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Commissioner:	Batjer
Admin. Law Judges:	J. Hecht, Z. Zhang
Witness:	R. McCann

PREPARED DIRECT TESTIMONY OF RICHARD McCANN, PH.D. ON AUTHORIZED COST OF CAPITAL FOR UTILITY OPERATIONS FOR 2022 ON BEHALF OF ENVIRONMENTAL DEFENSE FUND

January 31, 2022

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I. INTRODUCTION

Environmental Defense Fund (EDF) is one of the world's largest environmental advocacy organizations, with more than 2.5 million members worldwide and more than 60,000 members in California. EDF presents this testimony to ensure that key environmental and clean energy policy goals are accurately incorporated as the Commission considers updates to the overall rate of return for the energy utilities. In particular, EDF's testimony focuses on how best to achieve the goals of decarbonizing the economy by adding clean generation resources to the electric grid, promoting building decarbonization via electrification and/or fuel switching, promulgating of heavy-duty and medium-duty transport electrification, and aligning the utility business model with decarbonization, amongst others. A just and reasonable return on equity (ROE), debt to equity ratio, and overall rate of return will establish a utility business model that will better align the energy utilities with these critical policy goals. Much of the new capital investment that each energy utility will make in the coming years will be motivated by California's clean energy goals and policies; EDF wants to ensure that there is a stable financial and economic outlook for these investments, thereby lowering risk and associated costs for new infrastructure assets. The Commission's determination in these Applications results in all customers having access to a set of affordable, clean, and safe energy utility services.

The Commission must also consider different policy incentives for the electric and natural gas utilities. The California State Legislature and the Governor have enacted and adopted policy objectives to reduce greenhouse gas (GHG) emissions to mitigate the risk of a global climate crisis over the next century.[1] To achieve those goals will require that California's energy

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[1] Governor Edmund G. Brown Jr., "Executive Order to Achieve Carbon Neutrality," https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf,

uses be decarbonized to the maximum extent feasible. That means a substantial reduction in delivery of fossil-fuel derived natural gas to buildings, including residences and small businesses.[2] In its stead, most of these energy uses will be powered by electricity, which implies an expansion of the electricity system in some form, whether through extension of the centralized power grid or through increased reliance on distributed energy resources. The adoption and implementation of these GHG policy objectives means that the Commission must act to encourage investment in our electricity system by the utilities while at the same time maintaining just and reasonable rates to consumers.[3] If rates are set too high, customers will be discouraged from investing in the building and transportation decarbonization measures that will be required to meet our GHG goals.

To this end, the Commission must consider the appropriate balance between providing utility shareholders with a sufficient return on investment and ensuring that rates are just and reasonable while incentivizing consumer choices that move forward the state's goals in the environment and on equity. The utilities have already put forward significant rate increases for 2022,[4] and bundled ratepayers can anticipate a second large increase on March 1 from deferred

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September 10, 2018; Senate Bill 100 (2018); and "California Climate Change Legislation," https://www.climatechange.ca.gov/state/legislation.html, retrieved July 31, 2019.

[2] It appears the most cost effective and technologically feasible way to achieve the necessary reduction in natural gas will be through building electrification, which will lead to a reduction in the number of natural gas customers. Correspondingly, in order to prevent cost shifts to remaining natural gas customers, the Commission may need to eventually consider accelerated depreciation or partial decommissioning of the natural gas distribution system.

[3] Public Utilities Code Section 451. All section references are to the Public Utilities Code unless otherwise noted.

[4] PG&E Advice Letter 6408-E-B, December 30, 2021; SCE Advice Letter 4651-E/E-A, December 30, 2021; and SDG&E Advice Letter 3881-E, November 29, 2021.

decisions in Pacific Gas and Electric's (PG&E)[5] and Southern California Edison's (SCE)[6] Energy Resource Recovery Account cases. Further, PG&E is proposing in its 2023 General Rate Case application unprecedented distribution rate component increases through 2026, amounting to a *78% increase over 2022 levels* according to its filing.[7] Average utility rates by 2020 had already increased 57% for PG&E, 15% for SCE and 47% for San Diego Gas and Electric (SDG&E) since 2009.[8] All of these stand as impediments to the single most important task before the Commission—reducing greenhouse gas (GHG) emissions across all sectors in the state through electrification. Allowing utilities to maintain, or even increase, ROE that would otherwise decrease if the cost of capital mechanism (CCM) were allowed to proceed as designed runs directly counter to this state mandate.

The Assigned Commissioner in this case issued a short list of questions to be addressed in this particular set of proceedings:[9]

1) Are there extraordinary circumstances that warrant a departure from the CCM [cost of capital mechanism delineated in D.08-05-035] for 2022?

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[5] PG&E Advice Letter 6408-E, November 15, 2021; Commission Proposed Decision, A.21-06-001 PG&E 2022 ERRA Forecast, January 24, 2022.

[6] SCE, "Updated Testimony," A.21-06-003, SCE 2022 ERRA Forecast, November 9, 2021.

[7] PG&E, "2023 General Rate Case Application of Pacific Gas and Electric Company (U 39 M)," June 30, 2021, A.21-06-021, Tables 3-5.

[8] Public Advocates Office, "Electric Rate Trends: Rate Trends 2009-2021," Presented to Assembly Utilities and Energy Committee, Electricity Prices Matter Informational Hearing, https://autl.assembly.ca.gov/sites/autl.assembly.ca.gov/files/Public%20Advocates%20Office%20Rate%20%20Bill%20Trend%20Presentation.pdf, February 19, 2020.

[9] Assigned Commissioner Ruling, p. 7.

2) If so, should the Commission leave the cost of capital components at pre-2022 levels for the year 2022, or open a second phase to consider alternative cost of capital proposals for the year 2022?

This testimony focuses on the first question because the burden of proof to suspend the CCM is a high hurdle as described further below. The CCM should only be suspended when there is substantial consensus across all stakeholders that the utilities' financial situation requires such a suspension. The circumstances for such consensus would be in situations where the markets are acting in a manner not contemplated by the CCM's original design or have deviated in such a way that neither ratepayer nor shareholders would be well served by keeping the CCM in place. As described in this testimony, the market is not in this situation. There is no reason to deviate from the CCM practice, and the CCM should be triggered for each utility. Therefore, EDF argues that the answer to the first question should be "no" and the Commission need not consider the second question.

If, however, the Commission found that deviating from the CCM was a prudent course of action and did want to examine the second question, EDF believes that a Commission review of the evidence and Commission decisions would demonstrate that: (1) there is no basis for maintaining the ROE at 2020 levels; and (2) the authorized ROE should decrease based on the criteria that has led to the request for suspending the CCM in the first place. However, the Commission should note that if a second phase is opened up, any change in the ROE will not be instituted until late 2022, and if the financial situation is as dire as the utilities claim, then the required relief will come too late to be effective. This is true despite the creation of the memorandum accounts in an earlier decision in this proceeding. The Commission should recognize that suspending the mechanism is not intended to make future catch-up payments to shareholders—it is intended to provide immediate relief to prevent a potential financial catastrophe for the utility. The utilities must clearly demonstrate this in answering the first question. If the current evidence is likely to show that the ROEs should be decreased anyway, then any temporary relief from the suspension will be undermined by investors' expectations about future returns.

II. SETTING THE STAGE: ESTABLISHING THE QUESTION AT HAND AND THE CRITERIA TO GRANT RELIEF

In 2008, the Commission issued Decision (D.)08-05-035 that established a uniform process for updating the utilities cost of capital. It established a three-year cycle for significant updates to key parameters and annual review with a trigger in the cost of capital mechanism (CCM) for the element considered the more important relationship in the cost of capital formula—how return on equity relates to debt rates. The Commission wrote:

> ***This CCM streamlines the major energy utilities' cost of capital process while providing greater predictability of the utilities' cost of capital by eliminating the use of interest rate forecasts and disputes concerning interest rate levels and trends, as well as uncertainties associated with conflicting perceptions of financial markets and the return requirements of investors.*** *The CCM also enables the utilities, interested parties, and Commission staff to reduce and reallocate their respective workload requirements for litigating annual cost of capital proceedings…*
>
> *While streamlining the cost of capital process, the utilities have a right to file a cost of capital application outside of the CCM process* ***upon an extraordinary or catastrophic event that materially impacts their respective cost of capital and/or capital structure and affects them differently than the overall financial markets.*** *(Emphasis added.)*

The Commission laid out two important considerations in this decision. The first is that the event must be "an extraordinary or catastrophic event that materially impacts their respective cost of capital and/or capital structure…" This statement requires that the utilities clearly demonstrate that the event is so extraordinary or catastrophic that it disrupts their ability to attract sufficient capital or to remain financially viable. The evidence required for this standard should include reduction of bond ratings below investment grade, universal hold and sell recommendations by financial analysts, and balance sheet projections that show that the company faces financial collapse before the next cost of capital application filing. The Commission should remember that it has the opportunity to address any financial concerns that do not threaten the existence of each utility before the end of this year. The burden is on the utilities to make the case that they face such dire consequences ***now*** and require an emergency response.

The additional clause "***and*** affects them differently than the overall financial markets" goes further to require the utilities to demonstrate that their financial situation is substantially and materially different than the rest of the financial market. For example, the utilities must show that their share prices are substantially below the broader market over a long-term trend that reflects all of the previous deviations by utility share prices from the general market trend. If the utilities' share had been trading at a premium over an extended period, say the last decade, then a reduction in share price should be viewed as a correction, not a threat to the ability to raise capital or to stay viable.

The Commission also needs to consider how limited the option to suspend the CCM should be. The Commission was clear in D.08-05-035, which gives *only* the utilities the ability to request a suspension, even though the deadband around the trigger extends 100 basis points in both directions. No one can imagine that the utilities would request a suspension if the benchmark bond rate went *up* more than 100 basis points, triggering an increase in the authorized ROE. That intervenors are precluded from suspending the CCM at their initiative under D.08-05-035 bestows particular power on the utilities. The Commission must carefully constrain and consider any such request given this unique ability and opportunity by utilities.

III. THE ADJUSTMENT MECHANISM SHOULD BE TRIGGERED

A. Triggering the CCM is good regulation – it creates certainty and stability

In D.08-05-035, the Commission laid out the process of updating the ROE through the CCM each January:

> *In any year where the difference between the current 12-month October through September average Moody's utility bond rates and the benchmark exceeds a 100-basis point trigger, an automatic adjustment to the utilities' returns on equity (ROE) shall be made by an October 15 advice letter to become effective on January 1 of the next year…*

The Commission recognized the importance of consistency between scheduled filings of applications in D.08-05-035 when it laid out the rationale for the CCM:

> *This CCM streamlines the major energy utilities' cost of capital process while providing greater predictability of the utilities' cost of capital by eliminating the use of interest rate forecasts and disputes concerning interest rate levels and trends, as well as uncertainties associated with conflicting perceptions of financial markets and the return requirements of investors.*

Perhaps the most important passage here is avoiding the "uncertainties associated with conflicting perceptions of financial markets and the return requirements of investors." That there is universal opposition from a broad spectrum of intervenors illustrates precisely the situation that the Commission was setting out to preclude with the CCM—rounds of filings, hearings, briefings and negotiations over disputed facts and forecasts. The CCM should only be suspended when there is substantial consensus across all stakeholders that the utilities' financial situation requires such a suspension. Clearly that consensus does not exist, and the CCM should be triggered for each utility.

EDF notes that D.13-03-015 applied the CCM to Southern California Gas Company (SoCalGas), which is conspicuously absent from the current proceeding. Furthermore, SoCalGas has not filed the requisite October 15 Advice Letter as required under the CCM.

B. The market has already priced in the adjustment mechanism and expects the mechanism to operate as usual

The Commission has already received the information and analysis from the utilities that it needs to determine the revised ROE under the CCM trigger and the expected revenue reductions are already publicly available based on the utilities' submissions.[10] The equities markets, given that most investments in individual stocks are well researched by a cadre of analysts, have already priced a likely outcome into the utilities' shares given the transparency of this process and proceedings. Unless the utilities can clearly show that it is not possible to the required capital for its upcoming investments at the current share prices and debt rates given a proposed list of "extraordinary or catastrophic" events, then the CCM should be triggered as designed. Deviation from the CCM without this standard would introduce new uncertainty and risk into the equation, which the Commission expressly wanted to avoid in D.08-05-035.

[10] Assigned Commissioner's Scoping Memorandum and Ruling, December 24, 2021, pp. 2-3.

C. While the COVID pandemic has caused great death and disrupted the national economy for a period, the potential for economic and financial catastrophe has passed

As of the filing date for this testimony, the United States has suffered more than 865,000 deaths attributed to COVID-19.[11] The response to the pandemic has triggered multiple economic shutdowns and the largest ever one-month increase in unemployment in April 2020.[12] The economy contracted by 32 percent in the second quarter of 2020.[13] The utilities may have been justified in October 2020 to request suspension of the CCM.

However, the worst financial aspects of the crisis have now passed and California has taken action to de-risk the utilities. Continued claims for unemployment insurance on January 15, 2022 fell below the previous low point of 1,706,000 on February 15, 2020 to 1,675,000.[14] Economic activity rebounded and the gross domestic product (GDP) surpassed the pre-pandemic level by the first quarter of 2021—a year ago.[15] In the fourth quarter of 2021, the real-dollar GDP grew by 5.5%, far surpassing the average rate since 2000 of less than 2%.[16] By every metric the U.S. economy is performing at least on par with the pre-pandemic version, albeit with significant rearrangement of employment and spending. The economic recovery has progressed

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[11] "Cumulative confirmed COVID-19 deaths," *Our World in Data,* https://ourworldindata.org/explorers/coronavirus-data-explorer?facet=none&Metric=Confirmed+deaths&Interval=Cumulative&Relative+to+Population=false&Color+by+test+positivity=false&country=USA~ITA~CAN~DEU~GBR~FRA~JPN, retrieved January 27, 2022.

[12] "Continued Claims (Insured Unemployment)," *FRED Economic Data*, St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/CCSA, January 15, 2022.

[13] "Gross Domestic Product," *FRED Economic Data,* St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/A191RP1Q027SBEA, January 27, 2022.

[14] "Continued Claims (Insured Unemployment)," *FRED Economic Data*, St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/CCSA, January 15, 2022.

[15] "Gross Domestic Product," *FRED Economic Data,* St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/GDP, January 27, 2022.

[16] "United States GDP Annual Growth Rate", *Trading Economics,* *https://tradingeconomics.com/united-states/gdp-growth-annual,* retrieved January 27, 2022.

to the point where the utilities' financial health should be stable, particularly since California has bolstered the financials of the IOUs by addressing arrearages, as discussed below. The utilities must show that the rearrangement of economic activity somehow creates an "extraordinary or catastrophic" situation financially for them with a consensus of agreement from other stakeholders. Further, the utilities have not demonstrated that their financial health is somehow significantly different than the rest of the market. The request for suspending the CCM should be rejected.

D. The Legislature has provided relief from the most significant risk of rising uncollectible billing revenues with AB 135 in the Fiscal Year 2021-22 budget

As part of the trailer bills package adopted along with the state's budget for Fiscal Year 2021-22, Assembly Bill 135 established the California Arrearage Payment Program (CAPP)[17] and appropriating $695 million for financial assistance to distribution customers of investor-owned utilities.[18]

The Legislative Counsel's Digest reads:

The bill would require the department to survey utility applicants to obtain data pertaining to the total number of residential and commercial customer accounts in arrears to determine the total statewide energy utility arrearage and to develop an allocation formula for determining an individual utility applicant's share of CAPP funds. The bill would authorize specified utilities to apply for CAPP funds, on behalf of their customers, and would require the utility to use any funds received, as specified, to offset

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[17] Government Code Section 16429.5, Assembly Bill No. 135, Chapter 85, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB135, chaptered July 16, 2021.

[18] Government Code Section 16429.5(d)(2).

customer arrearages that were incurred during the COVID-19 pandemic bill relief period, as defined.[19]

This state law establishes the funding and reimbursement to the utilities of any revenue shortfalls created by the COVID pandemic. In other words, any financial risks to revenues from this "extraordinary" event have already been mitigated by direct state action. The utilities do not need the Commission to also step in and add further relief in this circumstance. The utilities' request for relief to deviate from the CCM should be denied on this basis.

The utilities' change in financial conditions due to falling sales do not qualify for mitigation. Most notably, the decline is utilities' sales is not a recent phenomenon triggered by the pandemic. In 2019 for example, the year *before* the pandemic, PG&E had an extraordinary fall in its service sales (the total of bundled and unbundled) that continued a long term trend that began in 2009.[20] The pandemic may have triggered a shift in sales among customer classes as more people work at home, but this also has been part of an ongoing trend as well.[21] The utilities already have mechanisms in place to reallocate revenue requirements among rate classes in the GRC Phase 2 and ERRA cases. No further adjustments are required in the ROE beyond what the Commission already established in D.08-05-035.

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[19] Ibid.

[20] PG&E, "02.ERRA 2020-Forecast_Nov_WP_PGE_Ch02_2-3_Sales_PUBLIC.xlsx. 2020 ERRA Forecast, A.19-06-001; and PG&E, "02. ERRA 2021-Forecast_WP_PGE_20200717_Ch02_Table 2-3_Sales_PUBLIC.xlsx," 2022 ERRA Application, A.20-07-002.

[21] Alexander Bick, Adam Blandin and Karel Mertens, "Work from Home Before and After the COVID-19 Outbreak," Federal Reserve Bank of Dallas, Working Paper 2017, https://www.dallasfed.org/-/media/documents/research/papers/2020/wp2017r2.pdf, Revised February 2021.

E. Triggering the CCM is warranted and reasonable in this instance

The Commission established the CCM to provide course corrections in the cost of capital in the midst of the three-year rate cycles that can be easily anticipated by the financial community. That course correction was intended to avoid the burden of a typical regulatory proceeding and to reflect a consensus of the stakeholders that the utilities are facing significant financial risk. Given that the utilities alone possess the ability to file for a suspension, the need for that consensus is an implicit requirement to prevent the utilities from abusing that unique power.

The request for suspending the CCM for 2022 should be rejected and the CCM triggered for the reasons delineated here. Clearly no consensus exists among stakeholders and in fact, the opposition appears to be virtually universal amongst all intervening parties. It is important to remember that these ratepayers require healthy utilities to maintain the grid and to supply power that keeps their businesses and jobs going in our electricity-intensive economy. It is not simply about getting the lowest possible rate. The transparency of the CCM has allowed the financial markets to easily anticipate the trigger and for the utilities to adjust their investment programs in response. What was a truly an unprecedented economic situation in mid-2020 has transformed into an unprecedented economic rebound. And the state has provided relief for pandemic-related revenue shortfalls. The utilities should not be protected from changes due to the normal course of business such as technological and social transformations. Utilities still require incentives to adapt their business models to those types of changes to maintain a modern energy system. For these reasons, the utilities should proceed with filing their advice letters instituting the CCM trigger.

IV. THE ROE RESULTANT FROM THE TRIGGER MECHANISM IS REASONABLE

A. California utilities are not viewed by investors as particularly risky

EDF's analysis of equity market activity indicates that investors have *not* priced a risk discount into California utility shares, and instead, until the recent wildfires, utility investors have placed a premium *value* on California utility stocks. This premium value indicates that investors have viewed California as either less risky than other states' utilities or that California has provided a more lucrative return on investment than other states.

The Commission sets the ROE to deliver an after-tax net income amount as a percentage of the depreciated capital invested by the utility or the "book value." This book value is fairly stable and tends to grow over time as higher cost capital is invested to meet growth and to replace older, lower cost equipment. Investors use this forecasted income to determine their valuation of the company's common stock in market transactions. Generally, the accepted valuation is the net present value of the income stream using a discount rate equal to the expected return on that investment. That expected return represents the market-based return on equity or the implied market return.

The Commission usually targets the ROE so that the book and market values of the utility company are roughly comparable. In that way, when the utility adds capital, that capital receives a return that closely matches the return investors expect in the marketplace. If the regulated ROE is low relative to the market ROE, the company will have difficulty raising sufficient capital from the market for needed investments. If the regulated ROE is high relative to the market ROE, ratepayers will pay too much for capital invested and excess economic resources will be diverted into the utility's costs.

Alfred Kahn discussed in his classic treatise *The Economics of Regulation: Principles and Institutions* that the market valuation of utility assets should not deviate significantly from the book value in a regulated environment. In referring to a previous period after World War II where the implied market value for regulated utilities outstripped the growth in manufacturing firms, he wrote:

> *(T)he sharp appreciation in the prices of public utility stocks, to one and a half and then two times their book value during this period, reflected also a growing recognition that the companies in question were in fact being permitted to earn considerably more than their cost of capital.*[22]

Kahn describes how the Commission in regulating utility returns must be cognizant of the relationship of implied market valuation relative to book value. Allowing market value to greatly and continually exceed book value creates an implicit regulatory asset without explicit Commission approval upon which shareholder earn return with no review of the whether the addition of that asset, which raises rates through the higher return, is appropriate or necessary. In this case, the utilities may try to claim that the market has priced in a premium for growth, but has discussed above, utility sales have not been growing. While sales may increase in the future due to electrification of new parts of the economy, revenue has been decoupled from sales directly for over thirty years.[23] In fact, the only way for revenues to grow is by increasing rates. Why would Commission authorize a higher ROE on the presumption that it will continually

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[22] Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions,* Volume I: Economic Principles, The MIT Press, Cambridge, Massachusetts, 1988, Footnote 69, p. 48.

[23] The utilities have instead increased revenues and shareholder income by increasing ratebased investment based on unsubstantiated and erroneous sales forecasts. I have discussed this process in testimony filed on behalf of the Agricultural Energy Consumers Association in each of the PG&E and SCE GRC Phase II cases since 2010.

increase rates counter to it charge to maintain just and reasonable rates? Instead, the Commission should adhere to the principle that the authorized and market-derived ROEs should be closely linked in order for the Commission to achieve its objectives.

On this premise, we compared each of the utilities' market valuation and implied market ROE against market baskets of U.S. utilities and the current authorized ROEs.

1. California utilities' share prices show rising valuations over the last two decades

Figure 1 shows how the stock price for each of the three California utility holding companies (PG&E Corporation (ticker symbol PCG), Edison International (EIX) and Sempra (SRE)) that own the energy utilities subject to these Applications. Figure 1 compares these stock prices to the Dow Jones Utility index average[24] from June 1998 to December 2021 starting from a common base index value of 100 on January 1, 2000.[25] The chart also includes (a) important Commission decisions and state laws that have been enacted and are identified by several of the utility witnesses as increasing the legal and regulatory risk environment in the state, and (b) catastrophic events at particular utilities that could affect how investors perceive the risk and management of that utility. Table 1 summarizes the annual average growth in share prices for the Dow Jones Utility average and the three holding companies up to the 2012 cost of capital decision, the 2017 cost of capital modification decision,[26] and to December 2021. Also of

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[24] The Dow Jones Utility average is composed of 15 large utility companies. The average is calculated on a value-weighted basis and is one of the most cited references for utility industry valuation trends. (See S&P Dow Jones Indices, "Dow Jones Averages Methodology," https://us.spindices.com/documents/methodologies/methodology-dj-averages.pdf, retrieved July 17, 2019, April 2019.)

[25] Share price, value and index data: Yahoo Finance. https://finance.yahoo.com/, retrieved January 27, 2022.

[26] Decision 17-07-005.

particular note, the chart includes the Commission's decision on incorporating a risk-based framework into each utility's General Rate Case process in D.14-12-025. The significance of this decision is that the utility's consideration of safety risk was directed to be "baked in" to future requests for new capital investment. The updated risk framework also has the impact of making new these new investments more secure from an investment perspective, since there is closer financial monitoring and tracking.

As you can see in both Table 1 and in Figure 1, the Dow Jones Utility average annual growth was 5.5% through July 13, 2017 and rose even further to 5.9% through December 31, 2021, California utility prices exceeded this average in all but one case, with Edison's shares rising 9.4% per annum through the first date and 7.2% through this December, and Sempra growing 15.2% to the first date and then reverting to a still exceptional 13.1% to the latest. Even PG&E grew at almost twice the index rate at 10.4% through 2017, and then took an expected sharp decline with its bankruptcy with a current return of 0.2%.

Table 1

Cumulative Average Growth from January 2000	**12/12/2012**	**7/13/2017**	**12/19/2019**	**12/31/2021**
Dow Jones Utilities	3.9%	5.5%	5.9%	5.9%
Edison International	7.2%	9.4%	7.8%	7.2%
PG&E Corp.	8.6%	10.4%	-0.3%	0.2%
Sempra	15.8%	15.2%	14.9%	13.1%

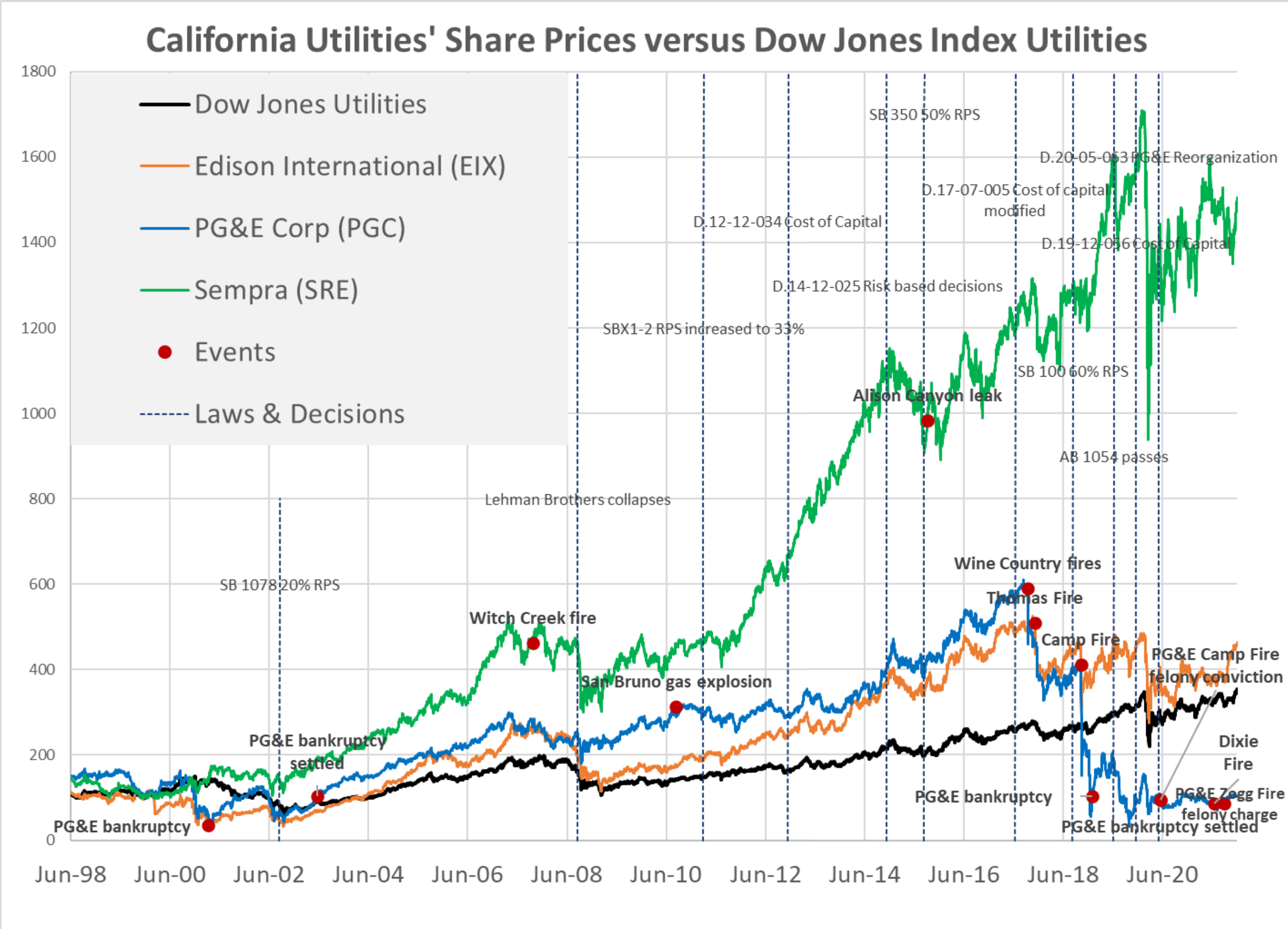
As demonstrated in Figure 1, both SRE and EIX significantly outperform the Dow Jones Utility average and PGC maintained the same trend until market had significant concerns about the company's role in the 2017 wildfires. The chart and table support three important findings:

1) California utility shares have significantly outpaced industry average returns since January 2000 and since March 2009;

2) California share prices only decreased significantly after the wildfire events that have been tied to specific *market-perceived* negligence on the part of the electric utilities in 2017 and 2018; and

3) Other events and state policy actions do not appear to have a measurable sustained impact on utilities' valuations.

Figure 1

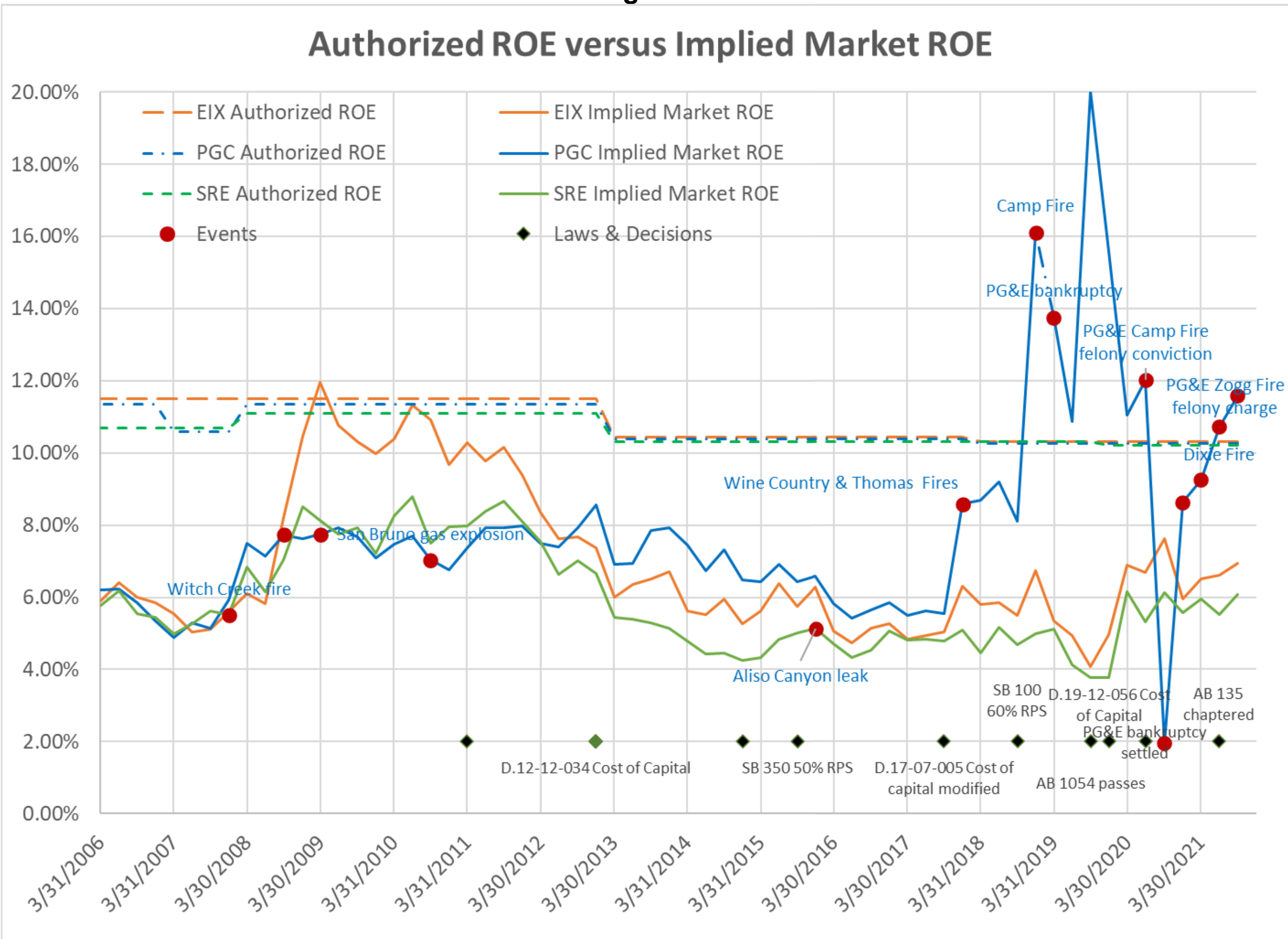

California Utilities' Share Prices versus Dow Jones Index Utilities
Dow Jones Utilities
Edison International (EIX)
PG&E Corp (PGC)
Sempra (SRE)
Events
Laws & Decisions
1800
1600
1400
1200
1000
800
600
400
200
0
Jun-98
Jun-00
Jun-02
Jun-04
Jun-06
Jun-08
Jun-10
Jun-12
Jun-14
Jun-16
Jun-18
Jun-20
SB 350 50% RPS
D.20-05-053 PG&E Reorganization
D.17-07-005 Cost of capital modified
D.12-12-034 Cost of Capital
D.19-12-056 Cost of Capital
D.14-12-025 Risk based decisions
SBX1-2 RPS increased to 33%
SB 100 60% RPS
Alison Canyon leak
AB 1054 passes
Lehman Brothers collapses
Wine Country fires
SB 1078 20% RPS
Thomas Fire
Witch Creek fire
Camp Fire
PG&E Camp Fire felony conviction
San Bruno gas explosion
PG&E bankruptcy settled
Dixie Fire
PG&E bankruptcy
PG&E Zogg Fire felony charge
PG&E bankruptcy
PG&E bankruptcy settled

These market values can then be linked to the utilities' book values and authorized returns on equity to calculate the implied market returns on equity. A comparable, commonly reported metric is the *price to earning ratio* or P/E ratio. The inverse of the P/E ratio, that is the earnings divided by the market price, is the revealed market-valued return on equity or ROE. As the P/E ratio gets larger (as has been the overall market trend over the last several years both in general and specifically for utilities[27]), the revealed market-based or implied market ROE decreases. So when a company shows that that comparable firms have higher P/E ratios, that means that those companies have lower implied market ROEs.

For utility companies, the authorized income or earnings per share is the authorized ROE multiplied by the book value per share. That income is divided by the market share price to arrive at the implied market return on equity for that company. Figure 2 shows the authorized ROEs for the three California holding companies and the implied market ROEs at the end of each quarter for each group from December 31, 2011 to September 30, 2021. In addition, the key decisions, laws and events shown in Figure 1 are repeated here.

[27] "Shiller PE Ratio by Year," Multpl, https://www.multpl.com/shiller-pe/table/by-year, retrieved January 27, 2022.

Figure 2



Authorized ROE versus Implied Market ROE
EIX Authorized ROE
PGC Authorized ROE
SRE Authorized ROE
Events
EIX Implied Market ROE
PGC Implied Market ROE
SRE Implied Market ROE
Laws & Decisions
20.00%
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Camp Fire
PG&E bankruptcy
PG&E Camp Fire felony conviction
PG&E Zogg Fire felony charge
Dixie Fire
Wine Country & Thomas Fires
San Bruno gas explosion
Witch Creek fire
Aliso Canyon leak
SB 100 60% RPS
D.19-12-056 Cost of Capital
AB 135 chaptered
PG&E bankruptcy settled
D.12-12-034 Cost of Capital
SB 350 50% RPS
D.17-07-005 Cost of capital modified
AB 1054 passes
3/31/2006
3/31/2007
3/30/2008
3/30/2009
3/31/2010
3/31/2011
3/30/2012
3/30/2013
3/31/2014
3/31/2015
3/30/2016
3/30/2017
3/31/2018
3/31/2019
3/30/2020
3/30/2021

The dashed lines in Figure 2 are the authorized ROE and the solid lines are the implied Market ROE for each utility. Figure 2 indicates strong performance for each California utility through 2017, with only one significant deviation from that pattern to the present day—due to PG&E's financial difficulties. When the market ROE is below the authorized ROE, that means that investors are willing to pay a premium relative to the book value of the utility—that the company is attractive to investors and its market value is greater than its book value. The Commission only needs to allow the market return rate to attract sufficient investment to cover the book value. Otherwise, the Commission is letting the market create an implied regulatory asset without Commission approval. Allowing this asset leads to higher rates for ratepayers.

Over the period from the 2012 cost of capital decision[28] to late 2017, the implied market ROE progressed steadily downward for both the California utilities. Sempra's premium leveled off in late 2014 and has drifted downward since without any significant corrections. SCE's diverged upward in mid-2016, but again there are not sharp changes in direction, even with the Thomas Fire in late 2017. SCE's premium is still larger than when the 2012 decision was issued. PG&E followed the same pattern as SCE until the Wine Country fires in late 2017, and took another sharp turn with the Camp Fire and, understandably, the subsequent voluntary bankruptcy filing. PG&E's returns are understandably volatile due to its own unforced errors.

Figure 3 tracks the difference or premium value of the authorized ROE over the market valuation of that ROE.[29] A premium value of zero means that the market valuation is on par with the authorized ROE. That was the situation in 2012 for Edison and PG&E; only Sempra showed a positive premium of 300 basis points as a result of a rapid increase in market value over 2012.

[28] D.12-12-034.

[29] Figure 3 is a different presentation of the same data shown in Figure 2.

A higher or positive premium value means that investors see the utility's equity shares as attractive investments with *lower* risks than the assessments of the Commission in setting the authorized ROEs. In other words, the Commission has provided an overly generous incentive to investors if the premium value is positive. We can see at the end of September 2017, just after the Commission decision on cost of capital,[30] the premiums for PG&E, Edison and Sempra all lied in a narrow band between 410 basis points for Edison and 470 basis points for PG&E. In other words: 1) California utility investors were receiving overly generous returns on their investments as evidenced in the share prices, and 2) California utility investors have not been demanding a significant discount for perceived increased risk compared to other U.S. utilities. Extending this analysis, if the Commission were to try to "stabilize" the market and prevent a decrease in the ROE, the Commission would in fact be rewarding shareholders further and prevent the downward pressure the rest of the market has faced. The adjustment as designed in the CCM is prudent and reasonable given the circumstances and deviating from it will not protect ratepayer interests.

A recent academic study using a similar methodology as presented here looking across all rate cases from 1980 to 2017 came to a confirming conclusion that "the weighted median of the approved return on equity is 0.5–4 percentage points too high."[31]

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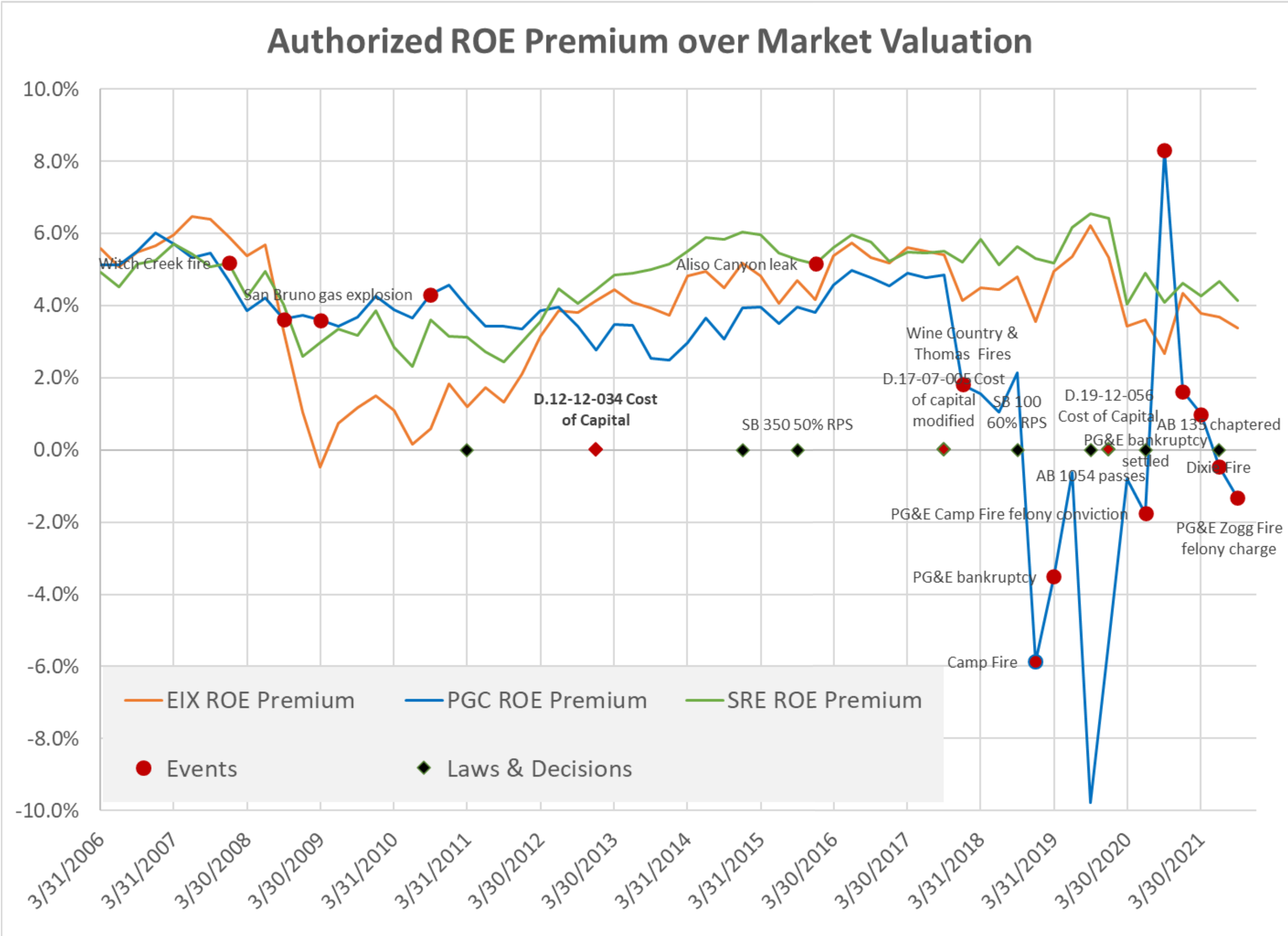
[30] D.17-07-005.

[31] Karl W. Dunkle Werner, *Essays on Energy and Environmental Economics*, University of California, Berkeley, Department of Agricultural and Resource Economics, Dissertation, "Chapter 3, Rate of Return Regulation Revisited" (with Steven Jarvis), 2021.

Figure 3



Authorized ROE Premium over Market Valuation
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
-6.0%
-8.0%
-10.0%
Witch Creek fire
San Bruno gas explosion
Aliso Canyon leak
D.12-12-034 Cost of Capital
SB 350 50% RPS
Wine Country & Thomas Fires
D.17-07-005 Cost of capital modified
SB 100 60% RPS
D.19-12-056 Cost of Capital
AB 1054 passes
PG&E bankruptcy settled
AB 135 chaptered
Dixie Fire
PG&E Camp Fire felony conviction
PG&E Zogg Fire felony charge
PG&E bankruptcy
Camp Fire
EIX ROE Premium
PGC ROE Premium
SRE ROE Premium
Events
Laws & Decisions
3/31/2006
3/31/2007
3/30/2008
3/30/2009
3/31/2010
3/31/2011
3/30/2012
3/30/2013
3/31/2014
3/31/2015
3/30/2016
3/30/2017
3/31/2018
3/31/2019
3/30/2020
3/30/2021

2. The rise in the market-implied ROE reflects both a needed correction and a recognition that the state has provided more revenue assurance to California utilities

Since March 2020, share prices for utilities have not risen as much as the broader market indices as shown in Figure 1. Utility stocks in general fell about the same percentage from the peak in February to the trough in March, so the rises in valuation over that period start from a comparable base. But that base is not the appropriate one. The appropriate starting point, at a minimum, are the valuations in 2012 when the authorized ROEs and implied market ROEs were closer together. As illustrated in Figures 2 and 3, after 2012 California stocks led to a significant divergence of market from book values. The less rapid rise in utility stocks since March 2020 reflects a correction back toward convergent par values.

The rise in the most popular broad market benchmarks (Dow Jones, S&P 500, NASDAQ) are dominated by the market value and share prices of the FAANG (Facebook, Apple, Amazon, Netflix, Google) plus Tesla that have attracted disproportionate investor attention which depresses their P/E ratios and implied ROEs. But these are the normal swings of market valuation as illustrated in the figures above. The Commission should not take this swing back in the pendulum as an "extraordinary or catastrophic event" that requires extraordinary action. The ROEs for a three-year cycle should account for the longer-term trends in companies' valuations and ignore short-term spikes and dips. The more recent shift is not justification for suspending the CCM.

V. CONCLUSIONS

The Commission faces a many important decisions over the next several years to implement the state's goals for mitigating climate change and preparing to adapt to the increased volatility and vulnerability that our historic GHG emissions have already baked into the future climate. At the center of the measures needed is increased electricity use to displace fossil fuels. But consumers will be much more resistant to those necessary changes if electricity rates continue to rise unabated as they have over the last half dozen years. Addressing this unfortunate trend will require hard choices that spread the pain to all stakeholder including utility investors.

Implementing the CCM trigger as specified in the previous Commission decision is one step toward slowing electricity rate increases. The utilities bear the burden of proof to suspend the CCM which is a high hurdle as described above. The CCM should only be suspended when there is substantial consensus across all stakeholders that the utilities' financial situation requires such a suspension. The circumstances for such consensus would be in situations where the markets are acting in a manner not contemplated by the CCM's original design or have deviated in such a way that neither ratepayer nor shareholders would be well served by keeping the CCM in place. None of the available evidence shows that such a suspension is required to keep the utilities financially healthy. The Commission should deny the utilities' requests.

Exhibit A

Statement of Qualifications
Richard McCann, Ph.D.

M.CUBED
POLICY ANALYSIS FOR THE PUBLIC AND PRIVATE SECTORS

DR. RICHARD MCCANN
PARTNER
426 12th Street
Davis, California 95616
530.757.6363
McCann@MCubed-Econ.Com

Professional Experience

M.Cubed, Partner, 1993-2008, 2014-present
Aspen Environmental Group, Senior Associate, 2008-2013
Foster Associates/Spectrum Economics/QED Research, Senior Economist, 1986-1992
Dames & Moore, Economist, 1985-1986

Academic Background

PhD, Agricultural and Resource Economics, University of California, Berkeley, 1998
MS, Agricultural and Resource Economics, University of California, Berkeley, 1990
MPP, Institute of Public Policy Studies, University of Michigan, 1986
BS, Political Economy of Natural Resources, University of California, Berkeley, 1981

Dr. McCann specializes in environmental and energy resource economics and policy. He has testified before and prepared reports on behalf of numerous federal, state and local regulatory agencies on energy, air quality, and water supply and quality issues.

Selected Projects

- **Agricultural Rate Setting Testimony, Agricultural Energy Consumers Association (1992-present).** Testified about agricultural economic issues related to energy use, linkage to California water management policy, and utility rates in numerous proceedings at the California Public Utilities Commission (CPUC), California Energy Commission, and California State Legislature.
- **Utilities Cost of Capital Testimony, Environmental Defense Fund (2019-present).** Testified at the California Public Utilities Commission in the four 2020 Cost of Capital applications and the 2022 Accelerated Cost of Capital Applications.
- **Regulatory Analysis and Support, Joint Community Choice Aggregators (2018-present)**. Testified at the CPUC (CPUC) in Pacific Gas and Electric's (PG&E) rate proceedings on the power charge indifference adjustment (PCIA) "exit" fee and other issues. Provides regulatory support. The Joint CCAs include Sonoma Clean Power, East Bay Community Energy, Peninsula Clean Energy, Pioneer Community Energy, Monterey Bay Community Power, Silicon Valley Clean Energy, and Marin Clean Energy.
- **Regulatory Analysis and Support, Sonoma Clean Power (2016-present)**. Testified at the CPUC (CPUC) in Pacific Gas and Electric's (PG&E) rate proceedings on the power charge indifference adjustment (PCIA) "exit" fee and other issues.
- **Master-Metered Utility Systems Transfer Program, Western Manufactured Housing Communities Association (2003-present)**. Prepared petition that opened a rulemaking to facilitate transfer of master-metered utility systems to serving utilities and testified in that proceeding. Testified before the State Legislature on proposed legislation.
- **Master-Meter Rate Setting Testimony and Regulatory Support, Western Manufactured Housing Communities Association (1998-present).** Testified in Pacific Gas and Electric Co., Southern California Edison Co., Southern California Gas Co. and San Diego Gas and Electric Co. rate proceedings on establishing "master-meter/submeter credits" provided to private mobile home park utility systems.

- **Testimony on Southern California Edison 2018 General Rate Case, Small Business Utility Advocates. (2018-2019).** Testified on proposed distribution system spending plan in SCE's GRC application.
- **Net Energy Metering Rate Setting for Kentucky Power, Kentucky Solar Energy Industry Association (2021)**. Testified before the Kentucky Public Service Commission on the appropriate principles for setting net energy metering rates.
- **Regulatory Analysis and Support, California Community Choice Aggregators (2018-2019)**. Testified at the CPUC (CPUC) in CPUC rulemakings on the power charge indifference adjustment (PCIA) "exit" fee and resource adequacy requirements.
- **Regulatory Analysis and Support, CalChoice (2017-2019)**. Testified at the CPUC (CPUC) in Southern California Edison's (SCE) rate proceedings on the power charge indifference adjustment (PCIA) "exit" fee and other issues.
- **Testimony on Protecting Solar Project Investment by Customers, County of Santa Clara (2017-2019)**. Testified at the CPUC (CPUC) in Pacific Gas and Electric's (PG&E) rate proceedings on the RES-BCT tariff provided to public agencies using renewable generation to supply their own accounts. The testimony addressed the appropriate rate structures for these projects in the context of state policy.
- **Electricity Research & Development Strategic Plan and Roadmap for Sacramento Municipal Utility District (2015-2016).** Reviewed SMUD's ERD Strategic Plan to reflect the changing electric utility environment.
- **Aggregating Agricultural Accounts to Facilitate Load Management, Agricultural Energy Consumers Association (2012-2017).** Analyzed load and billing data from pilot programs to assess the potential load reductions in the PG&E and SCE service area if agricultural customers were given the on-line tools and the rate incentives to manage all of their individual loads as aggregated sets of loads.
- **Davis Community Choice Advisory Committee, City of Davis (2014).** Served on City-appointed committee to assess options for creating a community choice aggregation utility for the City or Yolo County.
- **Community Solar Gardens Testimony, Sierra Club (2014).** Testified in Pacific Gas and Electric and Southern California Edison Green Tariff applications on changes needed to encourage the development of neighborhood and community-scale renewable distributed generation by allowing direct contracting and removing unnecessary transaction costs.
- **Time of Use Rates in California Residential Rates Rulemaking, Environmental Defense Fund (2013-2014).** Modeled how increased penetration of TOU rates in the residential sector for all three investor-owned utilities would reduce peak and energy demand, reduce residential bills, and reduce utility costs.
- **Southern California Edison v. State of Nevada Department of Taxation, Nevada Attorney General's Office (2013-2014)**. Testified on whether the sales tax imposed on coal delivered to SCE's Mohave Generating Station created a competitive disadvantage for SCE in the Western power market during the 1998-2000 period.
- **Alternative Generation Technology Assessment, California Energy Commission (2001-2014).** Developed and maintained the Cost of Generation Model, spreadsheet-based tool used by the CEC to produce generation cost estimates for the Integrated Energy Policy Report (IEPR).
- **Time of Use Rates in Consolidated Edison Rate Case, Environmental Defense Fund (2013).** Modeled how increased penetration of TOU rates in the residential sector for Consolidated Edison serving the New York City metropolitan area would reduce peak and energy demand, reduce residential bills, and reduce utility costs.

- **Analytic Support for Long Term Procurement Plan OIR, CPUC Energy Division (2011-2012).** Reviewed California Independent System Operator (CAISO) and three utilities' resource acquisition plans out to 2020.
- **Reliability and Environmental Regulatory Tradeoffs in the LA Basin, California Energy Commission (2009).** Developed analytic tool in Analytica to assess local capacity requirements (LCR) in the CAISO and LADWP control areas for the 2009-2015 period, and how air and water quality regulations impact the ability to meet the LCR.
- **Analytic Support for Klamath Project FERC Relicensing Case, California Energy Commission (2005-2007).** Prepared economic analysis comparing potential costs and benefits of proposed relicensing conditions and decommissioning scenarios for a consortium of government agencies.
- **US v. Reliant Resources CR04-125, US Attorney (2005-2007).** Testified in a wire fraud case as to the air quality regulatory constraints that Reliant may have faced when scheduling and operating its power generation facilities June 20 to June 23, 2000.
- **Agricultural Engine Conversion Program, Agricultural Energy Consumers Association (2005).** Testified before the CPUC on program to convert agricultural diesel engines to electricity. The adopted program led to the conversion of 2,000 pumps in the San Joaquin Valley. (A.04-11-007 and A.04-11-008)
- **Statewide Pricing Pilot, Track B Analysis, CPUC (2003-2005).** Developed experimental program to examine whether providing educational "treatments" communicated through a community-based organization in an environmentally-impacted neighborhood enhanced responses to critical peak pricing among residential energy users.
- **Environmental Performance Report Hydropower Relicensing Cost Evaluation, California Energy Commission (2003).** Developed estimates of lost value and incurred costs for California hydropower facilities subject to relicensing.
- **California Electricity Anti-trust Actions, California Office of the Attorney General (2002-2004).** Consulted on developing anti-trust cases and actions against merchant power generators as a result of the California 2000-2001 energy crisis.
- **FERC California Refund Case Testimony, California Electricity Oversight Board (2001-2003).** Testified before the Federal Energy Regulatory Commission on electricity price refund issues related to air emission and environmental permit costs, and effects on power plant operations from environmental regulations.
- **PG&E Hydro Divestiture EIR, CPUC (2000).** Evaluated the environmental impacts from divesting hydropower facilities and related lands by Pacific Gas and Electric Company
- **Thermal Power Plant Divestitures Environmental Assessments, CPUC (1997-1998).** Evaluated the environmental impacts of the generating plant divestiture by Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric Companies.
- **Gas Pipeline Need Assessment, South Coast Air Quality Management District (1989).** Prepared analysis and testimony presented to the CPUC on the need for additional interstate natural gas pipeline capacity to implement the Liquid and Solid Fuel Phase-out Policy for the South Coast Air Quality Management District. Developed a probabilistic gas shortage model based on weather and hydrological conditions, using results from the Elfin electric generation simulation model.
- **Rancho Seco NGS Evaluation, Sacramento Municipal Utility District (1988).** Independently reviewed resource planning alternatives and recommended action on Rancho Seco NGS operations, for SMUD QUEST Team.

- **QF Avoided Cost Rates, Oklahoma Corporation Commission Staff (1989).** Testified on Oklahoma Gas and Electric avoided-cost methodology and made projections for payments to cogeneration facilities using the PROMOD production-cost model. Testified for the OCC Staff, in Cause No. PUD 000600 and Cause No. PUD 000345.
- **QF Development Forecast, Sacramento Municipal Utility District (1988).** Identified and assessed the viability of qualifying facilities (QF) projects in PG&E's service territory — particularly in the San Joaquin Valley — through database searches and telephone survey.
- **Plant Closure Testimony, Cook County State's Attorney (1988).** Testified on savings from closure of coal-fired plants, based on Elfin production-cost model runs, before the Illinois Commerce Commission.
- **QF Siting Certification Cases, Sun Oil/Mission Energy (1987), Signal Energy (1988), Luz Engineering (1988).** Prepared testimony on need-for-power in Southern California Edison and San Diego Gas and Electric, for three qualifying facility project siting applicants at the CEC.
- **QF Siting Certification Cases, IBM (1985), Arco Refining (1986), Mobil Oil (1986).** Prepared testimony on need-for-power in Southern California Edison and Pacific Gas and Electric, for three qualifying facility project siting applicants at the CEC.

Manufactured Housing Communities Utility Issues

Skills: Master-Metered Utilities Rate Design and Analysis, Rent Control Proceedings Testimony

Professional Affiliations

- American Agricultural Economics Association
- Association of Environmental and Resource Economists
- American Economics Association

Civic Activities

- City of Davis 2020 Environmental Recognition Award
- Member, City of Davis Natural Resources Commission
- Former member, City of Davis Utilities Rates Advisory Commission
- Former member, City of Davis Community Choice Energy Advisory Committee
- Co-Chair, City of Davis / Cool Davis Georgetown University Energy Prize Implementation Task Force
- Member, Western Manufactured Housing Communities Association Utilities Task Force
- Former Member, City of Davis Citizens Electricity Restructuring Task Force
- Former Member, Yolo County Housing Commission

Exhibit B

Testimony Attachments

Footnote 1

California Climate Change Legislation

Date	Legislation	Description
July 26, 2017	Assembly Bill 617 (Christina Garcia, Chapter 136, Statutes of 2017)	**Companion to Cap-and-Trade** Extension Establishes a groundbreaking program to measure and reduce air pollution from mobile and stationary sources at the neighborhood level in the communities most impacted by air pollutants. Requires the Air Resources Board to work closely with local air districts and communities to establish neighborhood air quality monitoring networks and to develop and implement plans to reduce emissions. The focus on community-based air monitoring and emission reductions will provide a national model for enhanced community protection.
July 25, 2017	Assembly Bill 398 (Eduardo Garcia, Chapter 135, Statutes of 2017)	**Cap-and-Trade Extension** Extends and improves the Cap and Trade Program, which will enable the state to meet its 2030 emission reduction goals in the most cost-effective manner. Furthermore, extending the Cap and Trade Program will provide billions of dollars in auction proceeds to invest in communities across California.
September 19, 2016	Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016)	**Short-lived Climate Pollutants** Establishes statewide reduction targets for short-lived climate pollutants.
September 8, 2016	Assembly Bill 197 (Eduardo Garcia, Chapter 250, Statutes of 2016)	**Greenhouse gas regulations** Prioritizes direct emission reductions from large stationary sources and mobile sources.
September 8, 2016	Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016)	**Greenhouse Gas emission reduction target for 2030** Establishes a statewide greenhouse gas (GHG) emission reduction target of 40 percent below 1990 levels by 2030.
October 7, 2015	Senate Bill 350 (De León, Chapter 547, Statutes of 2015)	**Clean Energy and Pollution Reduction Act of 2015** Establishes targets to increase retail sales of renewable electricity to 50 percent by 2030 and double the energy efficiency savings in electricity and natural gas end uses by 2030.
September 21, 2014	Senate Bill 605 (Lara, Chapter 523, Statutes of 2014)	**Short-lived climate pollutants** Requires the State Air Resources Board to complete a comprehensive strategy to reduce emissions of short-lived climate pollutants by January 1, 2016.
September 21, 2014	Senate Bill 1275, (De León, Chapter 530, Statutes of 2014)	**Charge Ahead California Initiative** Establishes a state goal of 1 million zero-emission and near-zero-emission vehicles in service by 2020. Amends the enhanced fleet modernization program to provide a mobility option. Establishes the Charge Ahead California Initiative requiring planning and reporting on vehicle incentive programs, and increasing access to and benefits from zero-emission vehicles for disadvantaged, low-income, and moderate-income communities and consumers.
September 21, 2014	Senate Bill1204 (Lara, Chapter 524, Statutes of 2014)	**California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program** Creates the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology

		Program funded by the Greenhouse Gas Reduction Fund for development, demonstration, precommercial pilot, and early commercial deployment of zero- and near-zero emission truck, bus, and off-road vehicle and equipment technologies, with priority given to projects benefiting disadvantaged communities.
September 28, 2013	Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013)	**Alternative fuel and vehicle technologies: funding programs** Extends until January 1, 2024, extra fees on vehicle registrations, boat registrations, and tire sales in order to fund the AB 118, Carl Moyer, and AB 923 programs that support the production, distribution, and sale of alternative fuels and vehicle technologies and air emissions reduction efforts. The bill suspends until 2024 ARB's regulation requiring gasoline refiners to provide hydrogen fueling stations and appropriates up to $220 million, of AB 118 money to create a hydrogen fueling infrastructure in the state.
September 28, 2013	Assembly Bill 1092 (Levine, Chapter 410, Statutes of 2013)	**Building standards: electric vehicle charging infrastructure** Requires the Building Standards Commission to adopt mandatory building standards for the installation of future electric vehicle charging infrastructure for parking spaces in multifamily dwellings and nonresidential development.
September 30, 2012	Senate Bill 535 (De León, Chapter 830, Statutes of 2012)	**Greenhouse Gas Reduction Fund and Disadvantaged Communities** Requires the California Environmental Protection Agency to identify disadvantaged communities; requires that 25% of all funds allocated pursuant to an investment plan for the use of moneys collected through a cap-and-trade program be allocated to projects that benefit disadvantaged communities and 10 those 25% be use within disadvantaged communities; and requires the Department of Finance to include a description of how these requirements are fulfilled in an annual report.
September 30, 2012	Assembly Bill 1532 (J. Perez, Chapter 807, Statutes of 2012)	**Greenhouse Gas Reduction Fund in the Budget** Requires the Department of Finance to develop and submit to the Legislature an investment plan every three years for the use of the Greenhouse Gas Reduction Fund; requires revenue collected pursuant to a market-based compliance mechanism to be appropriated in the Annual Budget Act; requires the department to report annually to the Legislature on the status of projects funded; and specifies that findings issued by the Governor related to "linkage" as part of a market-base compliance mechanism are not subject to judicial review.
April 12, 2011	Senate Bill X1-2 (Simitian, Chapter 1, Statutes of 2011)	Governor Edmund G. Brown, Jr. signed Senate Bill X1-2 into law to codify the ambitious 33 percent by 2020 goal. SBX1-2 directs California Public Utilities Commission's Renewable Energy Resources Program to increase the amount of electricity generated from eligible renewable energy resources per year to an amount that equals at least 20% of the total electricity sold to retail customers in California per year by December 31, 2013, 25% by December 31, 2016 and 33% by December 31, 2020. The new RPS goals applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. This new RPS preempts the California Air Resources Boards' 33 percent Renewable Electricity Standard.
September 29, 2011	Assembly Bill 1504 (Skinner, Chapter 534, Statutes of 2010)	Forest resources and carbon sequestration. Bill requires Department of Forestry and Fire Protection and Air Resources Board to assess the capacity of its forest and rangeland regulations to meet or exceed the state's greenhouse goals, pursuant to AB 32.
September 30, 2008	Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008)	Sustainable Communities & Climate Protection Act of 2008 requires Air Resources Board to develop regional greenhouse gas emission reduction targets for passenger vehicles. ARB is to establish targets for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations. For more information on SB 375, see the ARB Sustainable Communities page.
October 14, 2007	Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007)	Alternative Fuels and Vehicles Technologies The bill would create the Alternative and Renewable Fuel and Vehicle Technology Program, to be administered by the Energy Commission, to provide funding to public projects to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies.
August 24, 2007	Senate Bill 97 (Dutton, Chapter 187, Statutes of 2007)	Directs Governor's Office of Planning and Research to develop CEQA guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions." For more information see the OPR CEQA and Climate Changepage.

July 18. 2006	Assembly Bill 1803 (Committee on Budget, Chapter 77, Statutes of 2006)	Greenhouse gas inventory transferred to Air Resources Board from the Energy Commission.
August 21, 2006	Senate Bill 1 (Murray, Chapter 132, Statutes of 2006)	California's Million Solar Roofs plan is enhanced by PUC and CEC's adoption of the California Solar Initiative. SB1 directs PUC and CEC to expand this program to more customers, and requiring the state's municipal utilities to create their own solar rebate programs. This bill would require beginning January 1, 2011, a seller of new homes to offer the option of a solar energy system to all customers negotiating to purchase a new home constructed on land meeting certain criteria and to disclose certain information.
September 26, 2006	Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006)	SB 107 directs California Public Utilities Commission's Renewable Energy Resources Program to increase the amount of renewable electricity (Renewable Portfolio Standard) generated per year, from 17% to an amount that equals at least 20% of the total electricity sold to retail customers in California per year by December 31, 2010.
September 27, 2006	Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006)	California Global Warming Solutions Act of 2006. This bill would require Air Resources Board (ARB) to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020. ARB shall adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program. AB 32 directs Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 to continue its role in coordinating overall climate policy. See more information on AB 32 at ARB.
September 12, 2002	Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002)	This bill establishes the California Renewables Portfolio Standard Program, which requires electric utilities and other entities under the jurisdiction of the California Public Utilities Commission to meet 20% of their renewable power by December 31, 2017 for the purposes of increasing the diversity, reliability, public health and environmental benefits of the energy mix.
September 7, 2002	Senate Bill 812 (Sher, Chapter 423, Statutes of 2002)	This bill added forest management practices to the California Climate Action Registry members' reportable emissions actions and directed the Registry to adopt forestry procedures and protocols to monitor, estimate, calculate, report and certify carbon stores and carbon dioxide emissions that resulted from the conservation-based management of forests in California.
July 22, 2002	Assembly Bill 1493 (Pavley, Chapter 200, Statutes of 2002)	The "Pavley" bill requires the registry, in consultation with the State Air Resources Board, to adopt procedures and protocols for the reporting and certification of reductions in greenhouse gas emissions from mobile sources for use by the state board in granting the emission reduction credits. This bill requires the state board to develop and adopt, by January 1, 2005, regulations that achieve the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks. For more information on AB 1493 Pavley I, see the ARB Clean Car Standards page.
October 11, 2001	Senate Bill 527 (Sher, Chapter 769, Statutes of 2001)	This bill revises the functions and duties of the California Climate Action Registry and requires the Registry, in coordination with CEC to adopt third-party verification metrics, developing GHG emissions protocols and qualifying third-party organizations to provide technical assistance and certification of emissions baselines and inventories. SB 527 amended SB 1771 to emphasize third-party verification.
September 30, 2000	Senate Bill 1771 (Sher, Chapter 1018, Statutes of 2000)	SB 1771 establishes the creation of the non-profit organization, the California Climate Action Registry and specifies functions and responsibilities to develop a process to identify and qualify third-party organizations approved to provide technical assistance and advice in monitoring greenhouse gas emissions, and setting greenhouse gas (GHG) emissions baselines in coordination with CEC. Also, the bill directs the Registry to enable participating entities to voluntarily record their annual GHG emissions inventories. Also, SB 1771 directs CEC to update the state's greenhouse gas inventory from an existing 1998 report and continuing to update it every five years.
September 28, 1988	Assembly Bill 4420 (Sher, Chapter 1506, Statutes of 1988)	The California Energy Commission (CEC) was statutorily directed to prepare and maintain the inventory of greenhouse gas emissions (GHG) and to study the effects of GHGs and the climate change impacts on the state's energy supply and demand, economy, environment, agriculture, and water supplies. The study also required recommendations for avoiding, reducing, and addressing related impacts - and required the CEC to coordinate the study and any research with federal, state, academic, and industry research projects.

Footnote 8

PUBLIC ADVOCATES OFFICE

Electric Rate Trends

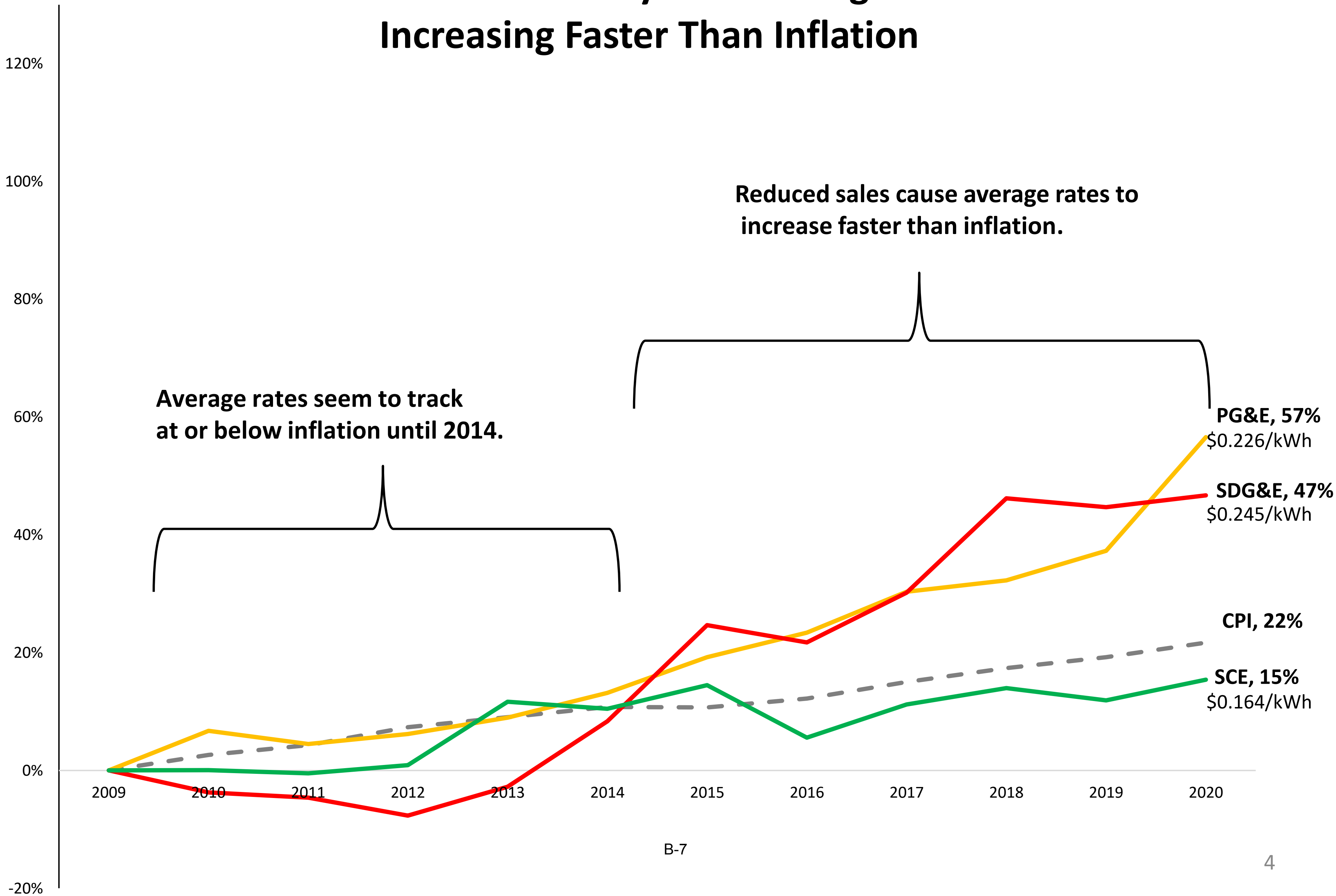
2009- 2021

Assembly Utilities and Energy Committee

Electricity Prices Matter Informational Hearing

February 19, 2020

PG&E and SDG&E System Average Rates Increasing Faster Than Inflation



Footnotes 11-16

COVID-19 Data Explorer

Download the complete *Our World in Data* COVID-19 dataset.

METRIC

Confirmed deaths

INTERVAL

Cumulative

☐ Relative to Population

☐ Color by test positivity

Type to add a country...

Sort by Select...

- ☑ **Canada**
- ☑ **France**
- ☑ **Germany**
- ☑ **Italy**
- ☑ **Japan**
- ☑ **United Kingdom**
- ☑ **United States**
- ☐ Afghanistan
- ☐ Africa
- ☐ Albania
- ☐ Algeria
- ☐ Andorra
- ☐ Angola
- ☐ Anguilla
- ☐ Antigua and Barbuda
- ☐ Argentina
- ☐ Armenia

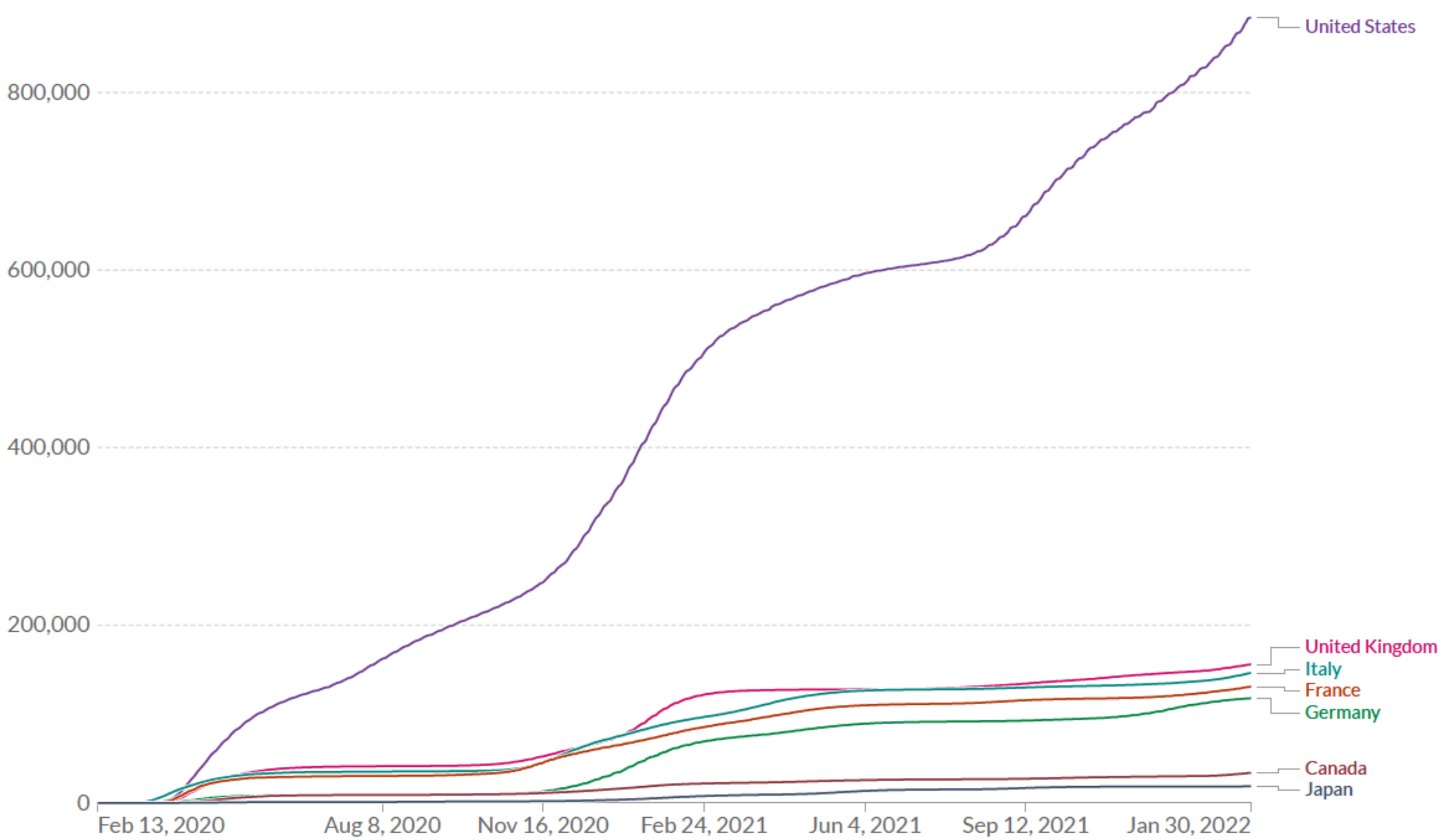
✕ Clear selection

Cumulative confirmed COVID-19 deaths

For some countries the number of confirmed deaths is much lower than the true number of deaths. This is because of limited testing and challenges in the attribution of the cause of death.

Our World in Data

LINEAR LOG



Source: Johns Hopkins University CSSE COVID-19 Data

Feb 13, 2020 Jan 30, 2022

CHART | MAP | TABLE | SOURCES | DOWNLOAD

Our goal at Our World in Data is to make data and research accessible so that we can achieve progress against the world's largest problems.

→ View all of our work on COVID-19.

→ Read about our mission.

Subscribe Feedback

Continued Claims (Insured Unemployment) (CCSA)

DOWNLOAD

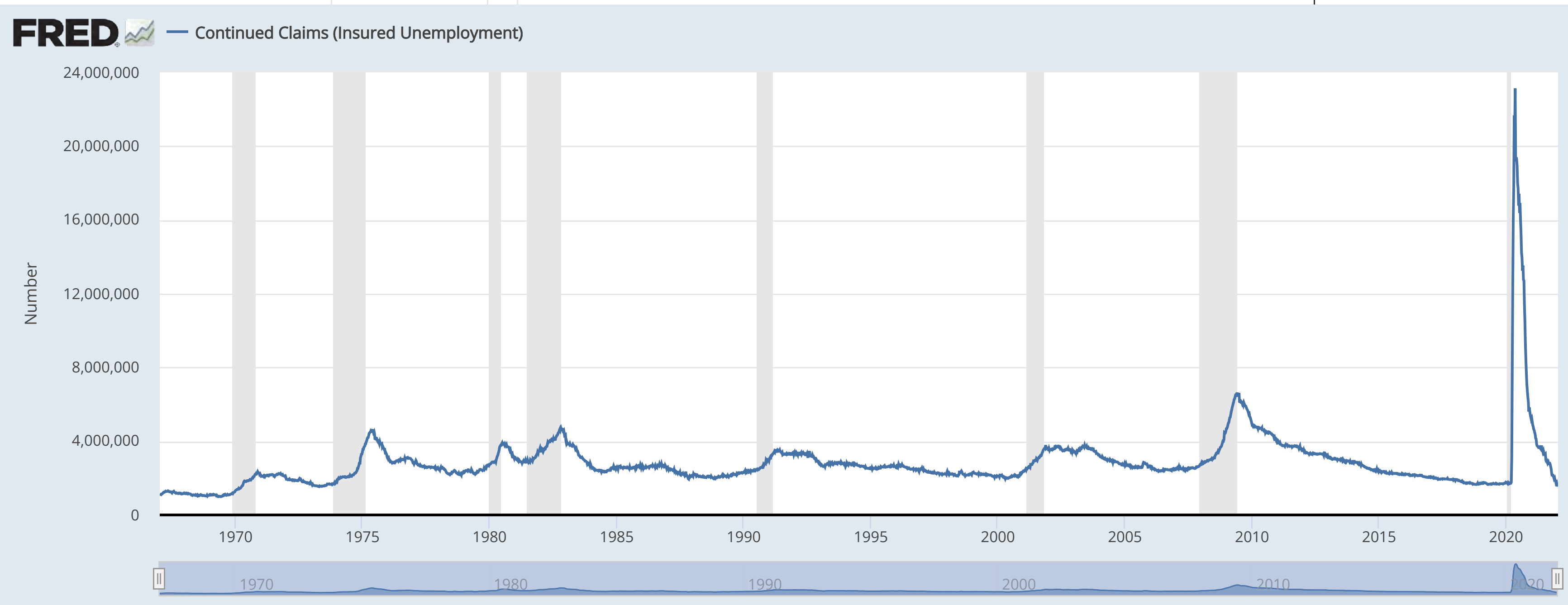
Observation:
2022-01-15: **1,675,000** (+ more)
Updated: Jan 27, 2022

Units:
Number,
Seasonally Adjusted

Frequency:
Weekly,
Ending Saturday

1Y | 5Y | 10Y | Max   1967-01-07 to 2022-01-15

EDIT GRAPH



Shaded areas indicate U.S. recessions.   Source: U.S. Employment and Training Administration   fred.stlouisfed.org

Share Links   Account Tools

NOTES

Source: U.S. Employment and Training Administration   **Release:** Unemployment Insurance Weekly Claims Report

Units: Number, Seasonally Adjusted

Frequency: Weekly, Ending Saturday

Gross Domestic Product (A191RP1Q027SBEA)

DOWNLOAD

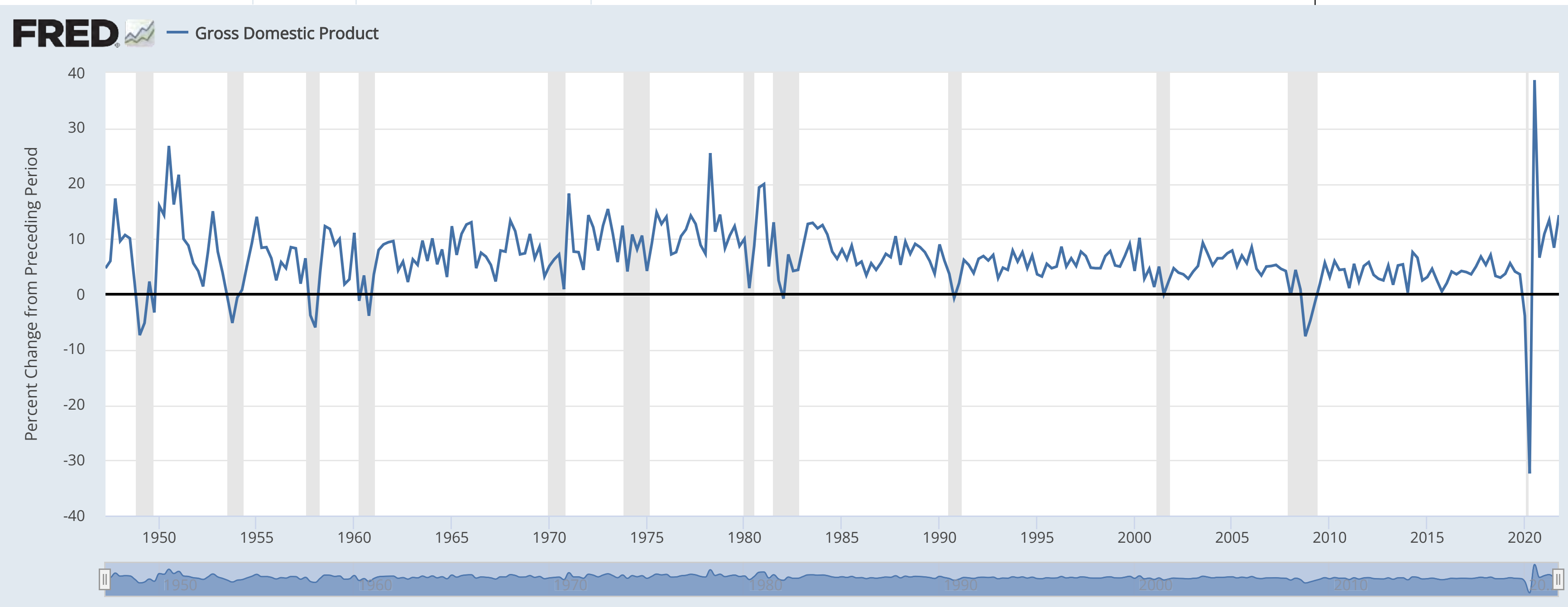
Observation:
Q4 2021: **14.3** (+ more)
Updated: Jan 27, 2022

Units:
Percent Change from Preceding Period, Seasonally Adjusted Annual Rate

Frequency:
Quarterly

1Y | 5Y | 10Y | Max   1947-04-01 to 2021-10-01

EDIT GRAPH



Shaded areas indicate U.S. recessions.   Source: U.S. Bureau of Economic Analysis   fred.stlouisfed.org

Share Links   Account Tools

NOTES

Source: U.S. Bureau of Economic Analysis   **Release:** Gross Domestic Product

Units: Percent Change from Preceding Period, Seasonally Adjusted Annual Rate

Frequency: Quarterly

Categories > Population, Employment, & Labor Markets > Weekly Initial Claims

Continued Claims (Insured Unemployment) (CCSA)

DOWNLOAD

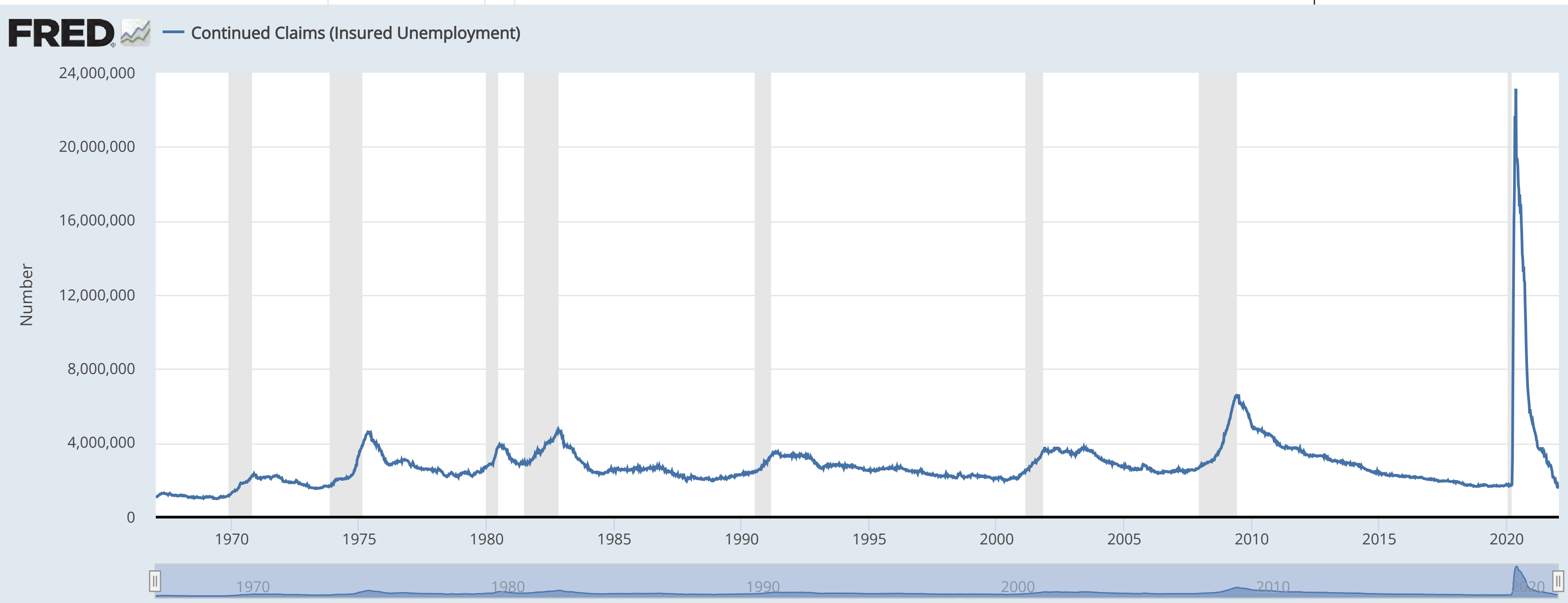
Observation:
2022-01-15: **1,675,000** (+ more)
Updated: Jan 27, 2022

Units:
Number,
Seasonally Adjusted

Frequency:
Weekly,
Ending Saturday

1Y | 5Y | 10Y | Max   1967-01-07 to 2022-01-15

EDIT GRAPH



Shaded areas indicate U.S. recessions. Source: U.S. Employment and Training Administration fred.stlouisfed.org

Share Links Account Tools

NOTES

Source: U.S. Employment and Training Administration **Release:** Unemployment Insurance Weekly Claims Report

Units: Number, Seasonally Adjusted

Frequency: Weekly, Ending Saturday

Gross Domestic Product (GDP)

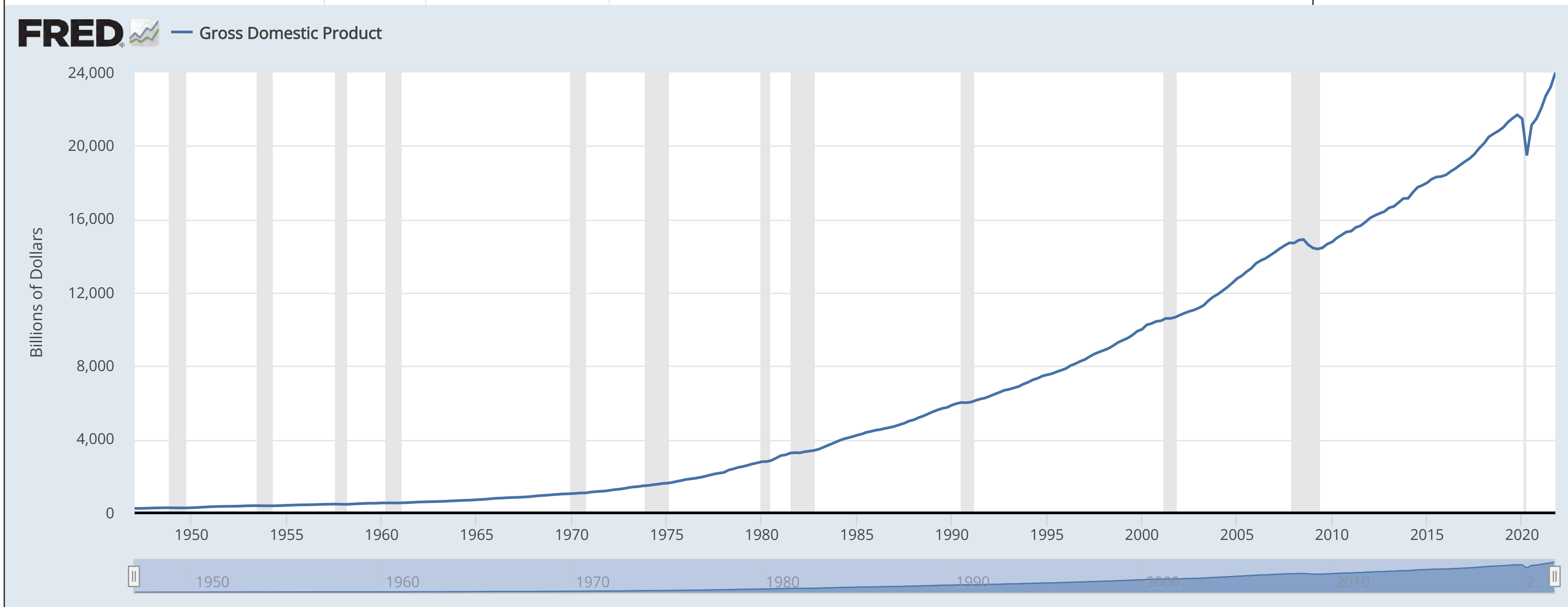
DOWNLOAD

Observation:
Q4 2021: **23,992.355** (+ more)
Updated: Jan 27, 2022

Units:
Billions of Dollars,
Seasonally Adjusted Annual Rate
Frequency:
Quarterly

1Y | 5Y | 10Y | Max 1947-01-01 to 2021-10-01

EDIT GRAPH



Shaded areas indicate U.S. recessions. Source: U.S. Bureau of Economic Analysis fred.stlouisfed.org

Share Links Account Tools

NOTES

Source: U.S. Bureau of Economic Analysis **Release:** Gross Domestic Product

Units: Billions of Dollars, Seasonally Adjusted Annual Rate

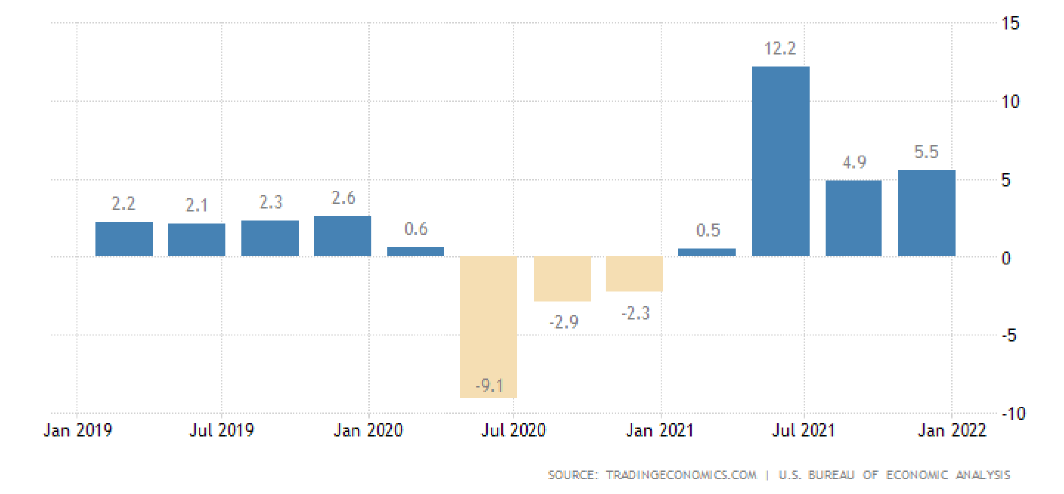
Frequency: Quarterly

United States GDP Annual Growth Rate

Summary | Calendar | Forecast | Stats | Download ▾ () | Alerts

The Gross Domestic Product (GDP) in the United States expanded 5.50 percent in the fourth quarter of 2021 over the same quarter of the previous year. source: U.S. Bureau of Economic Analysis (http://www.bea.gov)

3Y 10Y 25Y MAX Chart Compare Export API Embed



United States GDP Annual Growth Rate

The United States is the world's largest economy. Yet, in the last two decades, like in the case of many other developed nations, its growth rates have been decreasing. If in the 50's and 60's the average growth rate was above 4 percent, in the 70's and 80's dropped to around 3 percent. In the last ten years, the average rate has been below 2 percent and since the second quarter of 2000 has never reached the 5 percent level.

Actual	Previous	Highest	Lowest	Dates	Unit	Frequency
5.50	4.90	13.40	-9.10	1948 - 2021	percent	Quarterly

Compare GDP Annual Growth Rate by Country (https://tradingeconomics.com/country-list/gdp-annual-growth-rate)

Calendar	GMT	Reference		Actual	Previous	Consensus	TEForecast
2013-04-26	01:30 PM	YoY Adv	Q1 2013	1.8%	1.7%		
2013-05-30	01:30 PM	YoY Second Est	Q1 2013	1.8%	1.7%	1.8%	1.8%

+ (/calendar)

Related	Last	Previous	Unit
GDP Growth Rate (/united-states/gdp-growth)	6.90	2.30	percent
GDP Annual Growth Rate (/united-states/gdp-growth-annual)	5.50	4.90	percent
Government Spending (/united-states/government-spending)	3356.83	3381.57	USD Bill
GDP Constant Prices (/united-states/gdp-constant-prices)	19806.00	19478.89	USD Bill

Footnote 21

Work from Home Before and After the COVID-19 Outbreak

Alexander Bick, Adam Blandin and Karel Mertens

Working Paper 2017 **June 2020 (Revised February 2021)**

Research Department

https://doi.org/10.24149/wp2017r2

Work from Home Before and After the COVID-19 Outbreak*

Alexander Bick†, Adam Blandin‡ and Karel Mertens§

First version: June 9, 2020

Current version: February 23, 2021

Abstract

Based on novel survey data, we document the evolution of commuting behavior in the U.S. over the course of the COVID-19 pandemic. Work from home (WFH) increased sharply and persistently after the outbreak, and much more so among some workers than others. Using theory and evidence, we argue that the observed heterogeneity in WFH transitions is consistent with potentially more permanent changes to work arrangements in some occupations, and not just temporary substitution in response to greater health risks. Consistent with increased WFH adoption, many more – especially higher-educated – workers expect to WFH in the future.

JEL Codes: J1, J2, J22, I18, R4

Keywords: working from home, telecommuting, telework, remote work, COVID-19, pandemic

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Footnote 24

S&P Dow Jones Indices
A Division of S&P Global

Dow Jones Averages
Methodology

April 2019

Table of Contents

Introduction

Index Objective and Highlights

Dow Jones Industrial Average. The index is a 30-stock, price-weighted index that measures the performance of some of the largest U.S. companies. The index provides suitable sector representation with the exception of the transportation industry group and utilities sector which are covered by the Dow Jones Transportation Average and the Dow Jones Utility Average respectively.

Dow Jones Transportation Average. The index is a 20-stock, price-weighted index that measures the performance of some of the largest U.S. companies within the transportation industry group.

Dow Jones Utility Average. The index is a 15-stock, price-weighted index that measures the performance of some of the largest U.S. companies within the utilities sector.

Dow Jones Composite Average™. The index is a price-weighted measure of 65 U.S. companies that includes all components of the Dow Jones Industrial Average™, Dow Jones Transportation Average™, and Dow Jones Utility Average™.

Dow Jones High Yield Select 10 Index. The index measures the top ten companies in the Dow Jones Industrial Average™ selected based on indicated annual dividend yield. At each rebalancing, the constituents are equal weighted.

Dow Jones Industrial Average Yield Weighted. The index includes all the securities from the Dow Jones Industrial Average™ that pay dividends. At each rebalancing, the constituents are weighted by their indicated annual dividend yield.

Dow Jones Industrial Average Equal Weight Index. The index includes all the securities from the Dow Jones Industrial Average™. At each rebalancing, the constituents are equal weighted.

Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology	Equity Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology
S&P Dow Jones Indices' Global Industry Classification Standard (GICS) Methodology	GICS Methodology

This methodology was created by S&P Dow Jones Indices to achieve the objective of measuring the underlying interest of each index governed by this methodology document. Any changes to or deviations from this methodology are made in the sole judgment and discretion of the Averages Committee so that the index continues to achieve its objective.

Eligibility Criteria

Index Eligibility

The index universe for each index is described in the table below.

Index	Index Universe
• Dow Jones Industrial Average™	The index universe consists of securities in the S&P 500, excluding stocks classified under Global Industry Classification Standard (GICS) code 2030 (Transportation) and 55 (Utilities).
• Dow Jones Transportation Average™	The index universe consists of securities in the S&P Total Market Index classified under GICS code 2030.
• Dow Jones Utility Average™	The index universe consists of securities in the S&P Total Market Index classified under GICS code 55.
• Dow Jones Composite Average™	The index includes all constituents of the Dow Jones Industrial Average™, Dow Jones Transportation Average™ and Dow Jones Utility Average™.
• Dow Jones High Yield Select 10 Index • Dow Jones Industrial Average Yield Weighted • Dow Jones Industrial Average Equal Weight Index	All constituent stocks of the Dow Jones Industrial Average™ are eligible for the index.

Index Construction & Maintenance

Approaches

There are two steps in the creation of each index. The first is the selection of the index constituents; the second is the weighting of the constituents within the index.

Dow Jones Industrial Average™, Dow Jones Transportation Average™, and Dow Jones Utility Average™

While stock selection is not governed by quantitative rules, a stock typically is added only if the company has an excellent reputation, demonstrates sustained growth and is of interest to a large number of investors. Companies should be incorporated and headquartered in the U.S. In addition, a plurality of revenues should be derived from the U.S. Maintaining adequate sector representation within the index is also a consideration in the selection process for the Dow Jones Industrial Average™.

Changes to the indices are made on an as-needed basis. There is no annual or semi-annual reconstitution. Rather, changes in response to corporate actions and market developments can be made at any time. Constituent changes are typically announced one to five days before they are scheduled to be implemented.

At any given time, the constituents of the Dow Jones Industrial Average, Dow Jones Transportation Average and Dow Jones Utility Average make up the Dow Jones Composite Average.

Dow Jones High Yield Select 10 Index

The index is rebalanced annually effective after the close of the last trading session in December. The rebalancing reference date is five days prior to the last trading session in December.

The rebalancing process is as follows:

1. As of the rebalancing reference date, the 30 stocks of the Dow Jones Industrial Average™ are ranked by indicated annual dividend yield in descending order. No special dividends are included.
2. The top ten companies on the list are selected as the constituent stocks. The final list of constituents for the forthcoming year is announced three business days prior to the last trading session of December.
3. The new constituents are equal weighted based on closing prices of the last trading session in December

Between annual rebalances a company can be deleted from the index due to corporate events such as mergers, acquisitions, takeovers or delistings. If an index constituent is determined to be in extreme financial distress or is in bankruptcy proceedings, it may be removed to protect the integrity of the index. The non-constituent stock from the Dow Jones Industrial Average™ with the highest indicated annual dividend yield will be added to the index at a weight equaling the departing weight of the removed company.

Between annual rebalances if a constituent stock is removed from the Dow Jones Industrial Average™ for reasons other than those listed above, it will remain in the index until the next annual rebalancing. Additionally, if a constituent company reduces or suspends its dividend, it will remain in the index until the next annual rebalancing.

Dow Jones Industrial Average Yield Weighted

The index is rebalanced semi-annually effective after the close of the third Friday in March and September. The rebalancing reference dates are the last trading day of February and August.

The rebalancing process is as follows:

1. The index includes all constituents of the Dow Jones Industrial Average™ that pay dividends.
2. The index is yield-weighted based on indicated annual dividend yield as of the rebalancing reference date, defined as a stock's indicated annual dividend (not including any special dividends) divided by its price.
3. Index shares are assigned based on prices based on closing prices as of the second Friday of March and December.

Between semi-annual rebalances if a constituent stock is removed from the Dow Jones Industrial Average™, it will simultaneously be removed from the index. If a current constituent company eliminates its dividend, it will be removed from the index after the close of trading on the subsequent third Friday of March, June, September or December.

No additions are made to the index between rebalancings, except in the case of a spin-off.

Dow Jones Industrial Average Equal Weight Index

The index is rebalanced quarterly after the market close on the third Friday of the March June, September, and December.

The rebalancing process is as follows:

1. The index includes all constituents of the Dow Jones Industrial Average™.
2. At each quarterly rebalancing, companies are equally-weighted using closing prices as of the second Friday of the quarter ending month as the reference price.

Between quarterly rebalances if a constituent stock is removed from the Dow Jones Industrial Average™, it will simultaneously be removed from the index. The replacement stock is added to the index at a weight equaling the departing weight of the removed company.

Constituent Weightings

The table below describes each index's construction approach.

Index	Approach
• Dow Jones Industrial Average™ • Dow Jones Transportation Average™ • Dow Jones Utility Average™ • Dow Jones Composite Average™	The indices are price weighted.
• Dow Jones High Yield Select 10 Index • Dow Jones Industrial Average Equal Weight Index	The index is equal-dollar-weighted.
• Dow Jones Industrial Average Yield Weighted	The index is yield-weighted.

Corporate Actions

For more information on Corporate Actions, please refer to the relevant Price Weighted Indices, Equal Weighted Indices, and Modified Market Capitalization Weighted Indices sections of S&P Dow Jones Indices' Index Mathematics Methodology document.

Spin-offs. Any potential impacts on index constituents from a spin-off are evaluated by the Index Committee on a case by case basis.

Index	Approach
• Dow Jones Industrial Average™ • Dow Jones Transportation Average™ • Dow Jones Utility Average™ • Dow Jones Composite Average™	The price of the parent company is adjusted to the Price of the Parent Company minus (the Price of the Spun-off Company/Share Exchange Ratio). The index divisor adjusts simultaneously.
• Dow Jones High Yield Select 10 Index	The spun-off company is added to the index at a zero price on the ex-date with no divisor adjustment. The spin-off will be dropped from the index after the first day of regular way trading with its weight redistributed back to the parent company. The index divisor does not adjust.
• Dow Jones Industrial Average Yield Weighted	The spun-off company is added to the index at a zero price on the ex-date with no divisor adjustment. If the spin-off will not be permanently added it will be dropped from the index after the first day of regular way trading with its weight redistributed proportionately to the index. The index divisor adjusts simultaneously.
• Dow Jones Industrial Average Equal Weight Index	The spun-off company is added to the index at a zero price on the ex-date with no divisor adjustment. If the spin-off will not be permanently added it will be dropped from the index after the first day of regular way trading with its weight will be redistributed back to the parent company. The index divisor does not adjust. If the spin-off is replacing a dropped company in the index, on the effective date of the replacement, the weight of the spin-off is redistributed to the parent company. After that redistribution, the weight of the dropped company is redistributed to the spin-off. The index divisor does not adjust. If the spin-off is replacing the parent company in the index, on the effective date of the replacement, the weight of the parent is redistributed to the spin-off. The index divisor does not adjust.

For more information on Corporate Actions, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

Currency of Calculation and Additional Index Return Series

The indices are calculated in U.S. dollars. The Dow Jones Industrial Average™ is also calculated in Japanese yen. In addition, the Dow Jones Industrial Average™ is available upon request in Canadian dollars and euros.

WM/Reuters foreign exchange rates are taken daily at 4:00 PM London Time and used in the end-of-day calculation of the Dow Jones Industrial Average™ (JPY version). These mid-market fixings are calculated by The WM Company based on Reuters data and appear on Reuters pages WMRA.

In addition to the indices detailed in this methodology, additional return series versions of the indices may be available, including, but not limited to: currency, currency hedged, decrement, fair value, inverse, leveraged, and risk control versions. For a list of available indices, please refer to [S&P DJI's All Indices by Methodology Report](#).

For information on the calculation of different types of indices, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Multiple Share Classes

Each company is represented once by the Designated Listing. For more information regarding the treatment of multiple share classes, please refer to Approach B within the Multiple Share Classes section of the S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Other Adjustments

In cases where there is no achievable market price for a stock being deleted, it may be removed at a zero or minimal price at the Index Committee's discretion, in recognition of the constraints faced by investors in trading bankrupt or suspended stocks.

Index Calculations

The indices are calculated by means of the divisor methodology used in all S&P Dow Jones Indices' equity indices.

For more information on the index calculation methodology, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Base Dates and History Availability

Index history availability, base dates, and base values are shown in the table below.

Index	Launch Date	First Value Date	Base Date	Base Value
Dow Jones Industrial Average™	05/26/1896	05/26/1896	05/26/1896	40.94
Dow Jones Transportation Average™	10/26/1896	10/26/1896	10/26/1896	51.72
Dow Jones Utility Average™	01/02/1929	01/02/1929	01/02/1929	85.64
Dow Jones Composite Average™	01/02/1934	01/02/1934	01/02/1934	39.57
Dow Jones High Yield Select 10 Index	08/27/2007	10/31/1988[A] 12/29/2000[B]	10/31/1988	23.47
Dow Jones Industrial Average Yield Weighted	12/08/2015	12/31/1991[C] 03/15/2013[D]	12/31/1991[C] 03/15/2013[D]	1000
Dow Jones Industrial Average Equal Weight Index	02/13/2017	12/31/1991[C] 03/15/2013[D]	12/31/1991[C] 03/15/2013[D]	1000
Dow Jones Industrial Average™ Hedged JPY Leveraged 2X Index	09/27/2013	09/27/2013	12/31/2007	1000
Dow Jones Industrial Average™ Hedged JPY Inverse Index	09/27/2013	09/27/2013	12/31/2007	1000
Dow Jones Industrial Average™ JPY Hedged Index	09/27/2013	09/27/2013	12/31/2007	1000

[A] Price Return
[B] Total Return
[C] Price Return and Total Return
[D] Net Total Return

Index Data

Calculation Return Types

S&P Dow Jones Indices calculates multiple return types which vary based on the treatment of regular cash dividends. The classification of regular cash dividends is determined by S&P Dow Jones Indices.

- Price Return (PR) versions are calculated without adjustments for regular cash dividends.
- Gross Total Return (TR) versions reinvest regular cash dividends at the close on the ex-date without consideration for withholding taxes.
- Net Total Return (NTR) versions, if available, reinvest regular cash dividends at the close on the ex-date after the deduction of applicable withholding taxes.

In the event there are no regular cash dividends on the ex-date, the daily performance of all three indices will be identical.

For a complete list of indices available, please refer to the daily index levels file (".SDL").

For more information on the classification of regular versus special cash dividends as well as the tax rates used in the calculation of net return indices, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

For more information on the calculation and detail of return types, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Index Governance

Index Committee

The Dow Jones Industrial Average, Dow Jones Transportation Average and Dow Jones Utility Average are maintained by the Averages Committee. The Committee is composed of three representatives of S&P Dow Jones Indices and two representatives of *The Wall Street Journal*.

The Dow Jones High Yield Select 10 Index, Dow Jones Industrial Average Yield Weighted, Dow Jones Industrial Average Equal Weight Index as well as the Dow Jones Industrial Average Leveraged and Inverse indices are maintained by the Americas Thematic and Strategy Index Committee. All committee members are full-time professional members of S&P Dow Jones Indices' staff.

Each Committee meets regularly. At each meeting, the Committees review pending corporate actions that may affect index constituents, statistics comparing the composition of the indices to the market, companies that are being considered as candidates for addition to an index, and any significant market events. In addition, the Committees may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

S&P Dow Jones Indices considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all Index Committee discussions are confidential.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Index Policy

Announcements

All index constituents are evaluated daily for data needed to calculate index levels and returns. All events affecting the daily index calculation are typically announced in advance via the Index Corporate Events report (.SDE), delivered daily to all clients. Any unusual treatment of a corporate action or short notice of an event may be communicated via email to clients.

Press releases are posted on our Web site, www.spdji.com, and are released to major news services.

For more information, please refer to the Announcements section of S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Pro-forma Files

With the exception of the Dow Jones Averages, S&P Dow Jones Indices provides constituent pro-forma files each time the indices rebalance. The pro-forma file is typically provided daily in advance of the rebalancing date and contains all constituents and their corresponding weights and index shares effective for the upcoming rebalancing. In cases index shares are assigned based on prices prior to the rebalancing effective date, the actual weight of each stock at the rebalancing differs from these weights due to market movements.

Please visit www.spdji.com for a complete schedule of rebalancing timelines and pro-forma delivery times.

Holiday Schedule

The indices are calculated when the U.S. equity markets are open.

A complete holiday schedule for the year is available at www.spdji.com.

Unexpected Exchange Closures

For information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Recalculation Policy

For information on the recalculation policy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Real-Time Calculation

Real-time, intra-day, index calculations are executed during U.S. trading hours for certain indices. Real-time indices are not restated.

For information on Calculations and Pricing Disruptions, Expert Judgment and Data Hierarchy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Contact Information

For questions regarding an index, please contact: index_services@spglobal.com.

Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at www.spdji.com, major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

Tickers

The table below lists headline indices covered by this document. All versions of the below indices that may exist are also covered by this document. Please refer to S&P DJI's All Indices by Methodology Report for a complete list of indices covered by this document.

Index (Currency)	Return Type	Bloomberg	Reuters
Dow Jones Industrial Average™ (USD)	Price Return Total Return	DJI DJITR	.DJI .DJITR
Dow Jones Transportation Average™ (USD)	Price Return Total Return	TRAN DJTTR	.DJT .DJTTR
Dow Jones Utility Average™ (USD)	Price Return Total Return	UTIL DJUTR	.DJU .DJUTR
Dow Jones Composite Average™ (USD)	Price Return Total Return	COMP DJCTR	.DJA .DJCTR
Dow Jones High Yield Select 10 Index (USD)	Price Return Total Return	MUT MUTR	.MUT .MUTR
Dow Jones Industrial Average Yield Weighted (USD)	Price Return Total Return Net Total Return	DJIYW DJIYWT DJIYWN	.DJIYW -- --
Dow Jones Industrial Average Equal Weight Index (USD)	Price Return Total Return Net Total Return	DJIEW DJIEWTR DJIEWNTR	.DJIEW .DJIEWTR .DJIEWNTR
Dow Jones Industrial Average™ Hedged JPY Leveraged 2X Index	Price Return Total Return	DJIA2LJP DJIA2LJT	.DJIA2LJP .DJIA2LJT
Dow Jones Industrial Average™ Hedged JPY Inverse Index	Price Return Total Return	DJIAIJP DJIAIJT	.DJIAIJP .DJIAIJT
Dow Jones Industrial Average™ JPY Hedged Index	Price Return Total Return	DJIHJ DJIHJT	.DJIHJ .DJIHJT

Index Data

Daily constituent and index level data are available via subscription.

For product information, please contact S&P Dow Jones Indices, www.spdji.com/contact-us.

Web site

For further information, please refer to S&P Dow Jones Indices' Web site at www.spdji.com.

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Footnote 31

Essays on Energy and Environmental Economics

by

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Chapter Three

Rate of Return Regulation Revisited

Coauthor: Stephen Jarvis

1 INTRODUCTION

In the two decades from 1997 to 2017, real annual capital spending on electricity distribution infrastructure by major utilities in the United States has doubled (EIA 2018a). Over the same time period annual capital spending on electricity transmission infrastructure increased by a factor of seven (EIA 2018b). The combined total is now more than $50 billion per year. This trend is expected to continue. Bloomberg New Energy Finance predicts that between 2020 and 2050, North and Central American investments in electricity transmission and distribution will likely amount to $1.6 trillion, with a further $1.7 trillion for electricity generation and storage (Henbest et al. 2020).[1]

These large capital investments could be due to the prudent actions of utility companies modernizing an aging grid. However, it is noteworthy that over this time period, utilities have earned sizeable regulated rates of return on their capital assets, particularly when set against the unprecedented low interest rate environment post-2008. As the economy-wide cost of capital has fallen, utilities' regulated rates of return have not fallen nearly as much. The exact drivers for this divergence are unclear, though we rule out large changes in riskiness in section 3. Whatever the underlying cause, the prospect of utilities earning excess regulated returns raises an age-old concern in the sector: the Averch–Johnson effect. When utilities are allowed to earn excess returns on capital, they will be incentivized to over-invest in capital assets. The resulting costs from "gold plating" are then passed on to consumers in the form of higher bills. Capital markets and the utility industry have undergone significant changes over the past 50 years since the early studies of utility capital ownership (Joskow 1972, 1974). In this paper we use new data to revisit these issues. We do so by exploring two main research questions. First, what can we say about the return on equity utilities are allowed by their regulators? Second, how has this return on equity affected utilities' capital investment decisions?

To answer our research questions, we use data on the utility rate cases of all major electricity and natural gas utilities in the United States spanning the past four decades (Regulatory Research Associates 2021). We combine this with a range of financial information on credit ratings, corporate borrowing and market returns. To examine possible sources of over-investment in more detail we also incorporate data from annual regulatory filings on

1. North and Central American generation/storage are reported directly. Grid investments are only reported globally, so we assume the ratio of North and Central America to global is the same for generation/storage as for grid investments.

individual utility capital spending.

We start our analysis by estimating the size of the gap between the allowed rate of return that utilities earn and the correct return on equity. A central challenge here, both for the regulator and for the econometrician, is estimating the correct cost of equity. We proceed by considering a range of approaches to simulating the correct cost of equity based on the observed rates of return and available measures of capital market returns. For the most part, our simulations ask "if approved RoE rates hadn't changed relative to some benchmark index since some baseline year, what would they be today?" We examine a number of benchmark indexes. None of these are perfect comparisons; the world changes over time, and different benchmarks may be more or less appropriate. Taken together, our various estimation approaches result in a consistent trend of excess rates of return. We find that the weighted median of the approved return on equity is 0.5–4 percentage points too high.[2] Applying these additional returns to the existing capital base we estimate excess costs to US customers of $2–8 billion per year. The majority of these excess costs are from the electricity sector, though natural gas contributes as well.[3]

However, excess regulated returns on equity will also distort the incentives to invest in capital. To consider the change in the capital base, we turn to a regression analysis. Here we aim to identify how a larger RoE gap translates into over investment in capital. Identification is challenging in this setting, so we again employ several different approaches, with different identifying assumptions. In addition to a fixed effects approach, we examine an instrumental variables strategy. We draw on the intuition that when a rate case is decided a utility's RoE is *fixed* at a particular nominal percentage for several years. The cost of capital in the rest of the economy, and therefore the true RoE, will shift over time. We use these shifts in the timing and duration of rate cases as an instrument for changes in the RoE gap. We argue that the instrument is valid, after controlling for an appropriate set of fixed effects. Across the range of specifications used, we find a broadly consistent picture. In our preferred specification we find that an additional percentage point increase in the RoE gap leads to the allowed increase in capital rate base to be about 5 percent higher.

2. Here we weight by the utilities' ratebase, so our results are not over-represented by very small utilities.

3. For comparison, total 2019 electricity sales by investor owned utilities were $204 billion, on 1.89 PWh of electricity (US Energy Information Administration 2020a). Natural gas sales to consumers are $146 billion on 28.3 trillion cubic feet of gas (These gas figures include sales to residential, commercial, industrial, and electric power, but not vehicle fuel. They include including all sales, not just those by investor owned utilities. US Energy Information Administration 2020b.)

2 BACKGROUND

Electricity and natural gas utility companies are regulated by government utility commissions, which allow the companies a geographic monopoly and, in exchange, regulate the rates the companies charge. These utility commissions are state-level regulators in the US. They set consumer rates and other policies to allow investor owned utilitys (IOUs) a designated rate of return on their capital investments, as well as recovery of non-capital costs. This rate of return on capital is almost always set as a nominal percentage of the installed capital base. For instance, with an installed capital base worth $10 billion and a rate of return of 8%, the utility is allowed to collect $800 million per year from customers for debt service and to provide a return on equity to shareholders. State utility commissions typically update these nominal rates every 3–6 years.

Utilities own physical capital (power plants, gas pipelines, repair trucks, office buildings, etc.). The capital depreciates over time, and the set of all capital the utility owns is called the ratebase (the base of capital that rates are calculated on). Properly accounting for depreciation is far from straightforward, but we will not focus on that challenge in this paper. This capital ratebase has an opportunity cost of ownership: instead of buying capital, that money could have been invested elsewhere. IOUs fund their operations through issuing debt and equity, typically about 50%/50%. (For this paper, we focus on common stocks. Utilities issue preferred stocks as well, but those form a very small fraction of utility financing.) The weighted average cost of capital is the weighted average of the cost of debt and the cost of equity.

Utilities are allowed to set rates to recover all of their costs, including this cost of capital. For some expenses, like fuel purchases, it's easy to calculate the companies' costs. For others, like capital, the state public utilities commissions are left trying to approximate the capital allocation at a cost competitive capital markets would provide, if the utility was a competitive company, rather than a regulated monopoly. The types of capital utilities own, and their opportunities to add capital to their books, vary across states and time. Utilities in vertically integrated states might own a large majority of their own generation, the transmission lines, and the distribution infrastructure. Other utilities are "wires only," buying power from independent power producers and transporting it over their lines. Natural gas utilities are typically pipeline only – the utility doesn't own the gas well or processing plant.

In the 1960s and 70s, state public utilities commissions (PUCs) began adopting automatic fuel price adjustment clauses. Rather than opening a new rate case, utilities used an established formula to change their customer rates when fuel prices changed. The same automatic adjustment has not happened for capital costs, despite large swings in the nominal cost of capital over the past 50 years. We're aware of one state (Vermont) that has an automatic update rule; we'll discuss that rule in more detail in section 4.1, where we consider various approaches of estimating the RoE gap.[4]

The cost of debt financing is by no means simple, particularly for a forward-looking decision-maker who isn't allowed to index to benchmark values, but is easier to estimate than the cost of equity financing. The cost of debt is the cost of servicing historical debt, and expected costs of new debt that will be issued before the next rate case. The historical cost is known, and can serve a direct basis for future expectations. In our data, we see both the utilities' requested and approved return on debt. It's notable that the requested and approved amounts are very close for debt, and much farther apart for equity.

The cost of equity financing is more challenging. Theoretically, it's the return shareholders require on their investment in order to invest in the first place. The Pennsylvania Public Utility Commission's ratemaking guide notes this difficulty (Cawley and Kennard 2018):

> Regulators have always struggled with the best and most accurate method to use in applying the [*Federal Power Commission v. Hope Natural Gas Company* (1944)] criteria. There are two main conceptual approaches to determine a proper rate of return on common equity: "cost" and "the return necessary to attract capital." It must be stressed, however,

4. At least one other state, California, had an automatic adjustment mechanism that has since been abandoned. Regulators at the California PUC feel that the rule, called the cost of capital mechanism (CCM), performed poorly. "The backward looking characteristic of CCM might have contributed to failure of ROEs in California to adjust to changes in financial environment after the financial crisis. The stickiness of ROE in California during this period, in the face of declining trend in nationwide average, calls for reassessment of CCM." (Ghadessi and Zafar 2017)

> that no single one can be considered the only correct method and that a proper return on equity can only be determined by the exercise of regulatory judgment that takes all evidence into consideration.

Unlike debt, where a large fraction of the cost is observable and tied to past issuance, the cost of equity is the ongoing, forward-looking cost of holding shareholders' money. Put differently, the RoE is applied to the entire ratebase – unlike debt, there's typically no notion of paying a specific RoE for specific stock issues.

Regulators employ a mixture of models and subjective judgment. Typically, these formal models, as well as the more subjective evaluations, benchmark against other US utilities (and often utilities in the same geographic region). There are advantages to narrow benchmarking, but when market conditions change and everyone is looking at their neighbors, rates will update very slowly.

In figure 1 we plot the approved return on equity over 40 years, with various risky and risk-free rates for comparison. The two panels show nominal and real rates. Consistent with a story where regulators adjust slowly, approved RoE has fallen slightly (in both real and nominal terms), but much less than other costs of capital. This price stickiness by regulators also manifests in peculiarities of the rates regulators approve. Rode and Fischbeck (2019) notes the fact that regulators seem reluctant to set RoE below a nominal 10%.

That paper, Rode and Fischbeck (2019), is the closest to ours in the existing literature. The authors use the same rate case dataset we do, and note a similar widening of the spread between the approved return on equity and 10-year Treasury rates. That paper, unlike ours, dives into the financial modeling, using the standard capital asset pricing model (CAPM) to examine potential causes of the increase the RoE spread. In contrast, we consider a wider range of financial benchmarks (beyond 10-year Treasuries) and ask more pointed questions about "what should rates be today if past relationships held?" and "how much has this RoE gap incentivized utilities to own more capital?"

Using CAPM, Rode and Fischbeck (2019) rule out a number of financial reasons we might see increasing RoE spreads. Possible reasons include utilities' debt/equity ratio, the asset-specific risk (CAPM's β), or the market's overall risk premium. None of these are supported by the data. A pattern of steadily increasing debt/equity could explain an increasing gap, but debt/equity has fallen over time. Increasing asset-specific risk could explain an increasing gap, but asset risk has (largely) fallen over time. (They use the Dow Jones Utility Average as a measure of utility asset risk.) An increasing market risk premium has could explain an increased spread between RoE and riskless Treasuries, but the market risk premium has fallen over time. Appendix figure 8, reproduced from Rode and Fischbeck (2019), shows the evolution of asset risk and the market risk premium over time.

Prior research has highlighted the importance of macroeconomic changes, and that these often aren't fully accounted for in utility commission ratemaking (Salvino 1967; Strunk 2014). Because rates of return are typically set in fixed nominal percentages, rapid changes in inflation can dramatically shift a utility's real return. This pattern is visible in figure 1 in the early 1980s. Inflation has lower and much more stable in recent years,

Many authors have written a great deal about modifying the current system of investor-owned utilities. Those range from questions of who pays for fixed grid costs to the role of government ownership or securitization (Borenstein, Fowlie, and Sallee 2021; Farrell 2019). For this project, we assume the current structure of investor-owned utilities, leaving aside other questions of how to set rates across different groups of customers or who owns the capital.

Finally, we note that a utility's approved rate of return or return on equity might differ from the realized return. In this paper, we focus on approved values. Other recent work, e.g. Hausman (2019), highlights important differences between approved costs and realized prices that customers face.

3 DATA

To answer our research questions, we use a database of resolved utility rate cases from 1980 to 2021 for every electricity and natural gas utility that either requested a nominal-dollar ratebase change of $5 million or had a ratebase change of $3 million authorized (Regulatory Research Associates 2021). Summary statistics on these rate cases can be seen in table 1.

We transform this panel of rate case events into an unbalanced utility-by-month panel, filling in the rate base and rate of return variables in between each rate case. There are some mergers and splits in our sample, but our SNL Financial (SNL) data provider lists each company by its present-day (2021) company name, or the company's last operating name before ceased to exist. With this limitation in mind, we construct our panel by (1) not filling data for a company before its first rate case in a state, and (2) dropping companies five years after their last rate case. In contexts where a historical comparison is necessary, but the utility didn't exist in the benchmark year, we use average of utilities that did exist in that state, weighted by ratebase size.

We match with data on S&P credit ratings, drawn from SNL's *Companies (Classic) Screener* (2021) and Wharton Research Data Services (WRDS)' *Compustat S&P legacy credit ratings* (2019). Most investor-owned utilities are subsidiaries of publicly traded firms. We use the former data to match as specifically as possible, first same-firm, then parent-firm, then same-ticker. We match the latter data by ticker only. Then, for a relatively small number of firms, we fill forward.[5] Between these two sources, we have ratings data are available from December 1985 onward. Approximately 80% of our utility–month observations are matched to a rating. Match quality improves over time: approximately 89% of observations after 2000 are matched.

These credit ratings have changed little over 35 years. In figure 2 we plot the median (in black) and various percentile bands (in shades of blue) of the credit rating for utilities active in each month. We note that the median credit rating has not changed much over time. The distribution of ratings is somewhat more compressed in 2021 than in the 1990s. While credit ratings are imperfect, we would expect rating agencies to be aware of large changes in riskiness.[6] Instead, the median credit rating for electricity utilities is A−, as it was for all of the 1990s. The median credit rating for natural gas utilities is also A−, down from a historical value of A.

Beyond credit ratings, we also use various market rates pulled from Federal Reserve Economic Data (FRED). These include 1-, 10-, and 30-year treasury yields, the core CPI, bond yield indexes for corporate bonds rated by Moody's as Aaa or Baa, as well as those rated by S&P as AAA, AA, A, BBB, BB, B, and CCC or lower.[7]

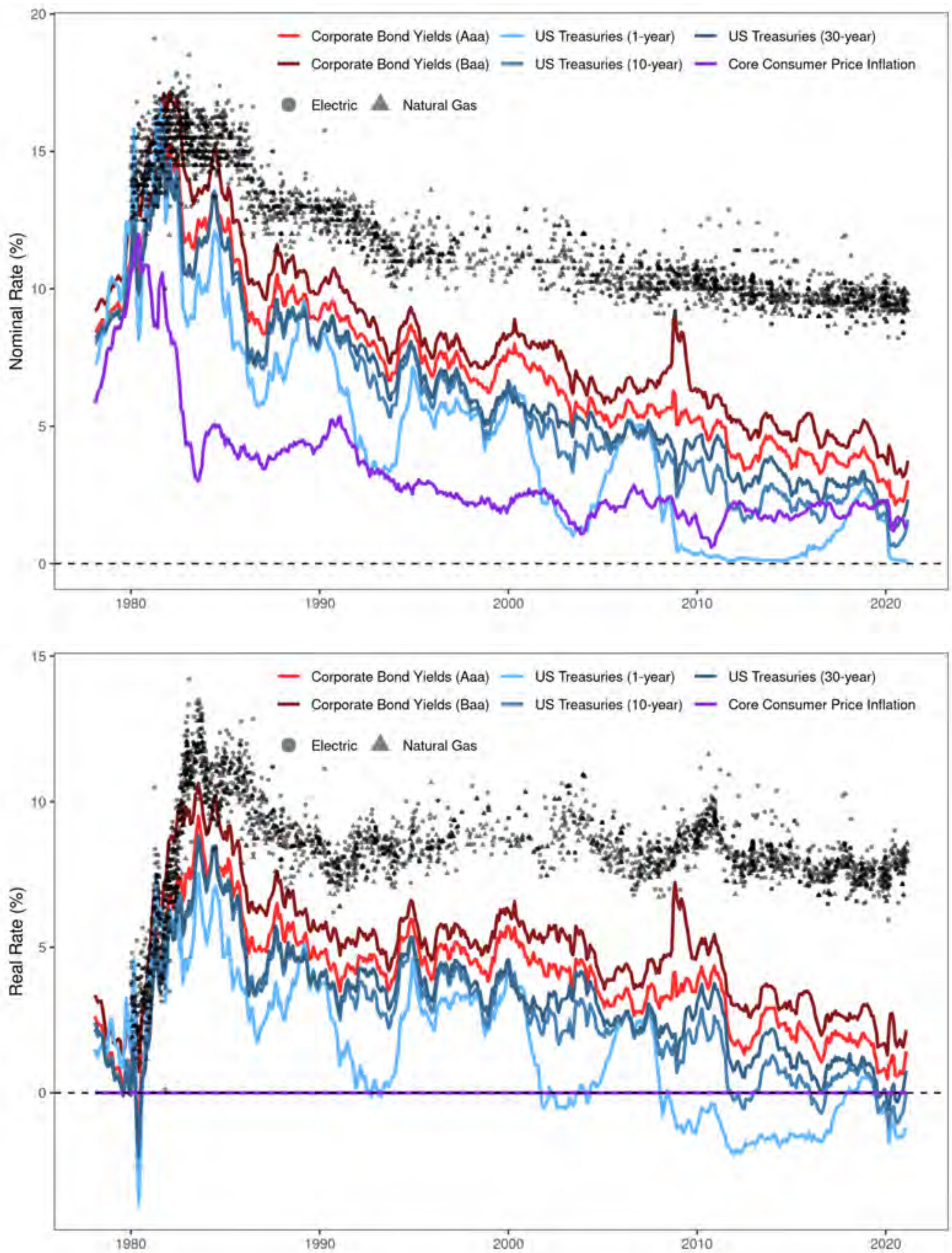
Matching these two datasets – rate cases and macroeconomic indicators – we construct the

5. When multiple different ratings are available, e.g. different ratings for subsidiaries trading under the same ticker, we take the median rating. We round down in the case of an even number of ratings, both here and in figure 2.

6. For utility risk to drive up the firms' cost of equity but not affect credit ratings, one would need to tell a very unusual story about information transmission or the credit rating process.

7. Board of Governors of the Federal Reserve System (2021a, 2021b, 2021c), US Bureau of Labor Statistics (2021), Moody's (2021a, 2021b), and Ice Data Indices, LLC (2021b, 2021a, 2021f, 2021d, 2021c, 2021g, 2021e).

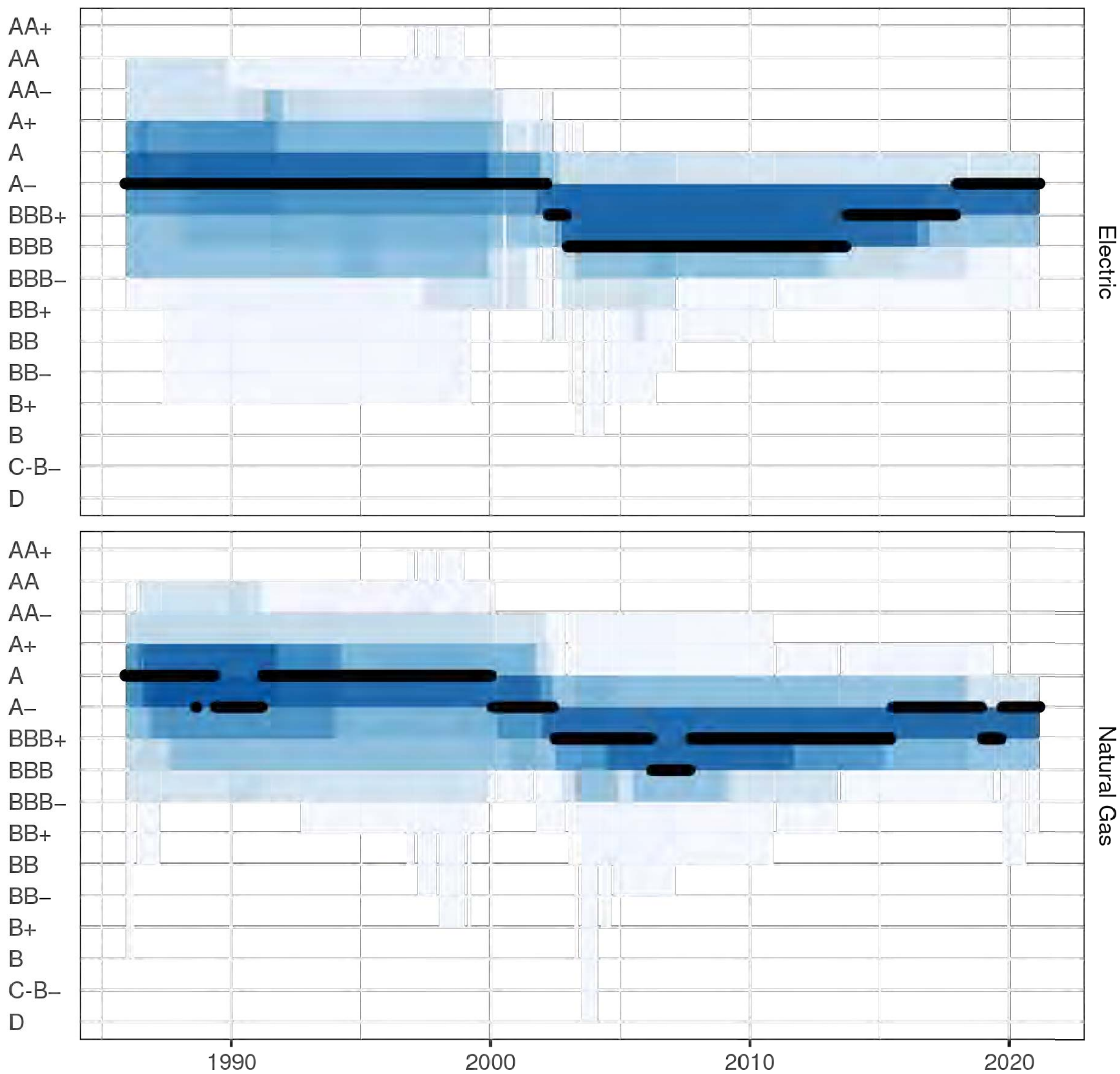
Figure 1: Return on Equity and Financial Indicators: Nominal and Real



Notes: These figures show the approved return on equity for investor-owned US electric and natural gas utilities. Each dot represents the resolution of one rate case. Real rates are calculated by subtracting consumer price index (CPI). Between March 2002 and March 2006 30-year Treasury rates are interpolated from 1- and 10-year rates.

Sources: Regulatory Research Associates (2021), Moody's (2021a, 2021b), Board of Governors of the Federal Reserve System (2021a, 2021b, 2021c), and US Bureau of Labor Statistics (2021).

Figure 2: Credit ratings have changed little in 35 years



NOTE: Black lines represent the median rating of the utilities active in a given month. We also show bands, in different shades of blue, that cover the 40–60 percentile, 30–70 percentile, 20–80 percentile, 10–90 percentile, and 2.5–97.5 percentile ranges. (Unlike later plots, these *are not* weighted by ratebase.) Ratings from C to B– are collapsed to save space.
SOURCE: *Companies (Classic) Screener* (2021) and *Compustat S&P legacy credit ratings* (2019).

Table 1: Summary Statistics

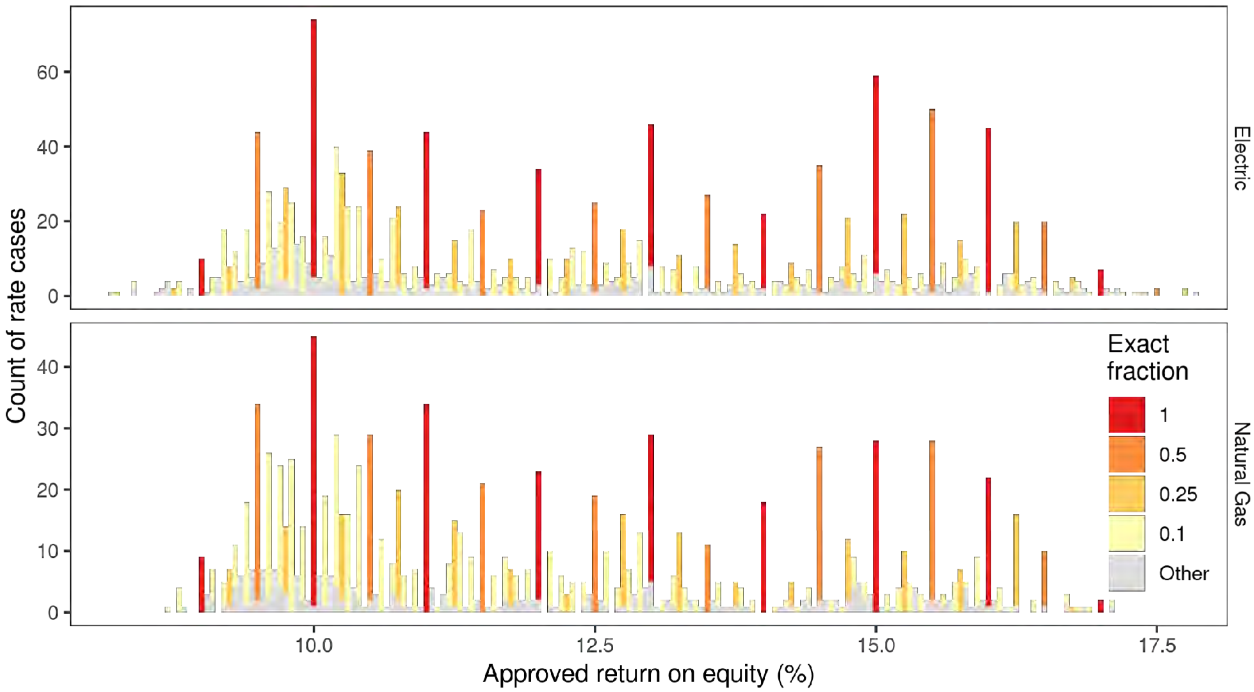
Characteristic	N	Electric	Natural Gas
Rate of Return Proposed (%)	3,324	9.95 (1.98)	10.07 (2.07)
Rate of Return Approved (%)	2,813	9.59 (1.91)	9.53 (1.95)
Return on Equity Proposed (%)	3,350	13.22 (2.69)	13.06 (2.50)
Return on Equity Approved (%)	2,852	12.38 (2.40)	12.05 (2.24)
Return on Equity Proposed Spread (%)	3,350	6.72 (2.18)	6.95 (1.99)
Return on Equity Approved Spread (%)	2,852	5.62 (2.27)	5.68 (2.10)
Return on Debt Proposed (%)	3,247	7.48 (2.11)	7.47 (2.16)
Return on Debt Approved (%)	2,633	7.54 (2.06)	7.44 (2.16)
Equity Funding Proposed (%)	3,338	45 (7)	48 (7)
Equity Funding Approved (%)	2,726	44 (7)	47 (7)
Rate Case Duration (mo)	3,713	9.1 (5.1)	8.1 (4.3)
Rate Base Increase Proposed ($ mn)	3,686	84 (132)	24 (41)
Rate Base Increase Approved ($ mn)	3,672	40 (84)	12 (25)
Rate Base Proposed ($ mn)	2,366	2,239 (3,152)	602 (888)
Rate Base Approved ($ mn)	1,992	2,122 (2,991)	583 (843)

NOTES: This table shows the rate case variables in our rate case dataset. Values in the Electric and Natural Gas columns are means, with standard deviations in parenthesis.
Approved values are approved in the final determination, and are the values we use in our analysis. Some variables are missing, particularly the approved rate base. The RoE spread in this table is calculated relative to the 10-year Treasury rate.
SOURCE: Regulatory Research Associates (2021) and author calculations.

timeseries shown in figure 1. A couple of features jump out, as we mentioned in the introduction. The gap between the approved return on equity and other measures of the cost of capital have increased substantially over time. At the same time, the return on equity has decreased over time, but much more slowly than other indicators. We quantify these observations in section 5.

We note that there are other distortions or ad-hoc evaluations in the PUC process. Rode and Fischbeck (2019) note a hesitancy for PUCs to set RoE below a nominal 10% level. We replicate this finding. In addition, we also note a bias toward round numbers, where regulators tend to approve RoE values at integers, halves, quarters, and tenths of percentage points. This finding is demonstrated in figure 3. We believe the true, unknown, cost of equity is smoothly distributed. If for instance, a PUC rounds in a way that changes the allowed RoE by 10 basis points (0.1%), the allowed revenue on the existing ratebase for the average electric utility in 2019 would change by $114 million. (The median is lower, at $52 million.) Small deviations have large implications for utility revenues and customer payments, though we don't know if rounding has a systematic bias toward higher or lower RoE. Of course, RoE values that aren't set at round numbers might not be any closer to the correct RoE. We leave this round number bias, as well as the above-10% stickiness, for future research.

Figure 3: Return on equity is often approved at round numbers



Colors highlight values of the nominal approved RoE that fall exactly on round numbers. More precisely, values in red are integers. Values in dark orange are integers plus 50 basis points (bp). Lighter orange are integers plus 25 or 75 bp. Yellow are integers plus one of {10, 20, 30, 40, 60, 70, 70, 80, 90} bp. All other values are gray.
Histogram bin widths are 5 bp. Non-round values remain gray if they fall in the same histogram bin as a round value. In that case, the bars are stacked.

SOURCE: Regulatory Research Associates (2021).

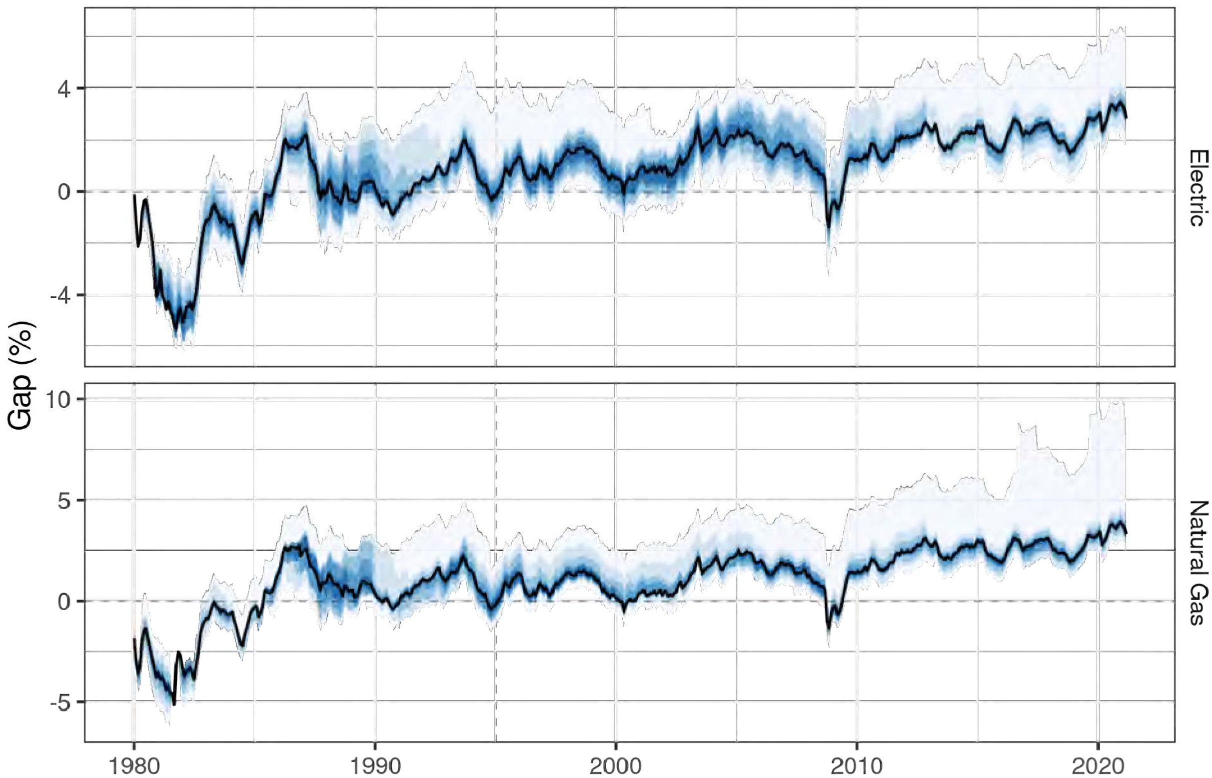
4 EMPIRICAL STRATEGY

4.1 RETURN ON EQUITY GAP

Knowing the return on equity (RoE) gap size is a challenge, and we take a couple of different approaches. None are perfect, but collectively, they shed light on the question. For each of the strategies we outline below (in sections 4.1.1, 4.1.2, 4.1.3, and 4.1.4) we plot the timeseries of the RoE gap. These are plotted in figures 4, 5, 6, and 7. Many of these strategies pick a specific time period as a benchmark. For all of these, we use January 1995. For the most part, our RoE gap results are flat over time (in the case of CPI) or steadily upward sloping (in the case of corporate bonds). The choice of baseline date determines where zero is, so changing the baseline date will shift the overall magnitude of the gap. As long as the baseline date isn't in the middle of a recession, our qualitative results don't depend strongly on the choice.

In each plot, we present the median of our RoE gap estimates, weighting by the utility's ratebase (in 2019 dollars). Our goal is to show the median of ratebase dollar value, rather than the median of utility companies, as the former is more relevant for understanding the impact of the RoE gap. We also show bands, in different shades of blue, that cover the 40–60 percentile, 30–70 percentile, 20–80 percentile, 10–90 percentile, and 2.5–97.5 percentile (all weighted by ratebase).

Figure 4: Return on equity gap, benchmarking to Baa-rates corporate bonds



Base year is 1995. Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU ratebase. See calculation details in section 4.1.1.

4.1.1 Indexed to Corporate Bonds

We first consider a benchmark index of corporate bond yields, rated Baa by Moody's.[8] The idea here is to ask if the *average* spread against the Baa rating hadn't changed since the baseline, what would the RoE be today? The results are plotted in figure 4. Moody's Baa is approximately equivalent to S&P's BBB, which is at or slightly below our most of the utilities in our data. We use January 1995 as our baseline. Our findings are qualitatively the same for other dates, though the magnitude differs.

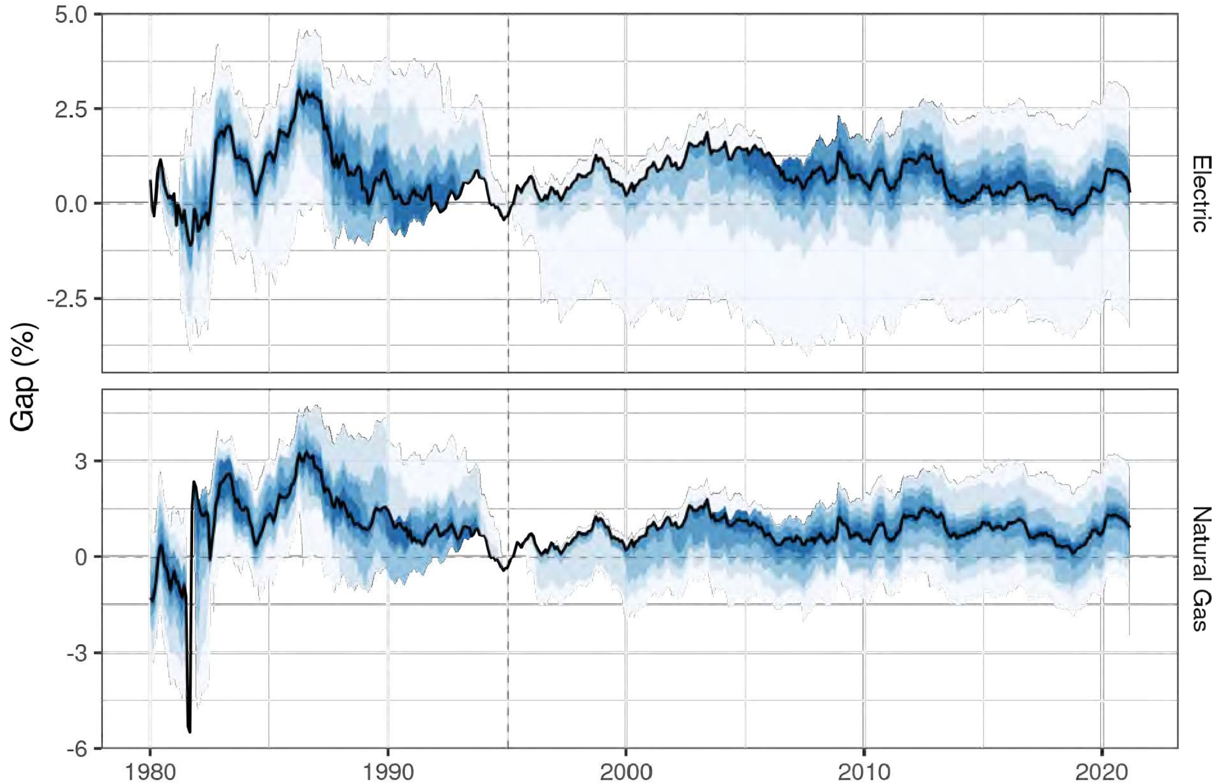
Making comparisons to debt instruments in this way, rather than benchmarking to some economy-wide cost of equity, means the measure of the RoE gap likely understates the gap. Rode and Fischbeck (2019) points out that (1) the market-wide equity risk premium has declined over the period and (2) the same is true for the utility sector.[9] Therefore, we would expect the mean spread against Baa bond yields to have declined, but instead, the spread has increased.

To calculate these results we first find the spread between the approved return on equity and the Moody's Baa rate for each utility in each state in each month. We then take the average at our baseline and simulate what that spread would be if the overall average

8. This index is one of two rating-specific corporate bonds indexes that's available for our entire study period. The other is Moody's Aaa.

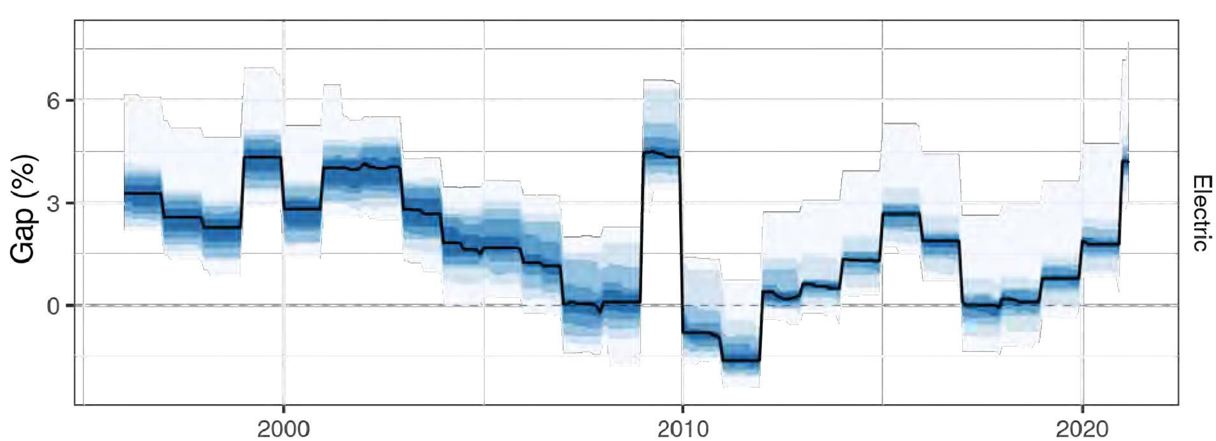
9. To the extent that observed utility stock returns are endogenous to the approved RoE, point #2 might be biased (Werth 1980).

Figure 5: Return on equity gap, using Vermont's update rule



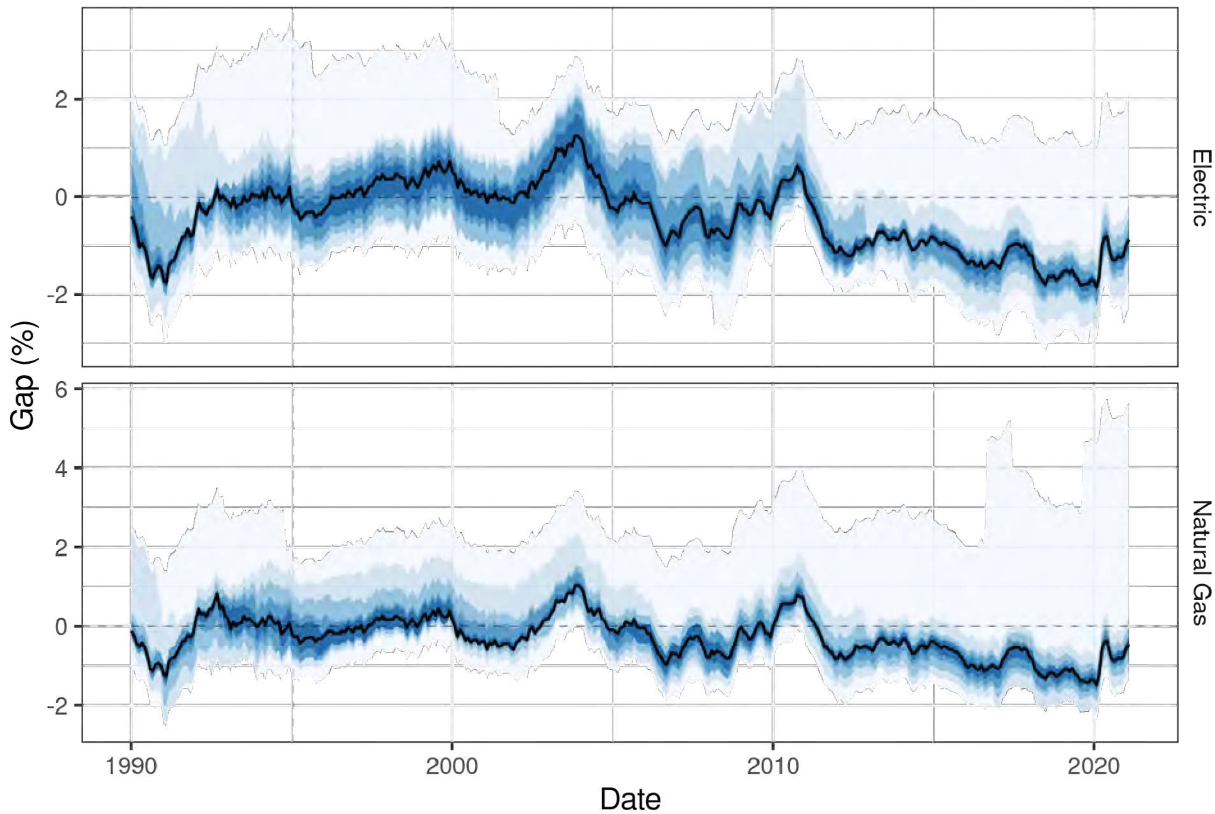
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU ratebase. See calculation details in section 4.1.2.

Figure 6: Return on equity gap, compared to UK utilities



Base year is 1995. Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU ratebase. See calculation details in section 4.1.3.

Figure 7: Return on equity gap, benchmarking to CPI



Base year is 1995. Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU ratebase. See calculation details in section 4.1.4. Dates before 1990 are omitted for better axis scaling.

spread hadn't changed. One advantage of this approach is that we can still allow utilities to move around in their relative rankings and RoE. For example if a particular utility gets riskier and has correspondingly high RoE, our measure allows for that change in individual riskiness.

4.1.2 *Indexed to Treasuries*

Our next measure uses the RoE update rule recently implemented by the Vermont PUC. This rule is the only one we're aware of, from any PUC, that currently does automatic updating. Define R' as the baseline RoE, B' as the baseline 10-year Treasury bond yield, and B_t as the 10-year Treasury bond yield in year t. The update rule says the RoE in year t is then:

$$R_t = R' + \frac{B_t - B'}{2}$$

In the graph, we set the baseline to January 1995. In reality the commission set the baseline period as December 2018, for their plan published in June 2019. (*Green Mountain Power: Multi-Year Regulation Plan 2020–2022* 2020). We simulate the gap between approved RoE and what RoE would have been if every state's utilities commission followed this rule from 1995 onward. (Pre-1995 values are not particularly meaningful, but we can calculate them with the same formula.) We plot results in figure 5.

4.1.3 International Benchmark

We also consider an international benchmark. Here we ask, "what if US utilities faced a return on equity that was the same as return on equity in the UK?" Unlike the previous cases, we're not considering some benchmark year. Instead, we're considering the contemporaneous gap between the US and UK. Of course many things are different between these countries, and it's not fair to say all US utilities should adopt UK rate making, but we've think this benchmark provides an interesting comparison. Our results are in figure 6.

4.1.4 Indexed to Inflation

We also consider a calculation where we benchmark against core CPI. The mechanics of this calculation are identical to the Baa comparison above, where we calculate the gap between approved RoE and what the RoE would be if the mean spread against core CPI were unchanged. In this analysis, we find a small negative gap: real approved values RoE have declined, but by less than other costs of capital.

4.2 RATE BASE IMPACTS

Next, we turn to the ratebase the utilities own. A utility with a positive RoE gap will have a too-strong incentive to have capital on their books. In this section, we investigate the change in ratebase utilities request and receive. For our purposes, change in ratebase is more relevant than the total ratebase, as the change is a flow variable that changes from rate case to rate case, while the total ratebase is the partially-depreciated stock of all previous ratebase changes. We consider both the requested change and the approved change, though the approved value is our preferred specification. We estimate $\hat{\beta}$ from the following:

$$\log(RBI_{i,t}) = \beta RoE^{gap}_{i,t} + \gamma X_{i,t}\theta_i + \lambda_t + \epsilon_{i,t} \quad (3.1)$$

where an observation is a utility rate case for utility i in year-of-sample t. The dependent variable, $RBI_{i,t}$, is the increase in the rate base, and we take logs. (Cases where the ratebase shrinks are rare, but do happen. We drop these cases.) The independent variable of interest, $RoE^{gap}_{i,t}$, is the gap between the allowed return on equity and the true return on equity over the length of the rate case, where each rate case has a duration of D years.

$$RoE^{gap}_{i,t} = RoE^{allowed}_{i,t} - \frac{1}{D}\sum_{t}^{t+D} RoE^{correct}_{i,t} \quad (3.2)$$

Unlike section 4.1, for this analysis we care about differences in the gap between utilities or over time, but do not care about the overall magnitude of the gap. For ease of implementation, we begin by considering the gap as the spread between the approved rate of return and the 10-year Treasury bond yield. We do not expect the correct return on equity to be equal to the 10-year Treasury yield, but our fixed effects account for any constant differences. Future research will consider a richer range of gap calculations.

4.2.1 Fixed Effects Specifications

Our goal is to make causal claims about $\hat{\beta}$, so we are concerned about omitted variables that are correlated with both the estimated RoE gap and the change in ratebase. We begin with a fixed-effects version of the analysis. Our preferred version includes time fixed effects, λ_t, at the year-of-sample level and the unit fixed effects, θ_i, are at the utility company and state level.[10] Here, the identifying assumption is that after controlling for state and year effects, there are no omitted variables that would be correlated with both our estimate of the RoE gap and the utility's change in ratebase. The identifying variation is the differences in the RoE gap within the range of rate case decisions

10. Many utilities operate within only on state, but some span multiple. These company and state fixed effects are only partially nested.

Table 2: RoE gap, by different benchmarks

A: Electric		Baa yield	VT rule	UK	CPI
Gap (%)	2000	0.796	0.21	3.17	0.531
	2020	3.26	0.485	2.03	−1.06
Excess payment ($bn)	2000	0.581	0.23	4.54	0.142
	2020	6.54	1.43	3.92	−2.61
B: Natural Gas					
Gap (%)	2000	0.969	0.142		0.704
	2020	3.9	1.15	1.89	−0.421
Excess payment ($bn)	2000	0.0896	0.0183		0.0212
	2020	2.14	0.658	0.975	−0.361

NOTE: Gap percentage figures are an unweighted average across utilities. Excess payments are totals for all IOUS in the US, in billions of 2019 dollars per year, *for the observed ratebase.*
For cases where it's relevant (Baa yield, VT rule, and CPI), the benchmark date is January 1995. See text for details of each benchmark calculation.

for a given utility, relative to the annual average across all utilities. These fixed effects handle some of the most critical threats to identification, such as macroeconomic trends, technology-driven shifts in electrical consumption, or static differences in state PUC behavior. In columns 1–3 of our results tables (3 and 4), we consider different specifications for our fixed effects.

In this case the identification hinges on looking at variation in the RoE gap within the range of rate case decisions for a given utility, relative to the annual average across all utilities. The identifying assumption is that after controlling for state, year, and company effects, there are no omitted variables that would be correlated with both our estimate of the RoE gap and the utility's change in ratebase. These fixed effects handle many of the stories one could tell, such as macroeconomic trends, technological shifts in electrical consumption, or static differences in state PUC behavior. However, there are certainly other avenues for omitted variables bias to creep in, so next we turn to an instrumental variables strategy.

4.2.2 *Instrumenting with Rate Case Timing and Duration*

To try and further deal with concerns regarding identification, we examine an instrumental variables approach based on the timing and duration of rate cases.

Our IV analysis takes the idea that rates move around in ways that aren't always easy for the regulator to anticipate. So for instance if the allowed return on equity is set in year 0 and financial conditions change in year 2 such that the real allowed return on equity increases, then we would expect the utility to increase their capital investments in ways that

Table 3: Relationship Between Proposed Rate of Return and Proposed Rate Base

	Fixed effects specs.			IV
Model:	(1)	(2)	(3)	(4)
Variables				
RoE gap (%)	0.0670***	0.0436*	0.0672***	0.0353
	(0.0134)	(0.0217)	(0.0151)	(0.0215)
Fixed-effects				
State	Yes	Yes	Yes	Yes
Year		Yes	Yes	Yes
Company			Yes	Yes
Fit statistics				
Observations	3,210	3,210	3,210	3,210
R^2	0.37	0.39	0.73	0.73
Within R^2	0.24	0.23	0.29	0.29
Wald (1st stage)				50.9
Dep. var. mean	63.69	63.69	63.69	63.69

Two-way (Year & Company) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

NOTES: The dependent variable in the first panel is log of the utility's proposed rate base increase. Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.2. Our preferred specification is column 4 of table 4. First-stage *F*-statistic is Kleibergen–Paap robust Wald test. All regressions control for an indicator of electricity or natural gas.

are unrelated to other aspects of the capital investment decision. For this instrument to work, it needs to be the case that these movements in bond markets or the like are conditionally independent of decisions that the utility is making, except via this return on equity channel. We control for common year fixed effects, and then the variation that drives our estimate is that different utilities will come up for their rate case at different points in time.

5 RESULTS

Beginning with the RoE gap analysis from section 4.1, table 2 summarizes the graphs, using 2000 and 2020 as example points in time. The table highlights the RoE gap and the excess payment on the existing ratebase. Our results on the RoE gap can largely be guessed from a close inspection of figure 1. Approved RoE has not changed much in real terms (i.e. relative to core CPI), but the gap has increased between RoE and various financial benchmarks. Of our various imperfect estimates of the gap, we believe the Baa benchmark is the most credible.

Table 4: Relationship Between Approved Rate of Return and Approved Rate Base

	Fixed effects specs.			IV
Model:	(1)	(2)	(3)	(4)
Variables				
RoE gap (%)	0.0551***	0.0752***	0.0867***	0.0523**
	(0.0200)	(0.0240)	(0.0225)	(0.0252)
Fixed-effects				
State	Yes	Yes	Yes	Yes
Year		Yes	Yes	Yes
Company			Yes	Yes
Fit statistics				
Observations	2,491	2,491	2,491	2,491
R^2	0.33	0.36	0.69	0.69
Within R^2	0.21	0.20	0.22	0.22
Wald (1st stage)				69.1
Dep. var. mean	38.63	38.63	38.63	38.63

Two-way (Year & Company) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

NOTES: The dependent variable in the first panel is log of the utility's approved rate base increase. Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.2. Our preferred specification is column 4. First-stage *F*-statistic is Kleibergen–Paap robust Wald test. All regressions control for an indicator of electricity or natural gas.

Totalling up the 2020 excess payments gives us $8.7 billion in the Baa benchmark, or $2.1 billion in the Vermont benchmark. The UK benchmark falls between these, at $4.9 billion.

We also consider how the RoE gap affects capital ownership. Tables 3 and 4 show our regression results for proposed and approved values, respectively. Our preferred specification is column 4, the IV specification, in table 4. These results find that a 1 percentage point increase in the approved RoE gap leads to a 5.2% increase in the increase in approved rate base. These results have a strong first stage (Kleibergen–Paap *F*-stat of 69).

As a caveat, we note that an IOU can increase their capital holdings in two distinct ways. One option is to reshuffle capital ownership, either between subsidiaries or across firms, so that the IOU ends up with more capital on its books, but the total amount of capital is unchanged. The second option is to actually buy and own more capital, increasing the total amount of capital that exists in the state's utility sector. We do not differentiate between these two cases. Because we don't differentiate, we consider excess payments by utility customers, but we remain agnostic about the socially optimal level of capital investment.

6 CONCLUSION

Utilities invest a great deal in capital, and need to be compensated for the opportunity cost of their investments. Getting this rate of return, particularly the return on equity, correct is challenging, but is a first-order important task for state PUCs.

Our analysis shows that the RoE that utilities are allowed to earn has changed dramatically relative to various financial benchmarks in the economy. Across relevant benchmarks, we found that current rates are perhaps 0.5–4 percentage points too high, resulting in $2–8 billion in excess rate collected per year, given the existing ratebase.

We then turned to the Averch–Johnson effect, and estimated the additional capital this RoE gap generates. In our preferred specification, we estimate that an additional percentage point in the RoE gap leads to 5% higher rate base increases.

We hope that policymakers and regulators consider these changes and these benchmarks in future rate making and the role that a wider variety of metrics benchmarks and adjustments can play in utility rate cases. We close by echoing Rode and Fischbeck (2019) and the Vermont PUC. Just as PUCs adopted fuel adjustment clauses in the 1960s and 1970s, RoE adjustment clauses are a tool that would allow rates to automatically adjust to changing market conditions. It would, of course, be possible to change the formula from time to time, but by default, the PUC wouldn't need to, even as the cost of raising capital changes. If such a scheme was implemented, it would be necessary to think hard about the baseline rate. As we demonstrated, the approved RoE has grown over time, so the choice of baseline period is crucial.

Figure 8: Figures 8 and 9 from Rode and Fischbeck (2019), showing CAPM β and market risk premium

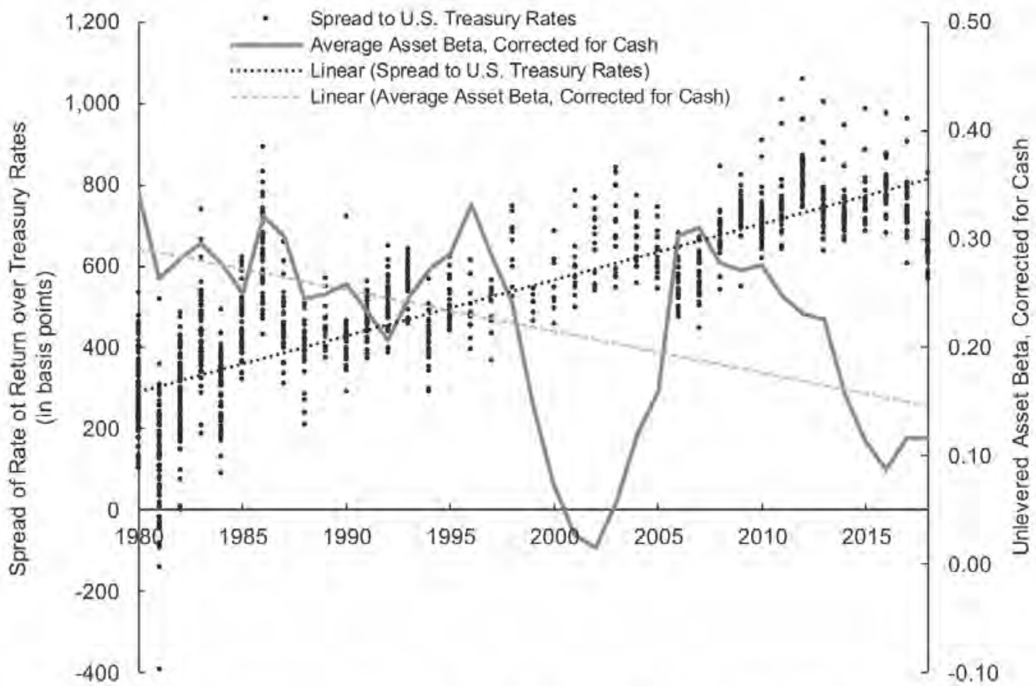


Fig. 8. Authorized return on equity premium vs. industry average asset beta.

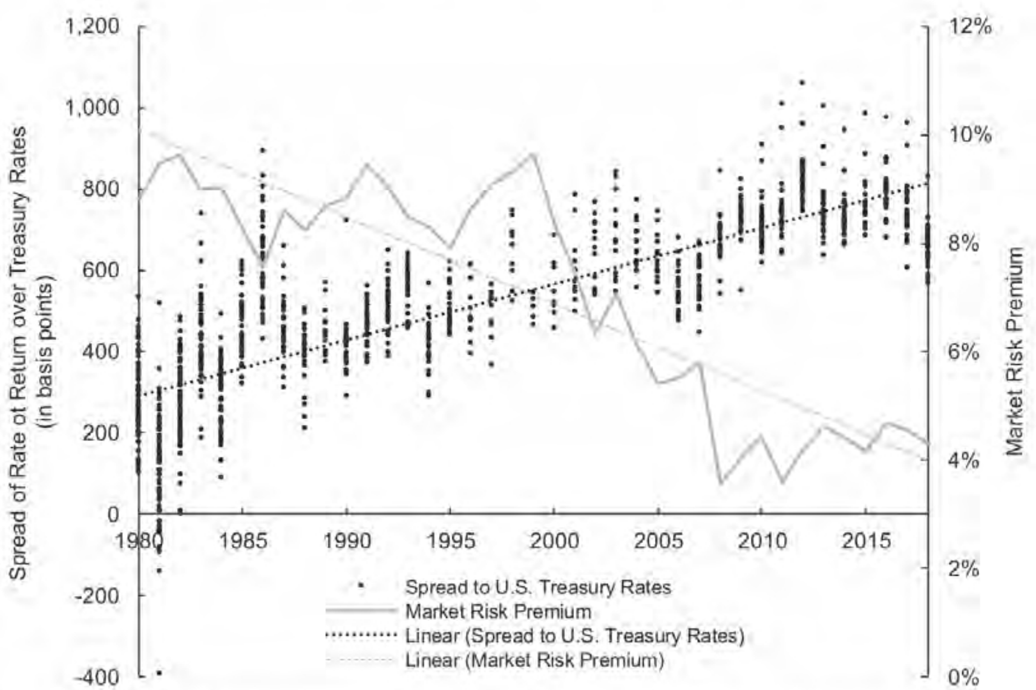


Fig. 9. Authorized rate-of-return premium vs. *ex ante* estimated market risk premium.

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