially models of past ROE decisions, not the actual cost of equity. As explained in Section II.A above, though, the cost of equity and the return on equity are two entirely different concepts; no basis exists to assume that they will or should be equal. And, in fact, as explained in Section II.B above, authorized ROEs have diverged dramatically from utilities' actual cost of equity, as reflected in the disparity between authorized ROEs and substantially lower forecast returns for the US equity market as a whole, despite the latter's higher risk; utility market-to-book ratios exceeding 1.0 for decades; and the growing divergence between average authorized ROEs and interest rates. Basing a utility's authorized ROE on historically authorized ROEs without any reference to the *actual cost of equity*, as both the RPA and EEA do, merely perpetuates these errors.

A simple calculation illustrates the EEA's conceptual flaw in equating ROE and COE. ROE is the ratio of earnings to the book value of equity. But investors cannot buy shares at book value; they must pay market value. The market value of the stocks Mr. Coyne chose to include in his peer group tend to trade at a significant premium to book value, currently 2.0 and 1.9 times for the SDG&E and SoCalGas proxy groups, respectively. Mathematically, if investors are paying more than book value for the same stream of earnings, their expected return, i.e., the cost of equity, *must* be less than the ROE calculated using book value.[38] For

[38] A simple example illustrates why this must be true. Suppose one pays $1 for an investment that guarantees a payment of $0.10 – a return of $0.010/$1.00 = 10% – every year into perpetuity. If instead the initial cost was

companies earning just their cost of equity, the *expected* return, i.e., the cost of equity, can be estimated by dividing the earnings per share (EPS).[39] EPS can be expressed as the product of ROE and book value per share, so COE can similarly be expressed as ROE divided by the market-to-book ratio. COEs so calculated are dramatically lower than Mr. Coyne's EEA estimates.[40] For example, Value Line's 2024-26 ROE for Alliant Energy Corporation is 11.5%,[41] and as of March 31, 2022, Alliant's market-to-book ratio was 2.6,[42] so investors' expected return would be only approximately 11.5/2.6 = 5%.[43] This deviation in expected ROE from COE is the mirror image of Kahn's observation that M/B ratios in excess of 1.0 are prima facie evidence that authorized ROEs exceed the cost of equity.

B. Mr. Coyne's DCF Model Uses Upwardly Biased Dividend Yield Calculations and Unrealistically Extrapolates Analyst Earnings Growth Forecasts into Perpetuity, Producing Economically Impossible Results.

Q. What is your assessment of Mr. Coyne's DCF model?

A. Mr. Coyne uses the constant-growth version of the DCF model (CG DCF) in his analysis, with a growth rate equal to equity analysts' consensus 3-to-5-year EPS growth rate estimates. The key shortcoming in his implementation of the CG DCF is the assumption that analysts' estimated EPS growth rates can be sustained into perpetuity. This assumption dramatically upwardly biases his results.

Q. Please describe the constant-growth DCF model.

A. The constant-growth DCF is based on the well-known and widely used mathematical formula for the value of a growing perpetuity stream of cash flows. It assumes a single, constant rate

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$2 instead of $1 for the same perpetual stream of $0.10 per year, the return would be $0.10/$2.00 = 5%. If the initial investment for the *identical* cash flow stream is higher, the return is lower.

[39] Damodaran, Implied Equity Risk Premium: Principles & Mechanics, p. 5, available at: https://pages.stern.nyu.edu/~adamodar/pdfiles/eqnotes/webcasts/ERP/ImpliedERP.pdf [last accessed July 22, 2022].

[40] COE = EPS / stock price = ROE x book value per share / stock price = ROE / M/B.

[41] SDG&E-04, Exhibit JMC-7, p. 1.

[42] Yahoo! Finance, available at https://finance.yahoo.com/ [last accessed July 25, 2022].

[43] The EEA suffers other flaws, such as the growth adjustment to book value which does not account for new share issuance, but their effect is minor relative to the central conceptual confusion between return on equity and cost of equity.

of cash flow growth. In the constant-growth DCF model used by Mr. Coyne and many other modelers, 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. Coyne uses this approach.[44] 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. Coyne uses the mean.

The general DCF model, which can allow for varying growth rates over time, 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 over time 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 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.[45]

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[44] SDG&E-04, p. JMC-33; SCG-04, p. JMC-33-34. 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 relative to a more accurate quarterly model, and this adjustment is therefore not necessary.

[45] Some equity return projections vary with forecast horizon, 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, e.g.*, BlackRock's capital market assumptions, available at:

But the *constant growth* version of the DCF used by Mr. Coyne is not well-suited for estimating the cost of equity for a utility or any other stock, for two reasons. First, it is not realistic to assume that a utility will maintain its current 3-to-5-year growth rate into perpetuity. At any given time, the 3-to-5-year growth rate will deviate from its long-term trend due to any number of factors, such as weather; economic conditions; new capital projects; regulatory, tax, and other policy changes; and unforeseen events like the covid pandemic. Second, the results of the CG DCF are particularly sensitive to the perpetuity growth rate assumption. The inaccuracy introduced by assuming a relatively short-term growth rate will be sustained forever invalidates the results of Mr. Coyne's CG DCF. Mr. Coyne's use of analyst estimates, a source widely known to be upwardly biased, for his growth rate assumption further invalidates his results.

1. Mr. Coyne's dividend yield calculations use unnecessarily long trailing price histories, introducing upward bias to his estimates.

Q. How does Mr. Coyne calculate the current dividend yield?

A. To calculate the dividend yield, Mr. Coyne divides four times the most recent quarterly dividend by the trailing average share price over 30, 90, and 180 trading days.[46]

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, *all three* of Mr. Coyne's averages are 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 into the dividend yield. Averaging the most recent month of data, approximately 21 trading days, better balances the competing objectives of mitigating the potential short-term volatility cited by Mr. Coyne and reflecting current investor expectations.

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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, e.g.,* 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.

[46] SDG&E-04, p. JMC-33; SCG -04, p. JMC-33.

2. Mr. Coyne's perpetuity growth rate is based on analysts' 3-to-5-year growth rate forecasts, producing economically impossible results.

Q. How does Mr. Coyne estimate each peer utility's perpetuity growth rate?

A. While estimating the current dividend yield is fairly straightforward (although, as just explained, (the potential for) bias exists even there), estimating the perpetuity growth rate is more subjective. Mr. Coyne uses analysts' consensus 3-to-5-year estimated earnings-per-share (EPS) growth rate provided by Value Line, Thomson First Call (as reported by Yahoo! Finance),[47] and Zacks.[48]

The DCF is a model of *dividends*, not earnings, so it would be preferable to use explicit dividend-per-share (DPS) forecasts. While some analysts, such as Value Line, provide DPS forecasts, they are less common, so EPS forecast are typically used instead.

Q. Is it reasonable to assume analysts' consensus growth rates into perpetuity in a DCF model?

A. No. There are several problems with using analysts' estimates for the perpetuity growth rate. A wealth of academic research over decades has found that analyst forecasts tend to be optimistic.[49] Several other observations and analyses demonstrate the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the constant-growth DCF model.

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[47] The providers of EPS estimates have consolidated and changed their names numerous times over the last two decades. First Call was integrated with I/B/E/S in 2000 and discontinued in 2012 (https://libguides.mit.edu/c.php?g=387236&p=2626822). I/B/E/S is now provided by Refinitiv (https://www.refinitiv.com/en/financial-data/company-data/ibes-estimates). Refinitiv is the source of Yahoo! Finance's estimates (https://help.yahoo.com/kb/finance-for-web/SLN2310.html).

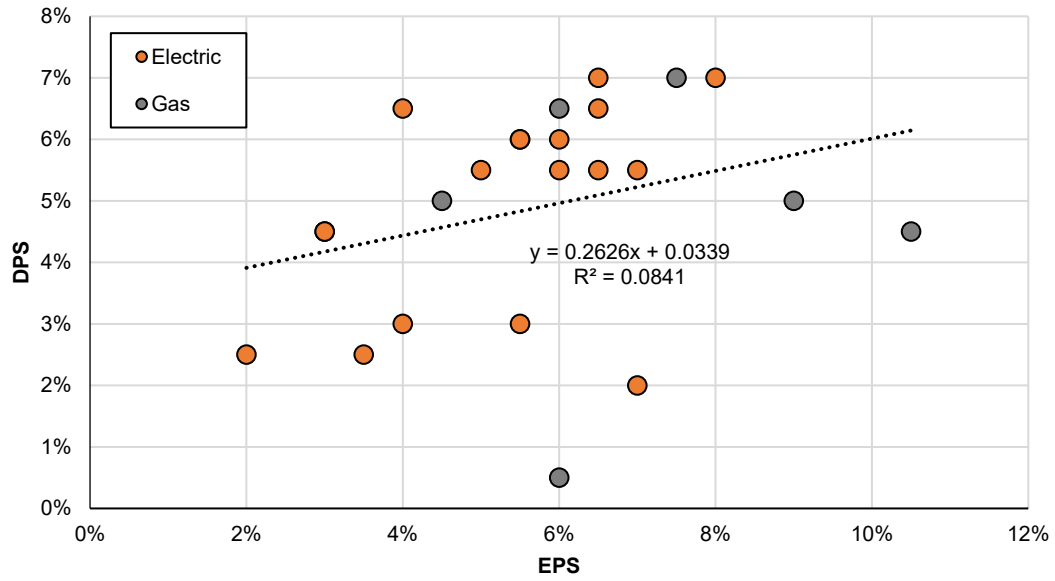
[48] The sources used by Mr. Coyne use the following forecast horizons, per their respective websites: Value Line, *see, e.g.,* SDG&E response to EPUC data request EPUC-SDG&E-DR-01, Q01 and SoCalGas response to EDF data request EDF-SCG-DR-01, Question 1-1 ('18-'20 to '24-'26 or '25-'27; '19-'21 to '25-'27); Zack's, available at https://www.zacks.com/stocks/ [last accessed July 22, 2022] (3 to 5 years); Yahoo! Finance, available at https://finance.yahoo.com/ [last accessed July 22, 2022] (next 5 years).

[49] *See, e.g.*, 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).

Q. What is your first observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. EPS growth rates are poor proxies for DPS growth over the 3-to-5-year horizon of the EPS forecast. EPS and DPS do tend to have similar growth rates over extended periods of time. But over the 3-to-5-year horizon of analyst growth rate forecasts, such as those used by Mr. Coyne, dividend and earnings growth expectations can vary widely. Figure 12 compares Value Line's dividend-per-share (DPS) and EPS growth rates for the members of Mr. Coyne's electric and gas utility proxy groups. On average, the DPS growth rate is lower, 4.8% vs 5.8% for EPS; EPS overestimates expected dividend growth, introducing upward bias into Mr. Coyne's DCF results. More importantly, as shown in Figure 12, a cross-plot of Value Line's EPS and DPS growth rate estimates, the correlation between the two sets of numbers is low (R^2 coefficient of 0.08). For both of these reasons – overestimation on average and low correlation – EPS is a poor proxy for DPS, and it is inappropriate to assume that analysts' relatively short-term EPS growth estimates reasonably reflect investors' DPS growth expectations into perpetuity.

Figure 12. Value Line DPS and EPS growth rates[50]



Q. What is your second observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. EPS growth rate horizons are likely not compatible with the CG DCF's forecast horizon. The starting time periods of analysts' estimates are not specified with precision. S&P explains of its estimates:[51]

> 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.

[50] M. Ellis analysis of data provided in SDG&E response to EPUC data request EPUC-SDG&E-DR-01, Q01 and SoCalGas response to EDF data request EDF-SCG-DR-01, Question 1-1.

[51] Via YCharts website, available at https://ycharts.com/glossary/terms/eps_est_long_term_growth [last accessed July 22, 2022] (reporting estimates provided by S&P).

The starting points for Yahoo! Finance's estimates are similarly unknown:[52]

> [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 *does* specify the starting point and forecast horizon of its estimates. Nonetheless, Value Lines growth rate forecast horizons are virtually certain not to be consistent with the dividend yield used in the CG DCF, i.e., the end of the last trading day of the share price averaging period. The starting period for the Value Line growth estimates used by Mr. Coyne, for example, is '18-'20, the midpoint of which, 2019, is more than three years before the first dividend payment in his DCF model.[53]

EPS can vary significantly from one year to the next, typically much more than the annual variation in DPS. Without knowing the forecast period, it is not possible to determine whether the estimate reflects the growth rate over the three to five years, much less the rate into perpetuity, from the starting point of the CG DCF. Following a year of poor performance, for example, expected growth would be elevated, potentially significantly above what could be sustained long-term.

The incompatibility of the growth estimates can be clearly observed in the data itself. For example, Value Line's growth rate for Edison International is reported as "not meaningful" because the company reported a loss in 2018, the first year of its growth forecast period. Yahoo! Finance's and Zacks's growth rates are both positive, presumably because the starting point of their growth rate forecasts are years in which Edison International reported a profit.[54]

[52] Via Stockopedia website, available at https://www.stockopedia.com/ratios/long-term-growth-forecast-5107/ [last accessed July 22, 2022] (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.)

[53] Mr. Coyne calculates average stock prices through February 28, 2022. The CG DCF assumes annual dividend payments, starting one year later, or February 28, 2023.

[54] SDG&E-04, Exhibit JMC-4.

Q. What is your third observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. The expected returns produced by a CG DCF model assuming DPS grows into perpetuity at analysts' 3-to-5-year EPS growth rates are inconsistent with analysts' own expected return forecasts.

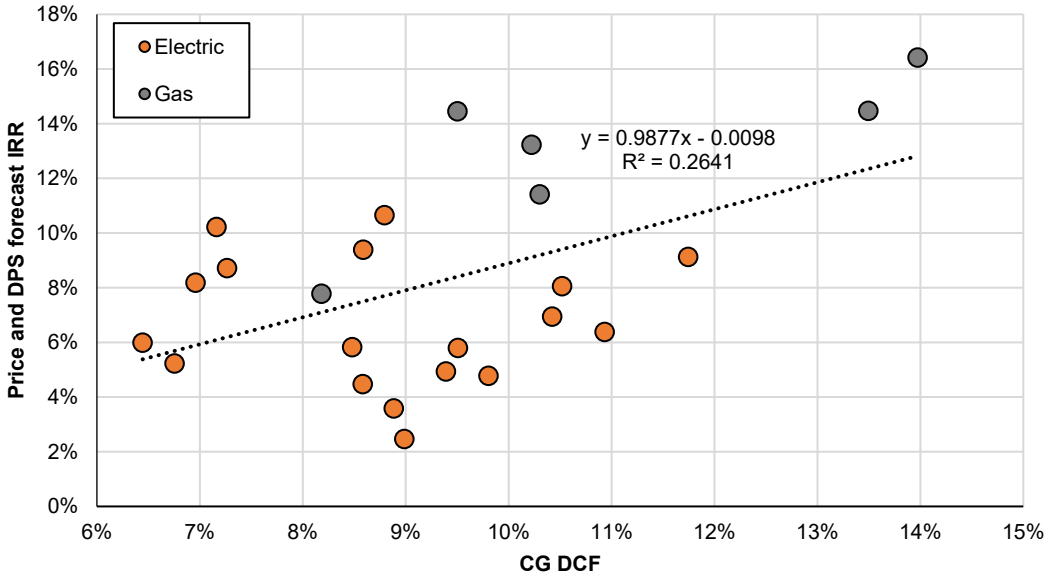
In addition to their EPS and DPS growth rates, Value Line publishes a variety of other forecasts, including for share prices.[55] These forecasts can be used to estimate Value Line's own expected return for each company, which can be compared to the CG DCF results using Value Line's dividend yield and EPS growth rate forecasts in Mr. Coyne's model.[56] Figure 13 compares the results of the two models. The horizontal axis is the COE estimated using Mr. Coyne CG DCF and Value Line's yield and EPS growth rate assumptions; the vertical axis is COE implied by Value Line's own dividend and price forecasts.

On average, the CG DCF COE estimates (9.4%) are significantly higher than the COE implied by Value Line's price and dividend forecast (8.6%). More importantly, the correlation between the two sets of model results is low ($R^2 = 0.26$) and is driven solely by the gas proxy group results; the results of the two models for the electric proxy group have zero correlation. A CG DCF COE based on Value Line's dividend yield and EPS growth bears almost no resemblance to the COE implied in its own dividend and price forecast. The analysts that provide 3-to-5-year EPS growth forecasts clearly do not assume those rates apply to dividends or will be sustained into perpetuity, as Mr. Coyne does. For Mr. Coyne's proxy groups, Value Line assumes DPS will grow more slowly, on average, than EPS beyond its forecast horizon.

[55] 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. *See, e.g.,* SDG&E responses to EPUC data request EPUC-SDG&E-DR-01, Q01 and EDF data request EDF-SCG-DR-01, Question 1-1.

[56] A simple DCF model can be constructed from Value Line's most recent annual average price (investment), dividend forecast (with missing years interpolated assuming a constant growth rate), and '24-'26 or '25-'27 price forecast (exit value). The COE is the internal rate of return (IRR) of this cash flow stream.

Figure 13. COE based on Value Line CG DCF and price and DPS forecast IRR[57]



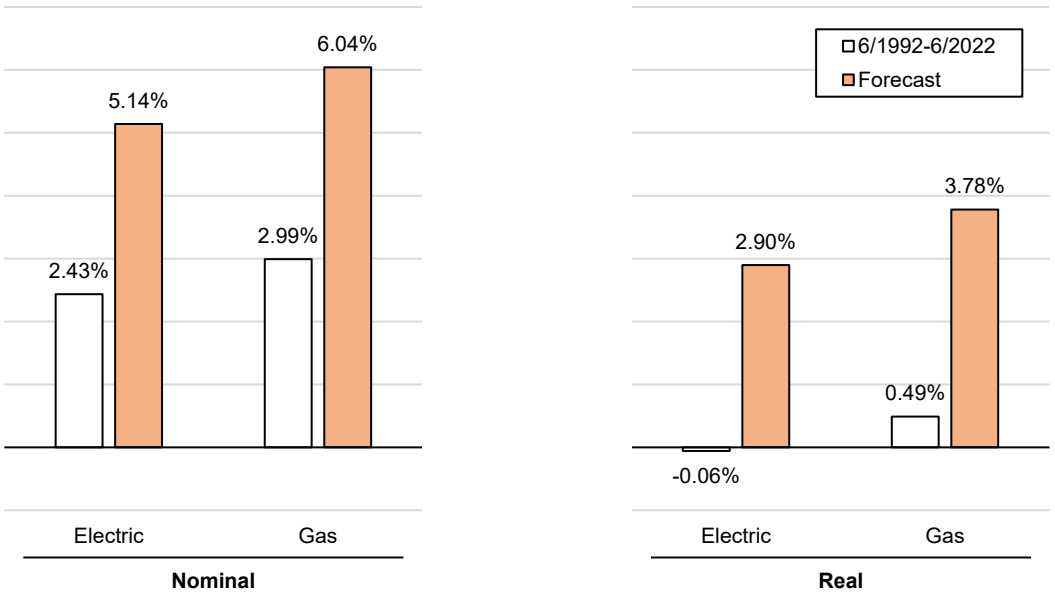
Q. What is your fourth observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. Analyst earnings (and, by assumption, dividend) growth forecasts tend to be higher than the companies' long-term historical results, further evidence that analysts' 3-to-5-year growth forecasts are not sustainable into perpetuity and are therefore unreasonable assumptions in a CG DCF model. Figure 14 compares the electric and gas utility proxy group average growth forecasts to their historical 30-year (1992-2022) DPS compound annual growth rates (CAGR). On average, forecast rates are approximately 2.5%-3.5% higher, in both nominal and real (inflation-adjusted) terms, than the historical average. The ~3% difference between historical and forecast growth highlights the unreasonableness of assuming analysts' estimates into perpetuity.[58]

[57] M. Ellis analysis of data provided in SDG&E response to EPUC data request EPUC-SDG&E-DR-01, Q01 and SoCalGas response to EDF data request EDF-SCG-DR-01, Question 1-1.

[58] Forecast growth rates are adjusted by the monthly average Treasury-TIPS spread as of February 28, 2022, to correspond with Mr. Coyne's analysis.

Figure 14. Proxy group historical and forecast DPS growth[59]
Percent



Q. What is your fifth observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. It is economically impossible for analyst earnings growth forecasts to be sustained even for one decade, much less into perpetuity. Figure 15 compares the forecast aggregate earnings of the US publicly-traded companies for which analysts provide EPS growth forecasts[60] to forecast US GDP.[61][62] Currently, these companies' combined earnings are equal to roughly

[59] M. Ellis analysis of S&P GMI data [last accessed July 27, 2022]; SDG&E-04, Exhibit JMC-4; SCG -04, Exhibit JMC-4; BLS data [last accessed July 27, 2022].

[60] M. Ellis analysis of S&P GMI data for 1,780 US stocks. Excludes companies with growth rates less than -100%.

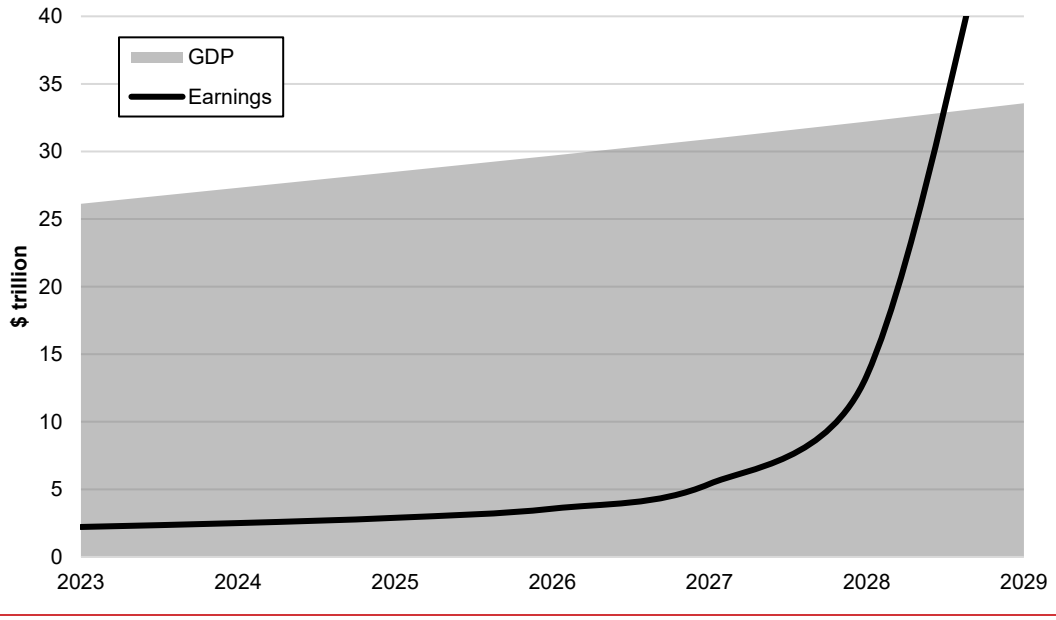
[61] Sum of the forecasts for each company. Analysts' EPS estimates and growth rates from S&P GMI as of June 30, 2022. GDP forecast is average of Congressional Budget Office, *The 2022 Long-Term Budget Outlook* (July 2022), data available at https://www.cbo.gov/system/files/2022-07/57054-2022-07-LTBO.xlsx; Energy Information Administration, *Annual Energy Outlook 2022 Macroeconomic Indicators* (March 2022), Table 20, data available at https://www.eia.gov/outlooks/aeo/excel/aeotab20.xlsx; Social Security Administration, *The 2022 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds* (June 2022), Supplemental Single-Year Tables, data available at https://www.ssa.gov/OACT/TR/2022/SingleYearTRTables_TR2022.xlsx.

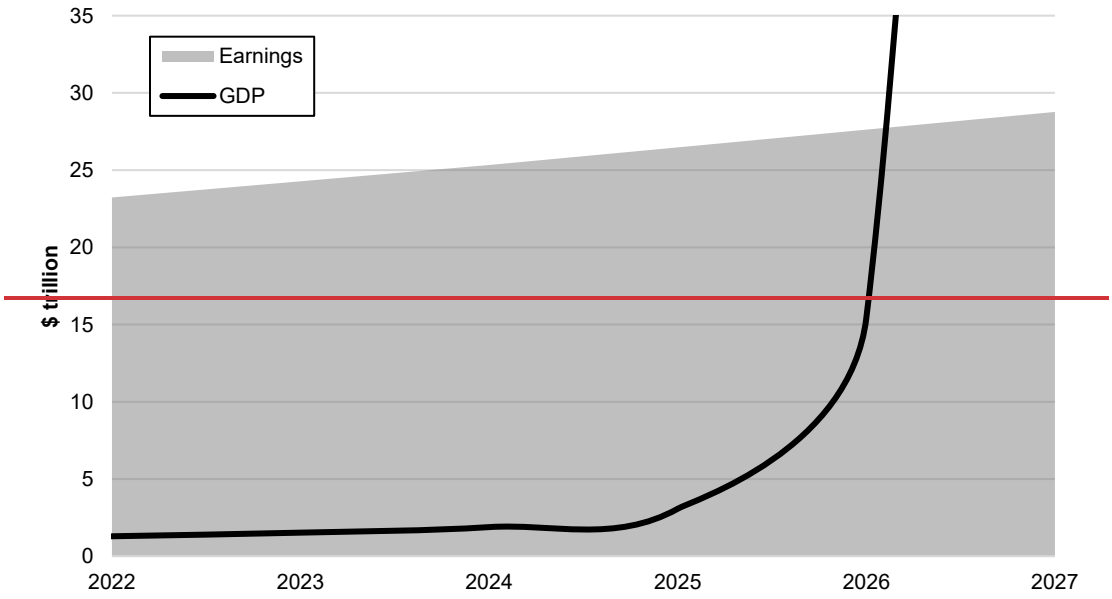
[62] ~~M. Ellis analysis of S&P GMI data for 9721,780 US stocks. Excludes companies with growth rates less than -100%.~~

86% of US GDP. Yet if analysts' growth projections were correct, they would exceed total US GDP in just six five years.[63]

[63] Sum of the forecasts for each company. Analysts' EPS estimates and growth rates from S&P GMI as of December 31, 2021June 30, 2022. GDP forecast is average of Congressional Budget Office,. *See The 2022 Long-Term Budget Outlook* (March 4,July 2022), data available at: https://www.cbo.gov/system/files/2022-07/57054-2022-07-LTBO.xlsxhttps://www.cbo.gov/publication/56977; Energy Information Administration, *Annual Energy Outlook 2022 Macroeconomic Indicators* (February 3,March 2022), Table 20, data available at https://www.eia.gov/outlooks/aeo/excel/aeotab20.xlsxhttps://www.eia.gov/outlooks/aeo/tables_ref.php; Social Security Administration, *The 2022 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds* (August 31,June 2022), Supplemental Single-Year Tables, data available at: https://www.ssa.gov/OACT/TR/2022/SingleYearTRTables_TR2022.xlsxhttps://www.ssa.gov/OACT/TR/2021/.

Figure 15. US stock market forecast earnings vs. GDP[64]





The Research Foundation of CFA Institute made a similar critique of projecting analysts' estimates beyond their forecast horizon in a 2012 report for the Dutch government:[65]

[64] 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%.

[65] Arnott, *Equity Risk Premium Myths*, published in Research Foundation of CFA Institute, Rethinking the Equity Risk Premium (2011), p. 97, cited in Harris, Villadsen, Lo Passo, Calculating the Equity Risk Premium and the Risk-free Rate, prepared for the Netherlands Competition Authority (2012), p. 30.

> Consensus long-term earnings growth estimates routinely exceed sustainable GDP growth. The current consensus growth rate for earnings on the S&P 500, according to the Zacks Investment Research survey, is 10 percent, which, if we assume a consensus inflation expectation of 2-3 percent, corresponds to 7-8 percent real growth. Real earnings growth of 8 percent is six times the real earnings growth of the past century, however, and three times the consensus long-term GDP growth rate. This growth is not possible.

Mr. Coyne himself has acknowledged the potential unreasonableness of assuming analyst growth rates into perpetuity in his CG DCF model, testifying in a recent rate case, "the Multi-Stage DCF can be used when there is concern that short-term growth rates may not be sustainable over the longer-term."[66]

Q. What is your sixth observation or analysis that demonstrates the unreasonableness of using analysts' 3-to-5-year EPS growth rate estimates for the perpetuity dividend growth rate in the CG DCF?

A. My sixth observation is the divergence in Mr. Coyne's DCF model results. Proxy group members are selected on the basis of the similarity of their risk profiles. Proxy group member companies, therefore, should be expected to have similar costs of equity. For Mr. Coyne's electric utility peer group, his CG DCF model results range from 5% to 12%, a factor of 2.4 – a clear indication that his CG DCF model is poorly specified for its intended purpose and its results should be disregarded.

Q. Given the numerous shortcomings of analysts' forecasts, should they be used at all in DCF models?

A. Discounted cash flow models can be 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 – 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-

[66] New Brunswick Energy and Utilities Board Docket No. 491, Liberty Utilities (Gas New Brunswick), Prepared Direct Testimony: James M. Coyne, (March 2021), p. 39.

stage DCF model (MS DCF). Despite the various deficiencies in analysts' estimates even in the short-term, they are 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 can weight them more appropriately.

3. Mr. Coyne's flawed DCF results should be disregarded.

Q. What is your conclusion regarding Mr. Coyne's DCF results?

A. Mr. Coyne's DCF model results should be disregarded completely. While, in principle, a constant-growth DCF model could be used to estimate the cost of equity, Mr. Coyne's implementation is deeply flawed. Its dividend yield calculations use excessively long historical price data series, introducing upward bias into the results. More critically, Mr. Coyne's DCF unrealistically assumes analysts' EPS growth estimates are valid for forecasting dividends into perpetuity. Several analyses demonstrate the invalidity of this assumption: the low correlation between analysts' EPS and DPS growth forecasts; the unknown starting period for analyst growth forecasts and therefore likely inconsistency with the DCF model's starting period; the inconsistency between the CG DCF results and analysts' own implied expected return estimates; the wide disparity between analyst forecasts and utilities' long-term historical DPS growth rates; and; the economic impossibility of sustaining EPS growth forecasts even for one decade, much less into perpetuity; and the wide disparity in model results across the members of Mr. Coyne's proxy groups that should, in principle, have similar costs of equity.

C. The Multi-Stage DCF Should Be Used Instead of the CG DCF Because It Allows More Realistic Cash Flow Projections, Yielding More Accurate Results.

1. The multi-stage DCF model enhances the CG DCF by allowing different dividend growth rates over time.

Q. What is the multi-stage DCF model?

A. The multi-stage DCF model (MS DCF) enhances the CG DCF by allowing 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 analyst estimates should not be ignored completely. Analysts' estimated 3-to-5 year growth rates 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 lies 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 $g_2 = \sqrt{(1+g_1)(1+g_3)} - 1$);[67] 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. Substantial precedent exists for the MS DCF model, in both its two- and three-stage forms, in both corporate finance and regulatory contexts.[68]

In my implementation of the MS DCF, 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 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.[69] The dividend yield is the most recent quarterly dividend divided by the average price over December 2021.

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

[68] *See, e.g.* Brealey, Myers, Allen, *Principles of Corporate Finance*, 10th ed. (2009), p. 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.

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

2. The MS DCF's initial growth rate can be estimated from analysts' EPS growth forecasts.

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

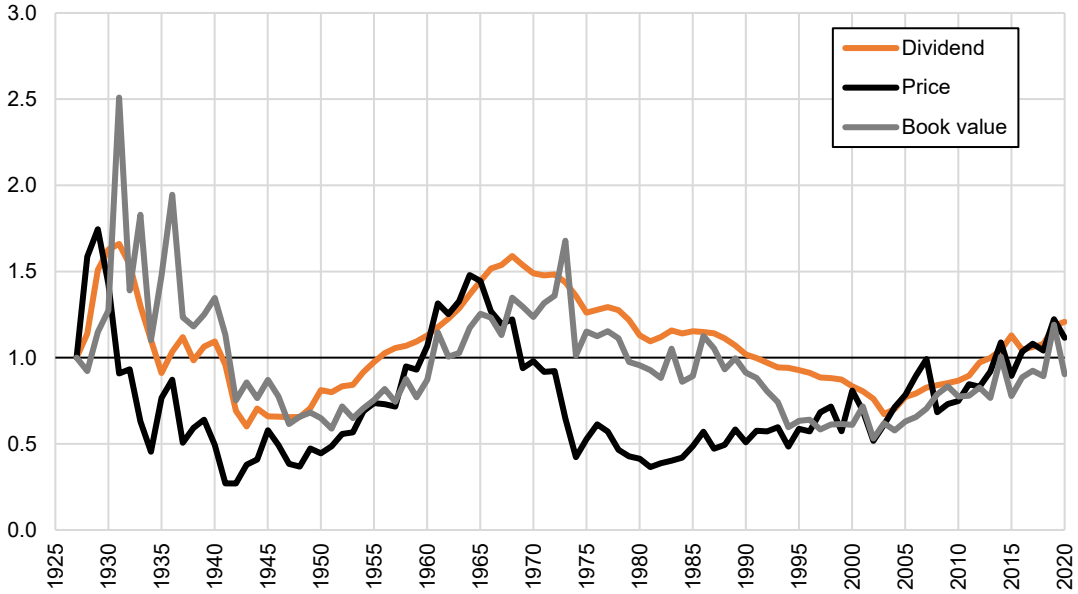
A. I use an average of analysts' EPS growth forecasts from S&P Global Market Intelligence (GMI), Yahoo! Finance, and Zacks.

3. The MS DCF's terminal growth rate can be estimated from expected inflation, based on utilities' long-term historical dividend growth.

Q. How do you estimate the terminal growth rate for the 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 the long term. Figure 16 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. Based on this long-term history, the terminal growth rate in the MS DCF for the two utility proxy groups is assumed to be equal to long-term inflation.

Figure 16. Utility sector real dividend and book value per share, 1927-2020[70]
1927=1.0



For the market as a whole, long-term real DPS growth has tracked GDP per capita, about 1.9% per year.[71] At any given time, some sectors grow faster, some slower. The technology and healthcare industries, for example, have sustained DPS growth rates higher than the market average for decades. Utilities are a mature industry, though, 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. The long-term track record of essentially zero real dividend growth further highlights the unreasonableness of Mr. Coyne's assumption that analyst growth forecasts can be sustained into perpetuity.

Q. How do you estimate expected long-term 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

[70] M. Ellis analysis of FDL data [last accessed July 30, 2022]; BLS data [last accessed July 30, 2022].
[71] *See, e.g.*, Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), p. 157-160 (Analysis is for total payout to account for the effect of net stock repurchases).

current measure of the market's forward-looking inflation expectation over the life of the bonds.

The MS DCF uses inflation for the terminal, not initial or transition, growth rate, so we \expected inflation into perpetuity is estimated 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 Julyne 2022, the long-term inflation estimate is 1.4183%.[72]

4. The MS DCF produces COE estimates substantially lower than Mr. Coyne's CG DCF.

Q. What are your MS DCF COE results?

A. Figure 17 summarizes the MS DCF results for the electric and gas utility proxy groups. The average COEs for the electric and gas proxy groups are 6.0% and 5.87%, respectively – substantially lower than Mr. Coyne's corresponding CG DCF average results of approximately 8.8% and 9.7%.

[72] M. Ellis analysis of FRED data [last accessed July 27August 18, 2022].

Figure 17. Utility Proxy Group MS DCF unlevered COE
As of Julyne 2022

Utility	Price	DPS	Yield %	Initial growth rate (%) S&P GMI	Yahoo!	Zacks	Average	COE %
Electric								
Alliant Energy	58.08	1.71	2.94	5.40	5.72	5.93	5.68	5.40
Ameren	88.34	2.36	2.67	6.46	7.20	7.25	6.97	5.34
American Electric Power	94.97	3.12	3.29	6.17	6.20	6.38	6.25	6.00
Avista	42.06	1.76	4.18	5.90	5.89	4.96	5.58	6.98
Black Hills	72.65	2.38	3.28	4.67	6.27	6.26	5.73	5.85
CMS Energy	66.21	1.84	2.78	8.48	8.11	7.85	8.15	5.79
Consolidated Edison	93.62	3.16	3.38	5.16	2.00	3.00	3.39	5.36
Duke Energy	106.72	3.94	3.69	5.87	6.01	5.55	5.81	6.41
Edison International	62.55	2.80	4.48	5.00	2.82	4.12	3.98	6.82
Entergy	110.78	4.04	3.65	6.04	6.72	6.13	6.30	6.50
Evergy	65.07	2.29	3.52	4.95	5.12	6.31	5.46	6.09
Eversource Energy	84.29	2.55	3.03	6.67	6.21	6.82	6.57	5.73
IDACORP	106.49	3.00	2.82	2.80	2.82	4.76	3.46	4.73
NorthWestern	56.49	2.52	4.46	4.50	2.27	2.92	3.23	6.57
OGE Energy	39.05	1.64	4.20	1.90	3.47	1.50	2.29	5.99
Pinnacle West	71.32	3.40	4.77	0.10	NA	5.90	3.00	6.84
Portland General Electric	49.58	1.81	3.65	3.23	4.39	4.45	4.02	5.85
Southern Company	72.32	2.72	3.76	6.12	4.00	5.74	5.29	6.35
WEC Energy Group	99.95	2.91	2.91	6.01	6.08	6.51	6.20	5.49
Xcel Energy	69.86	1.95	2.79	7.07	6.43	6.24	6.58	5.42
Mean			**3.51**				**5.20**	**5.98**
Gas								
Atmos	113.64	2.72	2.39	8.61	7.36	7.37	7.78	5.13
New Jersey Resources	44.10	1.45	3.29	6.00	6.00	6.85	6.28	6.01
NiSource	28.89	0.94	3.25	7.18	7.11	6.73	7.01	6.17
Northwest Natural Gas	52.94	1.93	3.65	4.60	4.30	4.70	4.53	5.99
ONE Gas	81.35	2.48	3.05	5.00	5.00	6.00	5.33	5.45
Spire	71.62	2.74	3.83	4.30	5.00	4.65	4.65	6.24
Mean			**3.24**				**5.93**	**5.83**

Utility	Price	DPS	Yield %	Initial growth rate (%) S&P GMI	Yahoo!	Zacks	Average	COE %
Electric								
Alliant Energy	58.53	1.71	2.92	5.40	5.72	5.93	5.68	5.70
Ameren	88.25	2.36	2.67	6.46	7.20	7.25	6.97	5.68
American Electric Power	95.58	3.12	3.26	6.17	6.20	6.38	6.25	5.85
Avista	41.95	1.76	4.20	5.90	5.89	4.96	5.58	6.87
Black Hills	72.42	2.38	3.29	4.67	6.27	6.26	5.73	5.80
CMS Energy	66.45	1.84	2.77	8.48	8.11	7.85	8.15	5.51
Consolidated Edison	93.33	3.16	3.39	5.16	2.00	3.00	3.39	5.56
Duke Energy	105.59	3.94	3.73	5.87	6.01	5.55	5.81	6.35
Edison International	64.37	2.80	4.35	5.00	2.82	4.12	3.98	6.74
Entergy	112.41	4.04	3.59	6.04	6.72	6.13	6.30	6.27
Evergy	65.22	2.29	3.51	4.95	5.12	6.31	5.46	6.03
Eversource Energy	85.31	2.55	2.99	6.67	6.21	6.82	6.57	5.56
IDACORP	103.84	3.00	2.89	2.80	2.82	4.76	3.46	5.01
NorthWestern	58.34	2.52	4.32	4.50	2.27	2.92	3.23	6.56
OGE Energy	38.24	1.64	4.29	1.90	3.47	1.50	2.29	6.36
Pinnacle West	72.35	3.40	4.70	0.10	NA	5.90	3.00	6.94
Portland General Electric	48.08	1.81	3.76	3.23	4.39	4.45	4.02	6.08
Southern Company	70.86	2.72	3.84	6.12	4.00	5.74	5.29	6.39
WEC Energy Group	98.22	2.91	2.96	6.01	6.08	6.51	6.20	5.48
Xcel Energy	69.85	1.95	2.79	7.07	6.43	6.24	6.58	5.32
Mean			**3.51**				**5.20**	**6.00**
Gas								
Atmos	110.57	2.72	2.46	8.61	7.36	7.37	7.78	5.05
New Jersey Resources	44.44	1.45	3.26	6.00	6.00	6.85	6.28	5.86
NiSource	29.28	0.94	3.21	7.18	7.11	6.73	7.01	5.90
Northwest Natural Gas	53.10	1.93	3.63	4.60	4.30	4.70	4.53	6.02
ONE Gas	82.09	2.48	3.02	5.00	5.00	6.00	5.33	5.42
Spire	74.74	2.74	3.67	4.30	5.00	4.65	4.65	6.07
Mean			**3.21**				**5.93**	**5.72**

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.

D. Mr. Coyne Makes Unrealistic, Upwardly Biased Assumptions for All Three Inputs into His CAPM.

Q. What is the capital asset pricing model?

A. Mr. Coyne's 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. The

market risk premium (MRP), the difference between the market return and the risk-free rate, $r_m - r_f$, reflects the additional return investors require as compensation for taking on equity market risk. The CAPM is a simple model of the fundamental financial risk-reward trade-off: investors demand higher returns as risk increases.

1. The source of Mr. Coyne's risk-free rate assumption has a long and widely known track record of upwardly biased interest rate forecasts.

Q. What risk-free rate does Mr. Coyne use in his CAPM?

A. Mr. Coyne uses the 30-year Treasury (T30). Because the models estimate the expected return on equity, which is a claim on cash flows into perpetuity, the longest-term rate available should be used. The 30-year Treasury is the longest-term risk-free rate, so the T30 is an appropriate term. Mr. Coyne calculates his CAPM COE estimates using both recent historical average and forecast Treasury rates.

Q. Do you have any concerns with Mr. Coyne's risk-free rate estimates?

A. Yes, I have two concerns. First, as with the average price calculation for the dividend yield in his DCF model, Mr. Coyne's historical T30 averaging period, 30 days, is too long. Curiously, Mr. Coyne provides no explanation for the use of different averaging periods in the two different models. One month of trading data, typically 20-22 days, is sufficient. Nonetheless, the difference in trailing averaging periods for interest rates generally does not introduce any bias in the results because, unlike stock prices, which tend to exhibit an upward trend over time, daily movements interest rates are random.

Q. What is your second concern with Mr. Coyne's risk-free rate estimates?

A. My second concern involves his use of a forecast rate. Using a forecast rate creates inconsistencies 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

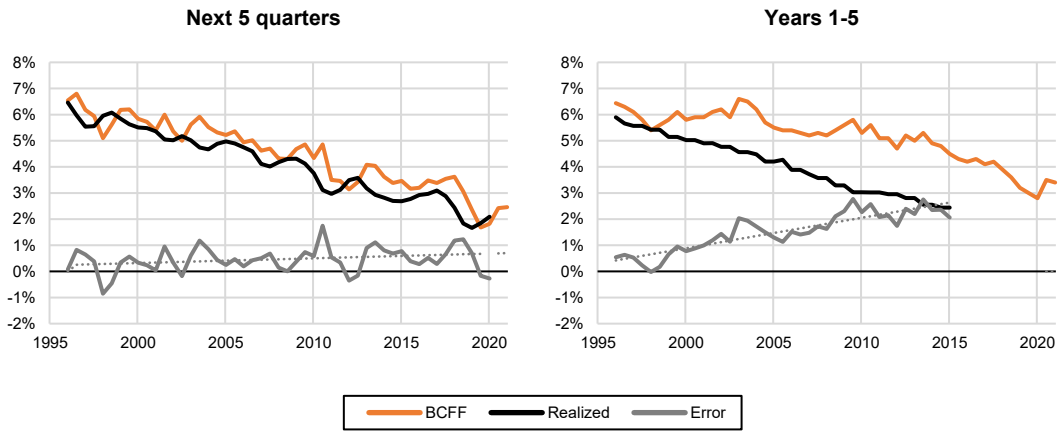
to occur one time step from today; therefore the rate determined by the DCF model is as of today. Using an interest rate expected at some future date in the CAPM produces a COE as of that future date, not today, and that COE is not directly comparable to the DCF's COE.

Ignoring the consistency concern, even if we did want to use a forecast rate, in general, commonly available interest rate forecasts are no better predictors of future interest rates than the current market rate. Most importantly, though, I am particularly concerned about Mr. Coyne's chosen source for his interest rate forecast, Blue Chip Financial Forecasts (BCFF). BCFF's 30-year Treasury forecast has an exceptionally poor track record.

Q. How accurate have the Blue Chip Financial Forecasts 30-year Treasury forecasts been in the past/historically?

A. BCFF has a multi-decade track record of producing systematically upwardly-biased forecasts, and the errors have only increased over time. Figure 18 compares the BCFF forecasts used by Mr. Coyne – the average of the next five quarters and years one to five – to their corresponding future average realized rates, going back to BCFF's first long-range forecast in December 1996. The chart shows that BCFF's 30-year Treasury forecasts have consistently overestimated future rates, and the forecast errors have tended to increase over time.

Figure 18. BCFF 30-year Treasury forecast vs. average realized rate[73]



[73] M. Ellis analysis of BCFF and FRED data. From June 2002 through June 2005, BCFF forecast the long-term average of the 20-year Treasury instead of the 30-year. Those forecasts are used in this analysis and compared to subsequent actual 20-year Treasury rates.

Q. How does Mr. Coyne justify his use of forecasts with such a poor track record?

A. Mr. Coyne cites a Massachusetts regulatory decision to argue that "Blue Chip Financial Forecasts is widely relied on by investors and provides a useful proxy for investor expectations for the risk-free rate."[74] BCFF may be relied upon by *some* investors, but no basis exists for Mr. Coyne's claim that BCFF forecasts represent a reasonable proxy for investor expectations. BCFF has no more than a hundred thousand subscribers,[75] 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.[76] Although utility cost of capital experts routinely argue that these forecasts represent the "market's view," 0.1% in no way represents the market. The market has tens of millions of participants responding to all kinds of information and the small slice of the market used by Mr. Coyne, via BCFF, does not represent an adequate or reasonably proxy.

Mr. Coyne's argument also implicitly assumes that investors rely *only* on BCFF forecasts, to the exclusion of all other ways that investors might develop their expectations; that they rely on BCFF"s forecasts as-is, with no adjustment for their historical inaccuracy; and that investors' only use of the forecasts is for investment decisions. None of Mr. Coyne's assumptions is true. The consistent errors in BCFF forecasts are well-known; the Congressional Budget Office has issued public reports on BCFF's interest rate forecasting errors for nearly twenty years.[77] Many investors undoubtedly take BCFF's forecasts "with a grain of salt" and inform their decisions with other forecasts and information. Finally, BCFF reports include dozens of other forecasts, as well as commentary and analysis. Investors might "rely" on the reports for that other content, not BCFF's interest rate forecasts, per se.

[74] SDG&E-04, p. JMC-38; SC-04, p. JMC-39-40.

[75] 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. *See* 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.

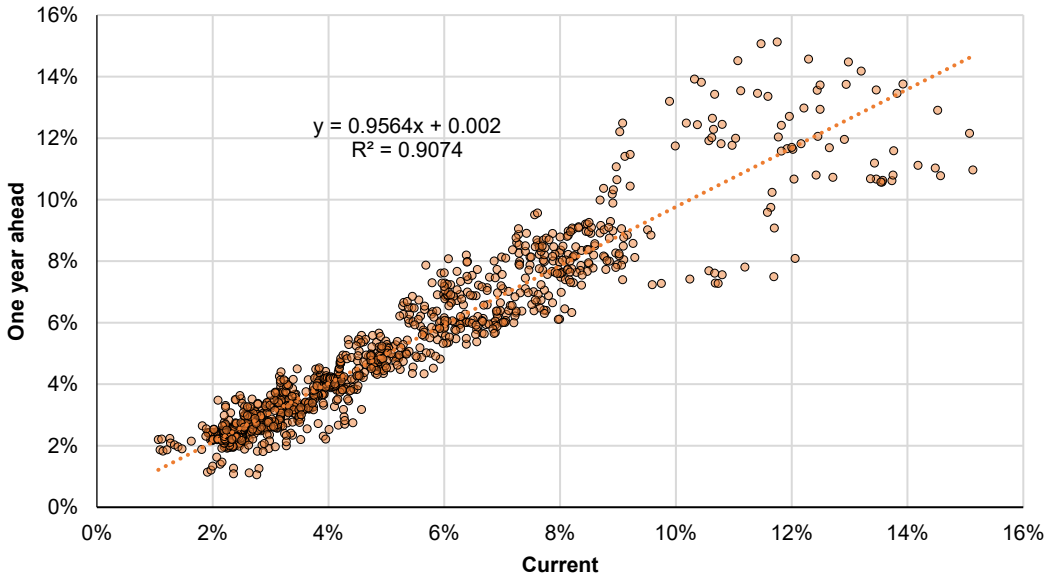
[76] More than half of US adults and households are invested in the stock market. *See, e.g.*, https://www.pewresearch.org/fact-tank/2020/03/25/more-than-half-of-u-s-households-have-some-investment-in-the-stock-market/ and https://news.gallup.com/poll/266807/percentage-americans-owns-stock.aspx.

[77] *See, e.g.,* Congressional Budget Office, *CBO's Economic Forecasting Record* (November 2002), p. 13, 18.

Q. Suppose we ignored the concern you expressed about consistency with the DCF and wanted a forecast risk-free interest rate assumption for the CAPM. What should we use?

A. It turns out that current interest rates generally provide an unbiased forecast of future rates. Figure 19 is a cross-plot of the 20-year Treasury rate one year ahead against the current rate. Current interest rates account for approximately 91% of the variation in future interest rates ; for rates two years in the future, current interest rates explain 83% of the variation in future interest rates, and for rates in three years, current interest rates explain 79%. Regardless of the forecast horizon, the current rate is unbiased – exhibiting no tendency to be systematically too high or too low.[78] Similar predictive validity is obtained for 30-year Treasurys and corporate bonds.[79]

Figure 19. Twenty-year Treasury rate, one year in the future vs. current[80]
January 1925-June 2022



[78] The bias in a forecast can be assessed from the decomposition of the mean square error into bias, inefficiency, and random variation components. For the 20-year Treasury, bias accounts for less than 0.2% of forecast error at all three forecast horizons. *See, e.g.*, Mincer and Zarnowitz, *The Evaluation of Economic Forecasts*, Economic Forecasts and Expectations: Analysis of Forecasting Behavior and Performance (NBER, 1969), p. 3-46; available at http://www.nber.org/chapters/c1214.

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

[80] M. Ellis analysis of FRED data.

More intuitively, markets are forward-looking. If investors expect interest rates to rise, their expectations will be incorporated into current yields. Consider the alternative. Suppose an investor expects the yield on the 30-year Treasury to rise from its current ~3% to 4% over the next six months. There is an inverse relationship between a bond's value and a bond's yield; when the yield rises, the value falls, and vice versa. An investor who expects bond yields to rise would not buy a bond today, because to do so would be to invest expecting a loss; better not to buy the bond at all. But market participants *do* buy at the current 3%, implying that the market overall does *not* expect rates to rise in the future. Current yields are the best predictor of future yields, especially for longer-term bonds.

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 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 [from the current interest rate] model."[81]

BCFF's consistently poor track record, the high predictive validity of current interest rates, and economic intuition are consistent with an extensive body of research on the superiority of simple prediction models to both more complex models and expert judgment.[82]

Current interest rates are the most accurate and unbiased publicly available estimates for future interest rates that I am aware of. Conveniently, using the current rate also entirely skirts the potential concern about horizon inconsistency with the DCF.

2. Mr. Coyne cherry-picks his beta calculation methodology, ignoring the wide variety of valid potential approaches and best practice for choosing among them.

Q. How does Mr. Coyne estimate the beta in his CAPM model?

A. Mr. Coyne uses beta estimates from two different financial data providers, Value Line and Bloomberg. He uses Value Line's betas as reported. Mr. Coyne overrides Bloomberg's default settings and uses only a subset of the beta estimates Bloomberg provides, such that

[81] Morin, *New Regulatory Finance* (2006), p. 172.
[82] *See, e.g.*, Kahneman, Sibony, Sunstein, *Noise: A Flaw in Human Judgment* (2021), p. 111-147.

the calculation methodology and resulting beta estimates he reports for Bloomberg are very similar to Value Line's.

Importantly, Mr. Coyne selects two nearly identical beta calculation methodologies among the multitude of methodologies commonly used by practitioners and academics, specifically the two that currently tend to produce the highest results.

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

A. Both Bloomberg and Value Line estimate beta from the slope of a linear regression model of a stock's returns against the returns of the market overall. Both calculate "raw" betas from a regression of trailing weekly, price-only returns of the stock in question against the corresponding market returns. Both also report "Blume-adjusted" betas – a weighted-average of approximately 2/3 of the raw beta and 1/3 of the market average of 1.0 – to correct for an empirically observed tendency for betas, on average, to regress toward the market mean over time that I discuss in more detail below.[83] Others details of their respective methodologies differ, which is why their beta estimates are not exactly the same even after Mr. Coyne's modifications to Bloomberg's defaults. Figure 20 summarizes the key elements of Value Line's and Bloomberg's beta estimation methodologies.

Figure 20. Value Line and Bloomberg beta estimation methodologies[84]

Parameter	Value Line	Bloomberg (default)
Return frequency	Weekly	Weekly
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	None (unadjusted) 2/3 x raw + 1/3
Rounding	Nearest 0.05	None
Updating frequency	Approximately quarterly	Daily

[83] Value Line reports only the Blume-adjusted beta. Bloomberg reports both raw and adjusted beta.

[84] Value Line, "Estimation of Beta by Value Line"; Bloomberg Professional Workstation Guide; "BETA, HRA, BETA, HRA, and CORR Calculation FAQs." Simple price-only returns: $r = \frac{P_{t+1}}{P_t} - 1$; logarithmic price-only returns: $r = \ln \frac{P_{t+1}}{P_t}$.

Q. Mr. Coyne writes, "[I]t is important to emphasize that Beta coefficients are calculated over a five-year period." Is five years of weekly returns with the Blume adjustment the only way to calculate beta?

A. No. Academic studies commonly use five years of *monthly* returns, without the Blume adjustment. Other financial data providers, including some used by Mr. Coyne elsewhere in his analysis, calculate beta using different trailing histories, return frequencies, and without the Blume adjustment. Yahoo! Finance and Zacks – data sources for some of Mr. Coyne's other cost of capital analyses[85] – use five years of monthly returns and are unadjusted, like many academic studies. S&P Global Market Intelligence (S&P GMI), another data source frequently cited by Mr. Coyne,[86] reports 1- and 3-year betas using daily returns, also without the Blume adjustment.[87]

Bloomberg's default trailing history is two years. Bloomberg allows users to override several of its calculation parameters, such as the trailing history, market index, and return frequency. Bloomberg also reports both raw and adjusted beta by default. Mr. Coyne apparently overrode Bloomberg's default trailing history parameter and simply ignored its raw beta estimates to arrive at the Bloomberg betas used in his CAPM, which are nearly identical to those provided by Value Line.

Figure 21 lists recent betas from Yahoo! Finance, Zacks, and S&P GMI for Mr. Coyne's SDG&E and SoCalGas proxy groups. For the SDG&E proxy group, the average betas are 0.45 for Yahoo! Finance and Zacks, both using 5 years of monthly returns, and 0.29 and 0.73 for S&P GMI using 1 and 3 years of daily returns. All four sources' beta estimates are lower than Mr. Coyne's 0.87-0.88 figures.[88] For the SoCalGas proxy group, the average betas are 0.45 for Yahoo! Finance and Zacks and 0.31 and 0.81 for the two S&P GMI trailing periods. As with the SDG&E proxy group, all four are lower than Mr. Coyne's 0.82-0.85 figures for the SoCalGas proxy group.[89]

[85] Mr. Coyne uses Yahoo! Finance and Zacks EPS growth rates in his DCF model. SDG&E-04, Exhibit JMC-4; SCG-04, Exhibit JMC-4.
[86] *See e.g.* SDG&E-04, Exhibit JMC-9; SCG-04, Exhibit JMC-9.
[87] Personal correspondence with S&P Global Market Intelligence (November 2021).
[88] SDG&E-04, p. JMC-18.
[89] SCG-04, p. JMC-19.

Figure 21. Yahoo! Finance, S&P GMI, and Zacks betas[90]
As of July 27, 2022

Utility	Ticker	Yahoo! Finance 5-year monthly	Zacks 5-year monthly	S&P GMI 1-year daily	S&P GMI 3-year daily
Electric utilities					
Alliant Energy	LNT	0.47	0.48	0.29	0.65
Ameren	AEE	0.37	0.36	0.31	0.71
American Electric Power	AEP	0.36	0.36	0.32	0.59
Avista	AVA	0.59	0.58	0.22	0.74
Black Hills	BKH	0.48	0.48	0.32	0.91
CMS Energy	CMS	0.28	0.28	0.23	0.61
Consolidated Edison	ED	0.23	0.24	0.23	0.54
Duke Energy	DUK	0.35	0.35	0.22	0.70
Edison International	EIX	0.68	0.66	0.43	0.80
Entergy	ETR	0.59	0.60	0.32	0.82
Evergy	EVRG	0.49	0.49	0.36	0.83
Eversource Energy	ES	0.46	0.45	0.28	0.71
IDACORP	IDA	0.56	0.56	0.28	0.72
NorthWestern	NWE	0.46	0.45	0.28	0.88
OGE Energy	OGE	0.65	0.67	0.37	0.76
Pinnacle West Capital	PNW	0.33	0.33	0.25	0.76
Portland General Electric	POR	0.52	0.50	0.24	0.79
Southern Company	SO	0.49	0.49	0.26	0.76
Wisconsin Energy	WEC	0.28	0.29	0.23	0.60
Xcel Energy	XEL	0.36	0.35	0.28	0.67
Mean		**0.45**	**0.45**	**0.29**	**0.73**
Gas utilities					
Atmos Energy	ATO	0.48	0.48	0.37	0.68
New Jersey Resources	NJR	0.55	0.54	0.38	0.95
NiSource	NI	0.38	0.38	0.36	0.76
Northwest Natural Gas	NWN	0.46	0.47	0.26	0.87
ONE Gas	OGS	0.53	0.53	0.25	0.84
Spire	SR	0.31	0.30	0.23	0.77
Mean		**0.45**	**0.45**	**0.31**	**0.81**

Q. Why do Bloomberg and other financial data providers use different beta calculation methodologies, provide multiple estimates, and allow users to override their defaults??

A. Beta is intended to be a *forward-looking* measure of relative risk, so it is inherently uncertain. It cannot be measured directly (like an interest rate) and is usually estimated from *historical* data, as the slope of the regression of the returns of a stock against the returns of the market over a recently-ended historical period. Estimates based on historical data generally

[90] Refinitiv via Yahoo! Finance, available at https://help.yahoo.com/kb/finance-for-web/SLN2310.html; S&P Global Market Intelligence; Zacks.

reasonably reflect future expectations, because most companies' risk profiles change slowly over time. Slowly changing risk profiles prove particularly true for the relatively stable and predictable utility sector.

But if a dramatic change in the market or in individual stocks occurs, as in the pandemic-related market turmoil of early 2020, that change will influence the beta estimate for as long as the period of change is included in the trailing data used in the beta calculation, even if investors' risk perceptions have returned to their level prior to the dramatic change. Analysts should always examine whether the change in market conditions was temporary or is sustained. Mr. Coyle's analysis suffers from his failure to examine whether the pandemic-related change in market conditions was temporary or has been sustained.

Q. How can we determine whether the change in investors' risk perceptions was temporary or has been sustained?

A. Determining whether the change in investors' risk perception was temporary or has been sustained is typically done by examining how betas calculated using different amounts of trailing data and returns calculated at different frequencies – for example, daily, weekly, or monthly – have changed over time.

Q. Is the need to estimate beta using different methodologies well known?

A. Yes. Utility cost of capital expert witnesses Michael Vilbert and Bente Villadsen, each of whom has testified multiple times before the Commission, have written about the trade-offs of different methodologies, highlighting the need to consider shorter calculation intervals in the wake of abrupt disruptions such as was experienced first during and then immediately after the pandemic-driven bout of market turmoil in early 2020:

> The choices for the interval for the return data and the length of the beta estimation window involve trade-offs between obtaining more observations through the choice of a longer window and/or more frequent return data, ensuring that no structural change has occurred during the estimation window, and avoiding problems due to insufficient trading activity. … Balancing these considerations, economists typically recommend estimating beta using daily, weekly, or monthly returns over the most recent 2- to 5-year period, with weekly being the more common, *except if there are reasons to think that the*

> *industry might be subject to recent changes in systematic risk so that the use of a more recent data window is desirable*.[91]

The need to examine beta using different calculation methodologies is also reflected in data providers' offerings. As explained previously, Bloomberg allows users to easily override its default beta calculation parameters. S&P GMI, in addition to reporting betas calculated using 1 and 3 years of trailing data, provides its users spreadsheet models that allow them to modify all of its beta calculation parameters.

In using both Value *and* Bloomberg betas, Mr. Coyne implicitly acknowledges that no single beta calculation methodology necessarily reflects current investor expectations. But the differences in the Value Line and (modified) Bloomberg beta methodologies he uses are immaterial. Their different market indexes – NYSE Composite for Value Line, S&P 500 for Bloomberg – are nearly perfectly correlated (0.96 correlation[92]), and their slightly different Blume adjustment weights yield differences in beta of 2% or less across the range of typical raw utility betas (0.4-1.0). My Coyne's chosen methodologies hardly reflect the wide range of ways beta could be calculated, each of which could produce dramatically different results. As Nobel laureate Fischer Black, one of the pioneers of empirical testing of beta and the CAPM, famously admonished, "Watch out for data mining!"[93] – running an analysis several different ways but reporting only the outcomes that support one's conclusions.

Q. Which methodological differences account for the most variation in beta estimates?

A. The largest potential sources of variation in beta estimates arise from their trailing return history duration, return calculation frequency, and Blume adjustment parameters.

Q. How does the duration of trailing return history affect beta estimates?

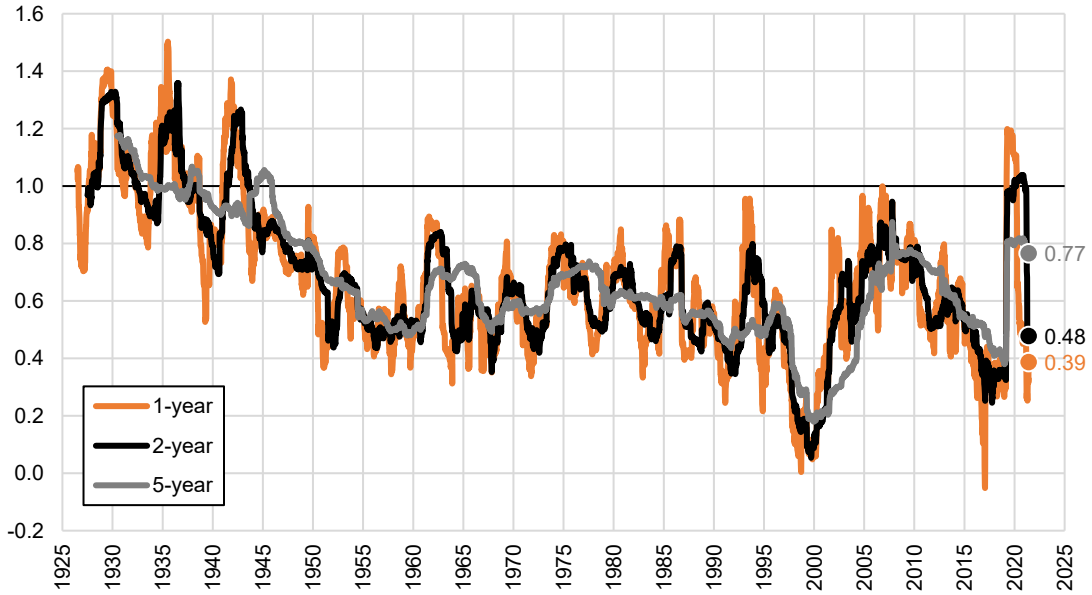
A. Following bouts of high market volatility, such as was experienced in the early days of the pandemic in February and March 2020, betas will be affected as long as the trailing history includes the volatile period, even if market conditions have stabilized. For example, S&P

[91] Villadsen, Vilbert, Harris, Kolbe, *Risk and Return for Regulated Industries* (2017), p. 73-76 (emphasis added).
[92] Correlation between five years of weekly, simple, price-only, absolute returns for the S&P 500 and NYSE Composite Indexes, through February 25, 2022. M. Ellis analysis of S&P GMI data.
[93] Black, *Beta and Return*, The Journal of Portfolio Management (Fall 1993).

GMI reports unadjusted betas calculated from both 1 and 3 years of daily returns.[94] As of July 27, 2022, the average 1-year beta for the proxy group, which does not include the volatile period, was 0.28; the average 3-year beta, which does include the volatile period, was 0.72.[95] For comparison, on the same day, Yahoo! Finance's and Zacks's group average 5-year unadjusted betas using monthly returns were 0.45.[96]

Figure 22 plots the raw beta for the entire utility sector using 1, 2, and 5 years of weekly returns from June 1926 through May 2022. At any given time, beta can be very sensitive to the trailing history used. As of the end of May 2022, the betas using the 1-, 2-, and 5-year trailing histories were 0.39, 0.48, and 0.77, respectively.

Figure 22. Utility sector raw beta – trailing return history sensitivity[97]
July 1926-May 2022



In general, betas calculated using longer return histories tend to be the more stable over time, as the effect of any short-term period of volatility is reduced by longer surrounding periods of stability. Because utility cost of capital proceedings seek a relatively long-term estimate, it might be tempting to conclude that a longer trailing history is preferred in estimating a utility's beta for purposes of authorizing an ROE. As Vilbert and Villadsen

[94] Personal correspondence with S&P Global Market Intelligence (November 2021).
[95] M. Ellis analysis of S&P GMI data [last accessed July 27, 2022].
[96] M. Ellis analysis of Yahoo! Finance data [last accessed July 27, 2022]; Zacks data [last accessed July 27, 2022].
[97] M. Ellis analysis FDL [last accessed July 20, 2022]

astutely recommend, though, "if there are reasons to think that the industry might be subject to recent changes in systematic risk … the use of a more recent data window is desirable."[98] The current 5-year beta of 0.77, driven by the market turmoil of early 2020, is higher than its historical average since 1955 of approximately 0.55. The 1- and 2-year betas, at 0.39 and 0.48, respectively, are below their long-term historical averages. After the brief period of unusual market volatility in early 2020 not seen since the World War II era, investor perceptions of utility risk quickly settled to their pre-pandemic levels. Because of their shorter trailing histories, the 1- and 2-year betas are more reflective of *current* investor sentiment.

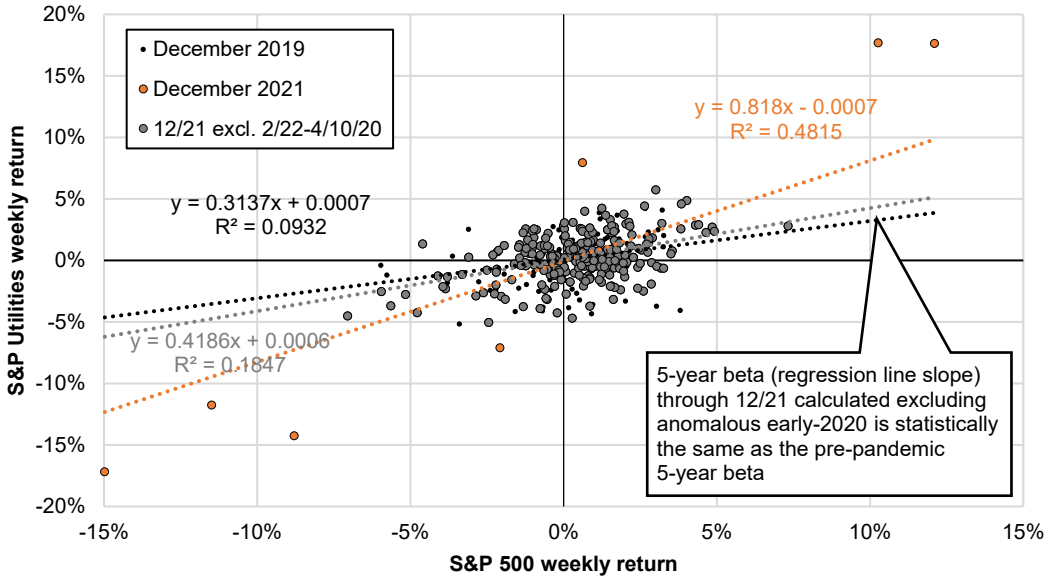
Figure 22 also betrays Mr. Coyne's claim that "the recent movement in betas captures a trend that began five years ago, but has been accelerated by the recent market conditions. The substantial increase in Beta coefficients for the proxy group companies represents a significant departure from how investors have typically viewed utilities relative to the broader market and is not just COVID-19 related."[99] Regardless of the duration of the trailing return used, utility sector betas were in a decade-plus-long decline before the pandemic. Once the early-pandemic period of market turmoil fell out of the trailing historical data, as with the 1- and 2-year betas, betas returned to their pre-pandemic levels.

Another way to confirm that 2020's market turmoil did not result in a permanent change in utilities' systematic risk is to recall that beta is simply the slope of the linear regression of a stock's returns against the market. Figure 23 depicts this graphically in a cross-plot of five years of weekly returns, like those used in Value Line's beta calculation, of the S&P Utility Index against the S&P 500 Index for three periods: through December 2019 (black), through 2021 (orange), and through 2021 excluding the seven weeks of market turmoil from February 22 through April 10, 2020 (gray). The seven weeks of turmoil are clear outliers. The slopes of the regressions – i.e., the betas – of the five years before the start of the pandemic and of the most recent five years excluding the temporary pandemic-related turmoil are not

[98] Villadsen, Vilbert, Harris, Kolbe, *Risk and Return for Regulated Industries* (2017), pp. 73-76.
[99] SDG&E-04, p. JMC-39; SCG-04, p. JMC-40.

statistically significantly different from each other.[100] The utility sector's post-pandemic beta is the same as the utility sector's pre-pandemic beta.

Figure 23. S&P Utility vs. S&P 500 weekly returns
5 trailing years



The sharp decline in the 1- and 2-year betas in Figure 22 and the similarity of the slopes in Figure 23 when the seven-week period of market turmoil is excluded make it clear that Mr. Coyne's elevated 5-year weekly betas are not valid indicators of current investor expectations but purely artifacts of the inclusion of a transitory and short-term market anomaly.

Q. How does the frequency of return calculation affect beta estimates?

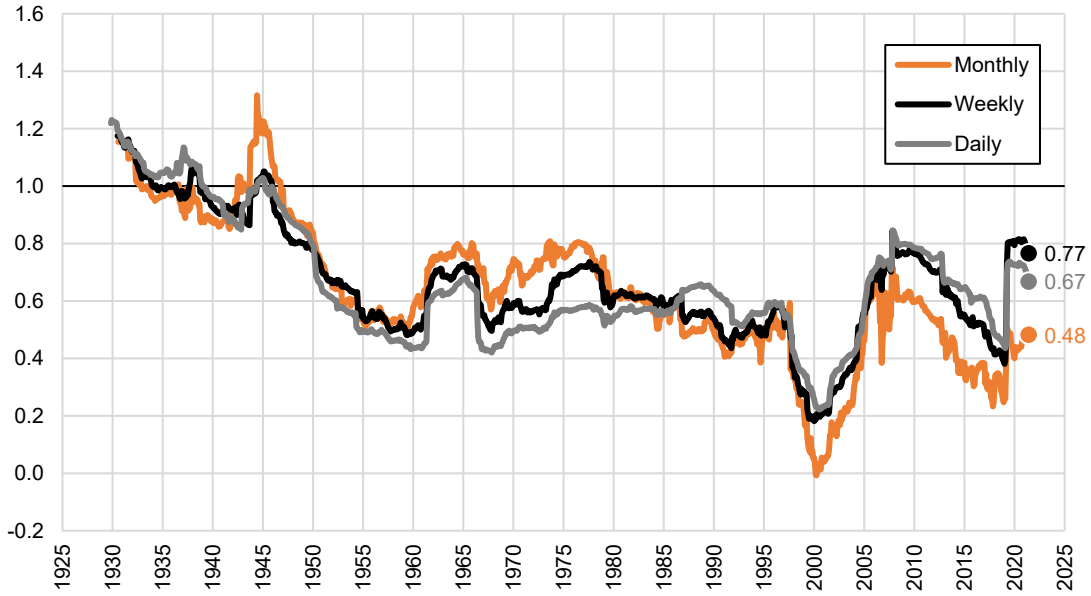
A. Figure 24 plots the raw beta for the entire utility sector using 5 years of monthly, weekly, and daily returns from June 1926 through May 2022. As with the trailing history, at any given time, beta can be very sensitive to the return calculation frequency used. As of the end of May 2022, the betas using the monthly, weekly, and daily trailing histories were 0.48, 0.77, and 0.67, respectively. In general, betas tend to be more stable at higher return calculation frequencies. For any given trailing history duration (e.g., 1, 2, or 5 years), shorter return

[100] A common test of statistical significance is the p-value. P-values greater than 0.05 are considered not statistically significant. The p-value for the difference in slopes in 0.20.

frequencies generate more data for use in the beta calculation: weekly returns generate approximately four times more data than monthly; daily approximately five times more than weekly. As the return frequency increases, any extreme data points are averaged with a larger number of "typical" data points, which tends to mitigate abrupt changes in beta over time.

This finding would tend to recommend using shorter return frequencies, due to their greater stability over time. But the choice of return frequency should reflect the time horizon of the analysis in which the CAPM-derived cost of equity will be used. Utility cost of capital proceedings seek to estimate a cost of equity that applies over a multi-year period. This consideration recommends a longer calculation frequency.

Figure 24. Utility sector 5-year raw beta – return calculation frequency sensitivity[101]
July 1926-May 2022



Q. How do other beta calculation parameters impact the variation in beta estimates?

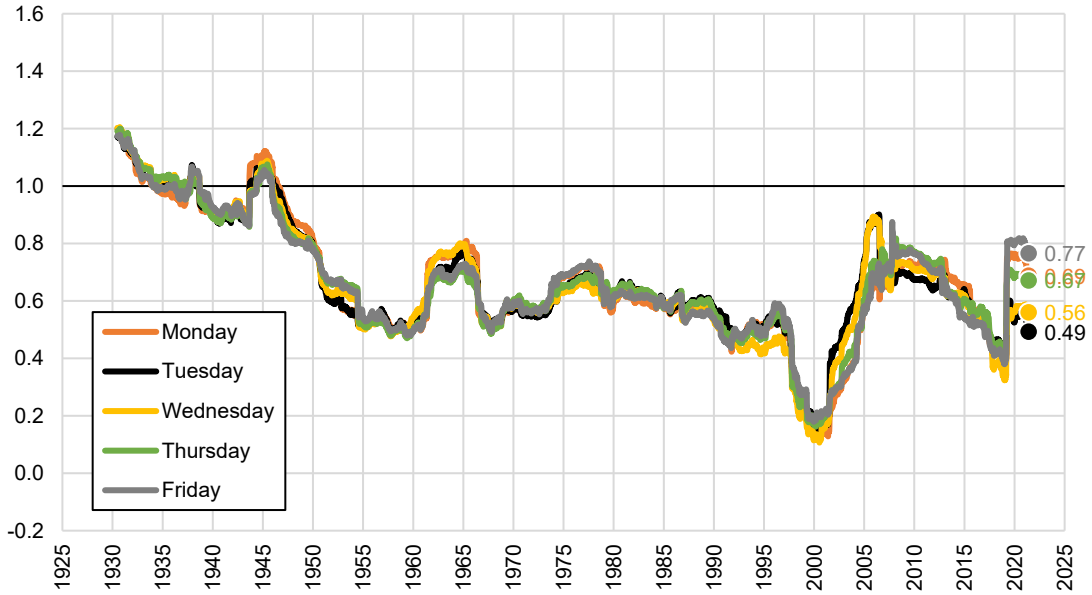
A. Even a beta calculation parameter as seemingly arbitrary as the day of the week on which weekly returns are calculated can materially affect the beta estimate. Figure 25 shows the 5-year trailing beta, i.e., raw Value Line-equivalent, with returns calculated on each weekday. Currently, Friday yields the highest beta, 0.77, but simply changing the calculation day to Tuesday reduces the beta to 0.49, 36% lower. This day-of the-week return calculation effect

[101] M. Ellis analysis of FDL data [last accessed July 30, 2022]

is only partially mitigated by averaging multiple utilities, The stock prices of individual companies within the sector tend to move together on any given day, so weekly returns calculated on the same day will tend to be similar.

This finding highlights the deficiency in Mr. Coyne's analysis in failing to examine alternative beta calculation methodologies and the potential arbitrariness of his selected methodologies. It also further highlights the need for caution in using the mechanically calculated betas provided by Value Line, Bloomberg, or other financial data providers, particularly betas calculated using weekly returns, without examining how they've changed over time or comparing them to long-term historical averages.

Figure 25. Utility sector 5-year weekly raw beta – return calculation day sensitivity[102]
July 1926-May 2022



Q. You listed the Blume adjustment as a third source of variation in beta estimates. What is the origin of the Blume adjustment?

A. The Blume adjustment is based on an analysis conducted by Wharton professor Marshall Blume in the early 1970s. Analyzing beta-sorted portfolios, he found a tendency for betas, on average, to regress toward the market average beta, 1.0, from one time period to the next.[103]

[102] M. Ellis analysis of French Data Library (FDL) data [last accessed July 30, 2022].
[103] Blume, *On the Assessment of Risk*, The Journal of Finance, 26:1 (March 1971), p. 1-10.

Based on this finding, some providers of beta estimates report adjusted betas that are a weighted average of the raw estimate and the market mean. The most common weighting is 2/3 on the raw beta, 1/3 on the market beta (1.0):[104]

$$\beta_{adjusted} = \frac{2}{3}\beta_{raw} + \frac{1}{3}.$$

For stocks with raw betas below 1.0, like most utilities historically, the effect of the adjustment is to increase the beta one-third of the way toward 1.0. For example, a stock with a raw beta of 0.4 would have an adjusted beta of 2/3 x 0.4 + 1/3 = 0.6. For its adjusted beta, Bloomberg uses the common 2/3 and 1/3 weights. Value Line's weights are similar, 0.67 and 0.35, respectively. Value Line also rounds to the nearest 0.05.[105]

As Vilbert and Villadsen note, "analysts have different views on whether to use raw or adjusted betas,"[106] hence the reporting of unadjusted betas by Bloomberg, Yahoo! Finance, and Zacks, and S&P GMI.

Q. Is the Blume adjustment valid for utilities?

A. No, it is not. The Blume adjustment is based on an observation of the tendency of betas, *on average*, to regress toward 1.0. But not every stock exhibits this tendency. Blume did not investigate whether and how this tendency might vary across stocks with different characteristics.

Rutgers professor Richard Michelfelder investigated the validity of the beta adjustment specifically for utility stocks and found no evidence of the average tendency observed by Blume.[107] This can be clearly seen in Figure 26, which shows the same 7-year monthly beta used by Blume in his original analysis for the entire utility sector going back to 1955. Since the 1950s, the beta for the utility sector as a whole has tended to regress toward 0.50-0.60, not 1.0.[108]

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[104] The 2/3 and 1/3 weights are based on the regression coefficients Blume presented in his original paper, which regressed betas in one period against betas in the previous period.

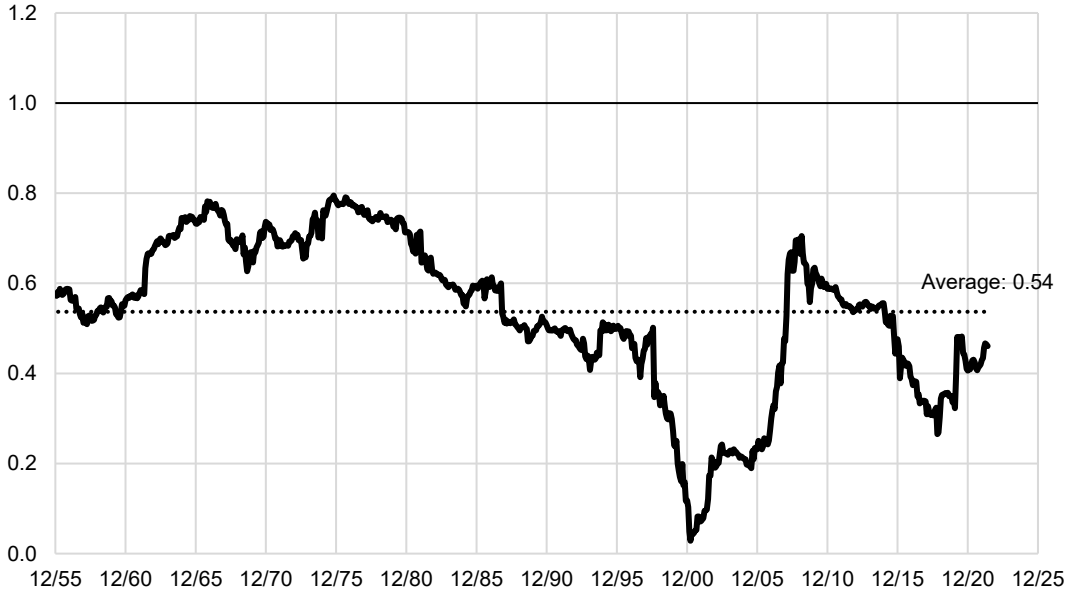
[105] Value Line, *Value Line's Estimation of Beta*, personal correspondence (October 6, 2021).

[106] Villadsen, et al, *Risk and Return for Regulated Industries*, p. 80.

[107] Michelfelder, Theodossiou, *Public Utility Beta Adjustment and Biased Costs of Capital in Public Utility Rate Proceedings*, The Electricity Journal, 29:9 (November 2013), p. 60-68.

[108] 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*

Figure 26. Utility sector 7-year monthly raw beta[109]
January 1956-May 2022



Blume speculated as to why betas, on average, tend to regress toward 1.0 over time.[110] 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 causal explanations applies to utility operating companies, like SDG&E and the publicly traded members of its proxy group. They are large and mature, and their investments tend to have consistently low risk profiles over time. These attributes combine to keep utilities' betas sustainably and significantly below 1.0.

Empirical analysis specifically investigating utility betas, grounded in sound economic reasoning, demonstrates that utility betas do not demonstrate a tendency to regress toward the market average and therefore should not be Blume-adjusted.[111]

Fama, French, *The Capital Asset Pricing Model: Theory and Evidence*, Journal of Economic Perspectives, 18: 3 (Summer 2004), p. 31.

[109] Market capitalization-weighted average of all NYSE-, AMEX-, or NASDAQ-listed utilities. M. Ellis analysis of FDL data.

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

[111] Blume used mean squared error (MSQ) to assess the accuracy of his adjustment. It can be shown that the standard 2/3 and 1/3 weights increase the MSQ for utility betas by approximately 35%.

Q. What are your conclusions about Mr. Coyne's choice of beta estimation methodology?

A. The variation in the three most recent beta estimates in Figure 22 suggests we should not unthinkingly use the most recent trailing betas from Value Line, Bloomberg, or any other data provider. It's important to keep in mind that all methodologies are intended to produce *estimates of investors' future expectations*. The elevated current 5-year betas used by Mr. Coyne are artifacts of arbitrary choices of calculation period; there is no reason to believe they reflect investors' current long-term expectations.

The seven-week bout of market volatility in early 2020 was an anomaly, and investor perceptions of utility risk quickly returned to their pre-pandemic levels. The 5-year return history used in Mr. Coyne's beta estimates does not accurately reflect current investor sentiment.

The betas used by Mr. Coyne are inflated because they are (1) Blume-adjusted and (2) incorporate an anomalous period that does not reflect investors' *current, long-term* expectations.

3. Mr. Coyne estimates his market risk premium using a constant-growth DCF model with the same flawed perpetuity growth assumption as his proxy group DCF analysis.

Q. How does Mr. Coyne estimate the third assumption in the CAPM, the market risk premium)?

A. Mr. Coyne estimates the market risk premium (MRP) using the same constant-growth discounted cash flow model he uses for the proxy group in his DCF analysis. As detailed in Section V.B.2 above, Mr. Coyne's fatally flawed implementation of the CG DCF erroneously assumes analysts' 3-to-5-year EPS growth estimates can be sustained into perpetuity, a deficiency of which he is aware. This assumption is invalid for several reasons, perhaps the most compelling of which is that it is simply economically impossible for the market to sustain analysts' forecast growth rates for even a decade, much less forever. Since 1926, US stock market dividend growth has averaged 4.9% (1.9% in real terms)[112] – roughly one-third the 13.5%-14.6% range assumed by Mr. Coyne.[113] The market has never sustained 13.5%

[112] M. Ellis analysis of FDL data [last accessed July 27, 2022].
[113] SDG&E-04, Exhibit JMC-5.1; SCG-04, Exhibit JMC 5.1

dividend growth for even seven years, much less into perpetuity – certainly raising a legitimate "concern that short term growth rates may not be sustainable over the longer-term." Mr. Coyne nonetheless ignores his own advice and uses the constant growth DCF to estimate his CAPM MRP. Consequently, Mr. Coyne's MRP results beggar belief: at 12.2%-13.4%, they are roughly 2.5 times the long-term historical average of approximately 5%.

4. Mr. Coyne's flawed CAPM results should be disregarded.

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

A. The CAPM is conceptually sound and one of the most widely used COE models in corporate finance. But Mr. Coyne's implementation choices – a forecast, not current, risk-free interest rate; a cherry-picked adjusted beta that is not reflective of current market conditions or utilities' long term risk profile; and a flawed MRP model – yields systematically upwardly-biased results. His flawed CAPM results should be disregarded.

E. Implementing the CAPM with More Rigorously Estimated Assumptions Produces Substantially Lower COE Estimates.

Q. Please explain your implementation of the CAPM.

A. There are three components to the CAPM: the risk-free rate, beta, and the market risk premium. For the risk-free rate I use the current, not forecast, 30-year Treasury rate.

As explained above in Section V.D.2, beta is the most subjective of the three CAPM parameters, and no single calculation methodology produces the most reasonable estimates in all market conditions. Based on my review of the latest research literature, I use the betas provided by Yahoo! Finance, calculated using five years of monthly returns. Five-year monthly betas are consistent with cost of capital proceedings' objective of estimating a multi-year cost of equity and their current values strike a reasonable balance between current market sentiment and the long-term historical average for utilities.

I estimate the market risk-premium from the average of the long-term historical trend and a forward-looking estimate calculated using the MS DCF.

1. The risk-free rate, one of the three CAPM inputs, should be estimated from the current, not forecast, interest rate.

Q. How do you estimate the risk-free rate?

A. Like Mr. Coyne, I use the 30-year Treasury. I use the most recent full-month average 30-year Treasury rate, for July~~ne~~ 2022, of 3.10~~25~~%. As explained above in Section V.D.1, current market interest rates provide an unbiased estimate of future rates and are generally superior to publicly available "expert" forecasts.

2. Betas calculated using five years of monthly returns are consistent with the objective of a cost of capital proceeding and strike an appropriate balance between recent market conditions and utilities' long-term historical risk profile.

Q. How do you estimate beta?

A. As explained in Section V.D.2 above, no single, widely used approach to estimating beta exists. 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 use 5-year monthly betas such as those provided by Yahoo! Finance and Zacks and commonly used in academic studies. Five-year betas using monthly returns are consistent with cost of capital proceedings' objective of estimating a multi-year expected return/cost of equity. The current average values of 0.45 for both proxy groups, shown in Figure 21, strike an appropriate balance between the long-term historical average of approximately 0.5 and current subdued investor perceptions of risk, as reflected in 1-year betas using daily returns of approximately 0.3.

3. The market risk premium estimate should reflect both current market conditions and the long-term historical trend.

Q. Why can't we just look up the MRP like, say, we can look up a stock price or interest rate?

A. The market risk premium is the difference between investors' expectations of future stock returns and the risk-free (interest) rate. While interest rates are directly observable, expected future market returns are not. The MRP must therefore be estimated. A historical average is a useful check for reasonableness, but the cliché, "past performance is no guarantee of future

results," applies. Instead, analysts use a variety of models and input assumptions to estimate the MRP.

Q. How do you estimate the market risk premium?

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

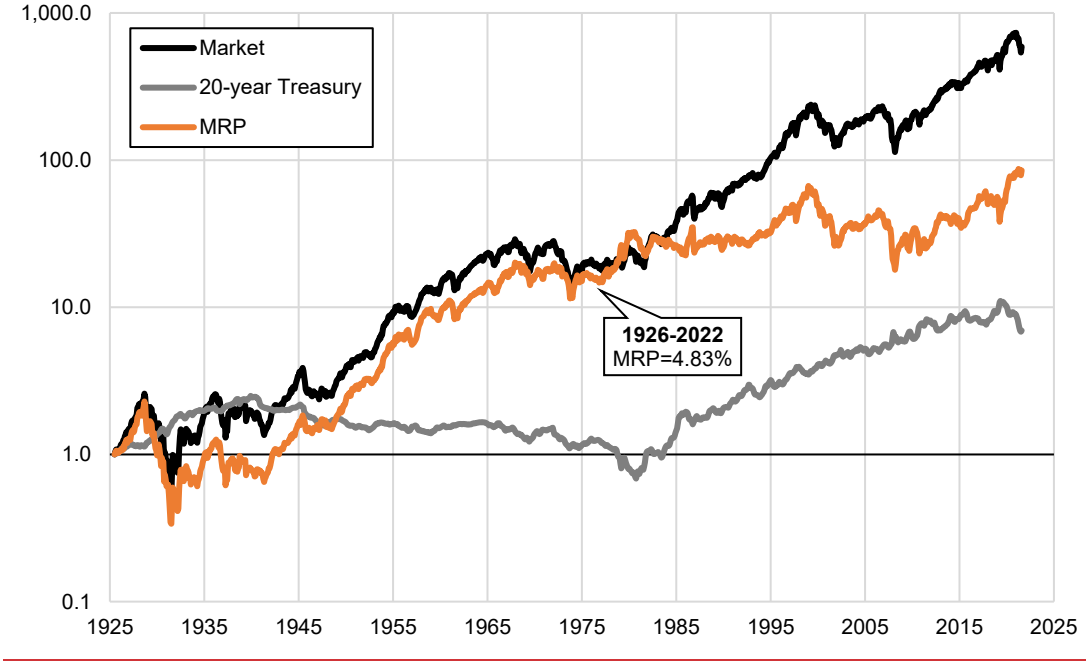
Q. How do you estimate the historical market risk premium?

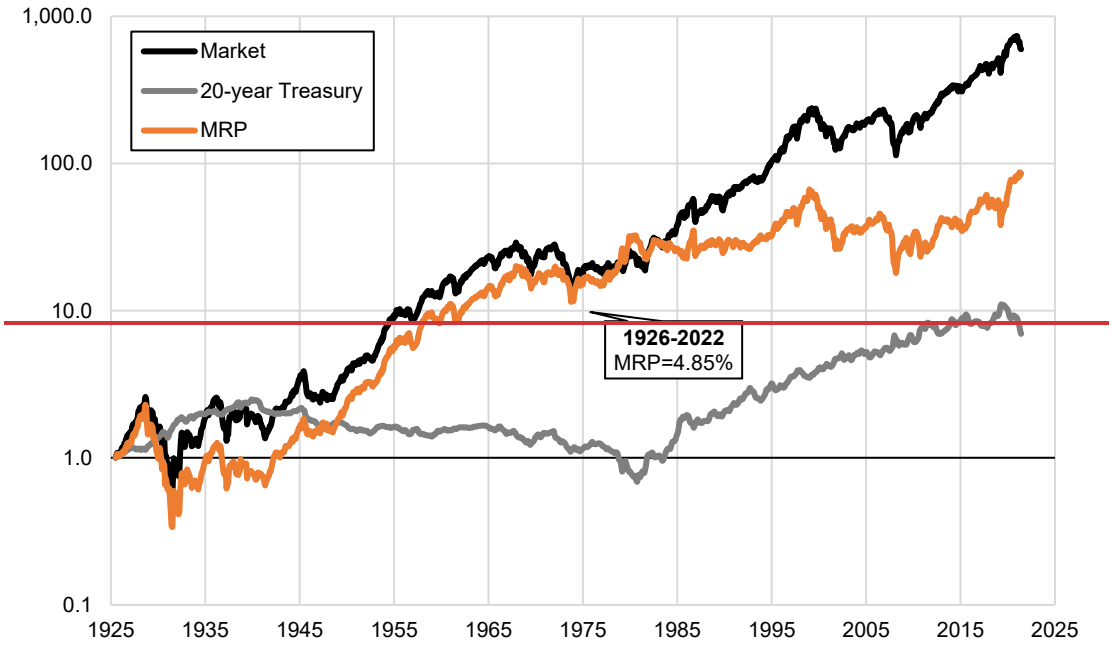
A. I use the long-term historical difference in the average real total returns on the market and long-term Treasury bond.[114]

Figure 27 shows the long-term historical real returns on the market and 20-year Treasury bonds, as well as the implied MRP, from June 1926 through July 2022~~December 2021~~. Over the last 96~~5~~+ years, stocks have outperformed 20-year Treasurys by 4.83~~5~~% per year.

[114] 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 (*see, e.g.*, http://people.stern.nyu.edu/adamodar/pc/datasets/histretSP.xls) and UCLA finance professor Ivo Welch (*see, e.g.*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1077876).

Figure 27. Market, 20-year Treasury, and MRP real total return index[115]
June 1926=1.0 (log scale)





[115] M. Ellis analysis of FDL data [last accessed ~~July 27~~August 22, 2022].

The historical MRP is calculated using 20-year Treasury data because that is the most extensive Treasury bond data set available.[116] Because I use the 30-year Treasury in my CAPM analysis, though, the premium is reduced by the current difference in the real 20- and 30-year Treasurys (TIPS), 0.1408%, for a 30-year real MRP of 4.6977%. Adjusted for the 30-year inflation rate estimated from the Treasury-TIPS spread (2.1945%), the nominal MRP is 4.879%.

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

A. I apply the same multi-stage DCF model I use for the utility proxy groups 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 proxy group members: the most recent dividend paid, through Julyne 2022, 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 1.731%.[117]

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

A. I use the weekly estimate provided in S&P's weekly S&P 500 earnings and estimate report. I use this source because it is publicly available, well-known, frequently updated, and produced by the party with the most intimate knowledge of the index. I estimate the value as of July 31, 2022, 13.6%, by linearly interpolating the values reported as of As of July 22, 2022, it as 13.7%, and August 11, 2022, 13.4%.[118]

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

A. Many analysts incorrectly assume long-term dividend growth equal to nominal GDP growth. Historically, per-share payout growth, whether measured as dividends or dividends plus net

[116] 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 estimate the 20-year yield.
[117] M. Ellis analysis of S&P GMI data [last accessed June 30August 11, 2022].
[118] S&P Dow Jones Indices, S&P 500 Earning and Estimate Report (July 22, 2022 and August 11, 2022), available at https://www.spglobal.com/spdji/en/documents/additional-material/sp-500-eps-est.xlsx [last accessed July 27August 12, 2022].

share buybacks, has tracked GDP per capita.[119] I assume a terminal growth rate based on forecast real long-term per-capita GDP plus the current market forecast for long-term inflation, estimated as described in Section V.C.3.

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),[120] the Energy Information Administration (EIA),[121] and the Social Security Administration (SSA).[122] I use the compound annual growth rate from 2042 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 provides a forecast of *consumer* price inflation. In contrast, real GDP forecasts are deflated by the GDP deflator, which reflects the prices of all domestic expenditures, including by businesses and government. For consistency with the CPI forecast derived from the Treasury-TIPS spread, which reflects only the prices paid by consumers, I use each agency's nominal GDP forecast deflated by its CPI forecast, rather than its GDP deflator forecast. Figure 28 summarizes the three agencies' real long-term per-capita GDP forecasts.

Figure 28. Real long-term per-capita GDP forecasts
Percent

		GDP				Nominal		CPI-deflated
Forecast	**Horizon**	Real	Deflator	Nominal	Population	**GDP pc**	**CPI**	**GDP pc**
CBO	2052	1.52	2.00	3.55	0.24	3.30	2.26	1.02
EIA	2050	1.99	2.28	4.32	0.33	3.98	2.40	1.55
SSA[123]	2100	NA	NA	4.09	0.42	3.65	2.40	1.22
Mean		1.76	2.14	3.99	0.33	3.64	2.35	1.26
+ Treasury-TIPS long-term inflation						~~3.12~~2.69	1.4~~183~~	

[119] *See, e.g.*, Ibbotson, Harrington, *Stocks, Bonds, Bills, and Inflation 2021 Summary Edition* (2021), p. 157-160 (Analysis is for total payout to account for the effect of net stock repurchases).
[120] Congressional Budget Office, "The 2022 Long-Term Budget Outlook" (July 2022); data available at https://www.cbo.gov/system/files/2022-07/57054-2022-07-LTBO.xlsx.
[121] Energy Information Administration, "Annual Energy Outlook 2022" (March 2022); data available at https://www.eia.gov/outlooks/aeo/excel/aeotab20.xlsx.
[122] Social Security Administration, "The 2022 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds" (June 2022); data available at https://www.ssa.gov/OACT/TR/2022/SingleYearTRTables_TR2022.xlsx.
[123] SSA does not forecast real GDP or the GDP deflator, only nominal GDP and CPI.

The average of the CBO, EIA, and SSA (the agencies) CPI-deflated long-term per-capita GDP growth rates is 1.26%. Adding the same long-term inflation expectation, 1.4183%, used to estimate the terminal growth rate in the proxy group MS DCF in Section V.C.3 above gives a nominal rate of 3.12.69%.[124] The corresponding average of the CBO, EIA, and SSA long-term per-capita nominal GDP growth rates is 3.64%. 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 Julyne 2022 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.

Q. What is your forward-looking MRP?

A. The S&P 500 MS DCF yields a forecast return of 5.826.30%. This result is consistent with the buy-side equity return forecasts summarized in Figure 2, which average 5.9% over the 10+-year horizon. Subtracting the current T30, 3.10025%, gives an MRP of 2.573.20%.

Q. And your combined MRP?

A. The average of my historical (4.879%) and forward-looking (2.573.20%) MRPs is 3.734.00%.

4. Implementing the CAPM with more rigorously estimated parameters yields COE estimates approximately one-third of Mr. Coyne's values.

Q. What are the results of your CAPM analysis?

A. Figure 29 summarizes my CAPM calculations and results. The averages of the Yahoo! Finance 5-year monthly betas for the electric and gas proxy group, listed in Figure 21, are both 0.45. The corresponding COEs are both 4.903%, approximately one-third of Mr. Coyne's estimates of 13.99-14.13% for SDG&E and 13.43%-13.62% for SoCalGas.

[124] Because these are compound growth rates, the geometric sum is used, $(1+g)(1+i)-1$.

Figure 29. CAPM results

Utility	Risk-free rate(%)	Beta	Market risk premium (%)	COE (%)[125]
SDG&E	3.1025	0.45	3.734.00	4.903
SoCalGas	3.1025	0.45	3.734.00	4.903

VI. RIGOROUS, FACT-BASED ANALYSIS OF SDG&E'S AND SOCALGAS'S COST OF EQUITY YIELDS RECOMMENDED ROES ROUGHLY ONE-HALF OF MR. COYNE'S RECOMMENDATIONS.

A. Based on Their Actual Costs of Equity, SDG&E's and SoCalGas's Recommended ROEs Are 5.50% and 5.35%, Respectively.

Q. What are your ROE recommendations for SDG&E and SoCalGas?

A. I base my ROE recommendations on each Sempra Utility's actual, fact-based cost of equity. As summarized in Figure 30, the average of the MS DCF and CAPM COEs for SDG&E and SoCalGas are 5.446% and 5.373%, respectively, which I round up to the nearest 0.5% to arrive at my recommended ROEs of 5.450% and 5.4035%.

Figure 30. Summary of SDG&E and SoCalGas COE analysis and recommended ROEs

	COE (%)		
Model	SDG&E	SoCalGas	**Key assumptions**
DCF	**6.005.98**	**5.8372**	
Dividend yield	3.51	3.241	Most recent quarterly dividend divided by one-month trailing price history (~21 trading days)
Initial growth rate	5.20	5.93	Analysts' EPS growth rates for three years to mitigate upward bias
Terminal growth rate	1.8341	1.8341	Based on long-term historical utility DPS growth rate equal to inflation
CAPM	**4.903**	**4.903**	
Risk-free rate	3.1025	3.1025	Current (one-month trailing average) 30-year Treasury
Beta	0.45	0.45	5-year monthly balances long-term historical trend and current market conditions
Market risk premium • Historical • Forward	3.734.00 4.879 2.573.20	3.734.00 4.879 2.573.20	Average of forward-looking using MS DCF and long-term historical average; MS DCF long-term growth rate equal to pre-capita GDP
Mean	**5.446**	**5.373**	
Recommended ROE	**5.450**	**5.4035**	

[125] COE = 3.1025% + β x 3.734.00%

B. Recommended ROEs of 5.50% for SDG&E and 5.35% for SoCalGas Would Reduce Customer Costs by 11% Compared to the Sempra Utilities' Proposed ROEs.

Q. How would your recommended ROEs impact customer costs?

A. Based on analysis of SDG&E's and SoCalGas's general rate case filings, their proposed ROEs, grossed up for taxes, account for 22% of each utility's revenue requirement.[126] My recommended ROEs are 48% lower than SDG&E's proposed ROE of 10.55% and 50% lower than SoCalGas's proposed 10.75%. Assuming no change in their capital structure or cost of debt, adopting my recommended ROEs instead of SDG&E's and SoCalGas's proposed ROEs would reduce average costs by 11% for both SDG&E and SoCalGas customers.

[126] A.22-05-016, Prepared Direct Testimony of Ryan Hom (Summary of Earnings) (May 2022), Exhibit SDG&E-44, p. RH-B-1 (Table RH-1) (M. Ellis analysis adjusting earnings, taxes, and revenue to reflect 5.50% ROE); A.22-05-015, Prepared Direct Testimony of Ryan Hom (Summary of Earnings) (May 2022), Exhibit SCG-39, p. RH-B-1 (Table RH-1) (M. Ellis analysis adjusting earnings, taxes, and revenue to reflect 5.35% ROE)).

MARK E. ELLIS

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SUMMARY

Mark E. Ellis is a former utility executive now working as an independent consultant and testifying expert in finance and economics in utility regulatory proceedings.

Before establishing his own consultancy, Mark led the strategy function at Sempra Energy (parent of SDG&E and SoCalGas) for fifteen years. Previously, he worked as a consultant in McKinsey's energy practice, in international project development for ExxonMobil, and in industrial demand-side management for Southern California Edison. He has an MS from MIT's Technology and Policy Program, where he focused on utility policy and conducted research in the MIT Energy Lab, and a BS in mechanical engineering from Harvard.

EXPERT TESTIMONY

Client	Utility	Description	Docket No.	Date
Southern Environmental Law Center	Georgia Power	Cost of capital	44280	8/22-ongoing
Clean Wisconsin	Wisconsin Electric Power, Wisconsin Gas	Cost of capital	5-UR-110	8/22-ongoing
Clean Wisconsin	Wisconsin Public Service	Cost of Capital	6690-UR-127	8/22-ongoing
The Protect Our Communities Foundation	Pacific Gas & Electric, San Diego Gas & Electric, Southern California Gas	Cost of capital	A.22-04-008, et seq.	4/22-ongoing
The Utility Reform Network	Pacific Gas & Electric	Wildfire liability self-insurance	TBD	11/21-ongoing
The Protect Our Communities Foundation	Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison	Cost of capital	A.21-08-013 et seq.	11/21-ongoing
New Hampshire Department of Energy	Aquarion Water Company of New Hampshire	Cost of capital	DW 20-184	6/21-ongoing
The Utility Reform Network	Pacific Gas & Electric	$7.5-billion wildfire cost securitization	A.20-04-023	6/20-2/21

EMPLOYMENT

Company	Title	Location	Date
Self-employed	Independent consultant and testifying expert	La Jolla, CA	2019-present
Sempra Energy	Chief of Corporate Strategy	San Diego, CA	2004-2019
McKinsey & Company	Engagement Manager	Houston, TX	2000-03
ExxonMobil	Venture Development Advisor	Houston, TX	1996-2000
MIT Energy Laboratory	Research Assistant	Cambridge, MA	1994-96
Southern California Edison	Staff Engineer	Irwindale, CA	1994
Sanyo Electric Company	Research Engineer	Osaka, Japan	1992-93
Los Angeles Department of Water & Power	Seasonal Waterworks Laborer	Chatsworth, CA	1988

MARK E. ELLIS

Independent consultant and testifying expert in utility finance and economics

START-UP

Organization	Title	Description	Date
Gridware	Advisor	Y Combinator graduate developing wildfire prevention technology for electric utilities	2021-present
GATEMatrices	CEO & Founder	Created iOS app to prepare elementary-school children for gifted-and-talented education program admission tests	2013-present
Apertur	CEO & Founder	Created a technology-enabled professional development platform of workshops, assessments, toolkit, and apps to help organizations improve their culture and decision-making by reducing cognitive bias	2013-2020
Climate Policy Initiative	Power Program Director	Climate change policy advisory non-profit funded by George Soros	2010-13

NON-PROFIT BOARD

Organization	Date	Organization	Date
Harvard Club of San Diego	2015-17	Chabad Hebrew Academy	2007-14
Congregation Adat Yeshurun	2005-12	San Diego Agency for Jewish Education	2005-07

EDUCATION

Institution	Degree	Date
Massachusetts Institute of Technology	MS, Technology and Policy	1996
Harvard University	BS, *magna cum laude,* Mechanical and Materials Sciences and Engineering	1992