- A firm's risk exposure (beta), another component of the discount rate, changes through time and is a function of its capital structure. Thus, a firm's risk increases with leverage, which is related to the business cycle.
- The last component of the discount rate is the risk-free rate, which is determined by the term structure of interest rates. The term structure reflects expectations of real interest rates, real economic activity and inflation, which are connected to the business cycle.

Thus, equity returns, and financial asset returns in general, are predictable to a certain extent. Expected returns of many assets tend to be high in bad macroeconomic times and low in good times.

This predictability of returns manifests itself statistically through *autocorrelation*. Autocorrelation in time series of returns describes the correlation between values of a return process at different points in time. Autocorrelation can be positive when high returns tend to be followed by high returns, implying momentum in the market. Conversely, negative autocorrelation occurs when high returns tend to be followed by low returns, implying mean reversion. In either case, autocorrelation induces dependence in returns over time.

Empirical persistence of the business cycle makes financial asset returns somewhat predictable.

Traditional mean-variance analysis focused on short-term expected return and risk assumes that returns do not exhibit time dependence and that prices follow a random walk. In a random walk, expected returns are constant, exhibiting zero autocorrelation; realized short-term returns are unpredictable. Volatilities and cross-correlations among assets are independent of the investment horizon. Thus, the annualized volatility estimated from monthly return data, scaled by the square root of 12, should be equal to the volatility estimated from quarterly return data, scaled by the square root of 4.

In the presence of autocorrelation, the scaling rule described above (using the square root of time) is invalid, since the sample standard deviation estimator is biased and the sign of autocorrelation matters for its impact on volatility and correlations. **Positive autocorrelation leads to an underestimation of true volatility.** A similar result holds for the cross-correlation matrix bias when returns exhibit autocorrelation. For long investment horizons, the risk/return tradeoff can be very different than for short investment horizons.

In a multi-asset portfolio, in which different asset classes display varying degrees of autocorrelation, failure to correct for the bias of volatilities and correlations will lead to suboptimal mean variance-optimized portfolios in which asset classes that appear to have low volatilities receive excessive allocations. Such asset classes include hedge funds, emerging market equities and non-public market assets such as private equity and private real estate, among others.

There are at least two ways to correct for autocorrelation:

- A direct method that adjusts the sample estimators of volatility, correlation and all higher moments
- An indirect method that cleans the data first, allowing us to subsequently estimate the moments of the distribution using standard estimators

Given that the direct methods become quite complex beyond the first two moments, our choice is to follow the second method and clean the return data of autocorrelation. Before we do that, we estimate and test the statistical significance of autocorrelation in our data series.

We estimate first-order autocorrelation as the regression slope of a first-order autoregressive process. We use monthly return data for the period 1979–2014. We subsequently test the statistical significance of the estimated parameter using the Ljung-Box Q-statistic.[7] The Q-statistic is a statistical test for serial correlation at any number of lags. It is distributed as a chi-square with k degrees of freedom, where k is the number of lags. Here we test for first-order serial correlation, thus $k = 1$. About 80% of our return series exhibit positive and statistically significant first-order serial correlation based on associated p-values at the 10% level of significance.[8]

Khandani and Lo provide empirical evidence that positive return autocorrelation is a measure of illiquidity exhibited among a broad set of financial assets including small-cap stocks, corporate bonds, mortgage-backed securities and emerging market investments.[9] The theoretical basis is that in a frictionless market, any predictability in asset returns can be immediately exploited, thus eliminating such predictability. While other measures of illiquidity exist, autocorrelation is the only measure that applies to both publicly and privately traded securities and requires only returns to compute.

Removing return autocorrelation prevents underestimation of volatility.

Since most of the return series we estimate exhibit autocorrelation, we apply the Geltner unsmoothing process to all series. This process corrects the return series for first-order serial correlation by subtracting the product of the autocorrelation coefficient ρ and the previous period's return from the current period's return and dividing by $1-\rho$. This transformation has no impact on the arithmetic return, but the geometric mean is impacted since it depends on volatility. This correction is thus important to make for long-horizon asset allocation portfolios.

Accounting for climate change

The vast majority of research concludes climate change is a significant risk to our planet's ecosystem and, according to the IMF and many other well-respected institutions, is set to have major economic impacts on many countries.[10] While we believe global economic outcomes will continue to be dominated by the business cycle and event stresses, climate change is a material issue, and its importance could increase going forward. Therefore, we believe climate change risks – both physical and transition[11] – should be considered when making forecasts of the future. Physical risks, for the most part, are best incorporated at the security level, although there are certain countries and asset classes (e.g., real estate) for which it is easier to make a clear, broad connection.

There are a few channels through which climate change could theoretically influence capital market assumptions: macro, fundamentals and repricing.

Macro: Climate-related considerations impact consumer behavior, investment needs, financing, supply chain organization, cross-border trade and stranded assets. These are mostly transition-risk related, driven by government policy and market forces. Climate change's effect on these variables flows directly to GDP growth and inflation; the magnitude of the effect will be driven partly by the increase in productivity-enabling technologies.

Fundamentals: Top-line output establishes the base for what companies can earn. Profit margins form the other component of the equation. The transition is certain to affect industries to different degrees, but the consequences are difficult to forecast in aggregate, so we retain our tried-and-true approach of assuming profit margins in mean revert to equilibrium.

Repricing: Changes in valuation are the most difficult to gauge. Determinants of valuation at any one point and across time are highly uncertain, especially for broad asset classes (e.g., US large cap equities), which is the level at which we forecast CMAs. We acknowledge that certain sectors generally deserve higher valuations than others, and subscribe to the idea that capital will flow to more "sustainable" investments over time, but we argue that it is difficult to predict changes in relative pricing across sectors based on inherent "greenness," especially across countries. Instead of comparing asset class carbon footprints based on sector compositions, we think sustainability characteristics should be defined at or below the industry level. Therefore, premiums and discounts for those factors, including climate change, should

7 Ljung, G.M. and Box, G.E.P., "On a Measure of Lack of Fit in Time Series Models," *Biometrika*, 65, (1978): 297–303.

8 The p-value is the probability of rejecting the null hypothesis of no serial correlation when it is true (i.e., concluding that there is serial correlation in the data when in fact serial correlation does not exist). We set critical values at 10% and thus reject the null hypothesis of no serial correlation for p-values <10%.

9 Khandani, A.E. and Lo, A., "Illiquidity Premia in Asset Returns: An Empirical Analysis of Hedge Funds, Mutual Funds, and US Equity Portfolios," Quarterly Journal of Finance 1 (2011): 205–264.

10 International Monetary Fund, https://www.imf.org/en/Topics/climate-change/climate-and-the-economy#publications, accessed 10/31/22.

11 Climate change risks can be divided into two categories: 1) physical risks, which result from climatic events such as wildfires, storms and floods; and 2) transition risks, which result from policy actions taken to shift the economy away from fossil fuels.

be applied to individual companies within their respective groups. As a result, our efforts are centered on macro and (to a lesser degree) fundamental inputs.

To define and evaluate the impact of changes in climate-related macro and fundamental inputs, we leaned on our partners at S&P Global to develop plausible climate scenarios and expected economic outcomes. Although countless climate scenarios are plausible and investors would be well served to stress-test portfolios against some of those possibilities, only one will actually occur. Therefore, we took the most likely climate scenario, called “Inflections” in Exhibit 8A, and integrated those assumptions into the global economic model for the base case and alternative scenarios that form the backbone of our CMA.

The climate scenarios (Exhibits 8A and 8B) are developed within the context of achieving net-zero carbon emissions by 2050. This places them on a different time horizon than our economic scenarios used for our 10-year CMA, so they need to be rescaled; still, they enable us to capture important developments along various temperature pathways. Unfortunately, given the lack of legally binding climate commitments by countries, daunting technological gaps and recent geopolitical strains, the current trajectory appears to have us on a path for a 2.4° Celsius increase in global average temperatures by 2050 (Exhibit 9). In this base-case scenario, the energy transition delivers fundamental change at the global emissions level, but geopolitical relations are likely to force adaptation rather than facilitate international cooperation and technological disruption. In all cases, a critical variable influencing emission paths is the price of carbon (Exhibit 10) as well as government taxation, regulation and international coordination around it. To get to zero, emitting greenhouse gases must become expensive relative to alternative means of production.

The difference in economic outcomes between most climate scenarios tested was modest. Thus, the impact of climate change in our capital market assumptions is minor.

Like climate change itself, the impact on the economy is one that will be felt gradually. The difference in economic outcomes among most climate scenarios tested was modest. Thus, the impact of considering climate change in our capital market assumptions is minor. The exception, however, is the “Discord” scenario, in which countries become more inwardly focused, climate policies are inconsistent, and decarbonization efforts lose momentum, resulting in limited meaningful action. In this case, global growth takes a sizable hit. Over the 10-year forecast horizon, the economic damage would be mostly due to the series of crises that underly the geopolitical rancor preventing climate change mitigation as opposed to the negative effects of climate change itself. As the time horizon extends, however, so too does the risk of major and potentially irreversible physical costs.

What is clear from our analysis is that striving to address this negative externality will lead to an improved outlook for growth and most risk assets, relative to taking no action. Moreover, incorporating views on climate change into our forecasts provides us with a more comprehensive picture of the world, which will help us generate better estimates going forward.

Exhibit 8A. Summary of base, optimistic and pessimistic climate scenarios

	Green rules A revolutionary transformation toward a sustainable low-carbon economy	Inflections Base case view of the energy future	Discord A stagnant world with weak markets and policies
General themes	**Crisis backlash and strong government policy** Societal reactions to chronic crises drive strong government actions that result in revolutionary change in energy markets and emissions levels	**Market forces and national self-interest** A mix of social, market, and government forces drives fundamental change in energy use and emissions pathways.	**Weak markets and policies** Political instability, combined with isolationist trends, inhibits governments, causes market uncertainty and slows the energy transition.
International cooperation	**Strong** International cooperation strengthens in response to strong public demands to address security concerns — which are increasingly linked to climate change.	**Mixed** The global balance of power is more broadly distributed than it has been in almost a century. National interests are central.	**Weak** International relations suffer from chronic domestic political division and weakness, sowing mistrust and isolationism.
Economic environment	**Mixed** Initial policy disorder, combined with the costs of forced energy transition, causes economic disruptions and hardships over the short term, but eventually establishes conditions that encourage private investment. Average growth: 2.5%	**Moderate** Recovery from the Covid crisis is uneven; an eventual return to pre-2020 average growth rates masks underlying long-term structural shifts in the global economy. Average growth: 2.6%	**Weak** The world emerges from the Covid crisis battered by uncertainty and facing ongoing political and economic fallout, which weakens governments and market confidence. Average growth: 2.1%
Climate policy	**Very strong** Political pressure and national security interests eventually drive nations to cooperate on global standards and protocols for GHG emissions across the world and promote clean energy technologies, business models, and lifestyles. **Some G20 countries move much closer to net-zero goals but do not meet them.**	**Strong** Climate policy moves forward strongly but remains driven more by national interests than global goals, hindering the effectiveness of international coordination on standards and conventions and the consistency of net-zero programs and efforts. **G20 countries do not meet net-zero goals.**	**Weak to moderate** Climate policy is fragmented as many countries become more inwardly focused and decarbonization efforts lose political momentum in the face of chronic economic uncertainty and weakness. **Many countries abandon net-zero goals.**

As of 09/30/22. Source: S&P Global. Forecasts are subject to change.

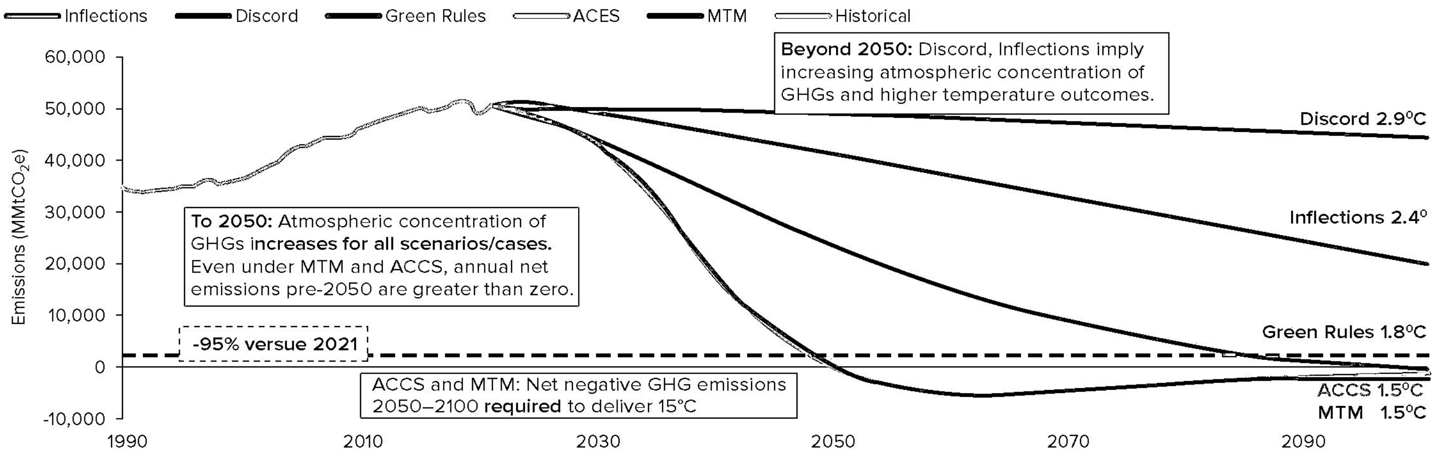
Exhibit 8B. Summary of net-zero climate scenarios

	Accelerated carbon capture systems (CCS) Net zero 2050 with high carbon capture	Multi-tech mitigation (MTM) Net zero 2050 with low carbon capture
General themes	**Broad global use of CCS in the energy and non-energy sectors**	**Supply diversification, electrification, and renewables dominate as key drivers, as well as a moral imperative to move away from hydrocarbons**
International cooperation	**Strong** Recognition that CCS can help accomplish decarbonization goals, use existing infrastructure and save jobs.	**Strong** Intense policy and societal intent to minimize fossil fuel use across all sectors. Incentives widely used to foster green hydrogen.
Economic environment	**Moderate** Costs of rapid acceleration of expensive carbon capture keep economic growth slightly below that of the "green rules" scenario. *Average growth: 2.5%*	**Moderate** Costs of a rapid shift away from hydrocarbons and abandonment of existing facilities keep economic growth below that of the "green rules" scenario for some period. *Average growth: 2.5%*
Climate policy	**Very strong** Very strong and coordinated climate policies globally. High carbon prices to incentivize use of carbon capture, with global carbon markets reaching \$200 per metric ton of CO_2 (real 2020 US\$) by 2040.	**Very strong** Very strong and coordinated climate policies globally. Moderately high carbon prices, reaching \$150 per metric ton of CO_2 (real 2020 US\$) by 2040, supplemented by incentives and mandates to reduce fossil fuels.

As of 09/30/22. Source: S&P Global. Forecasts are subject to change.

Exhibit 9. The path to 2050 and beyond: Emission trends and implied temperatures

Only the back-cast cases achieve the net-zero target of the Paris Agreement

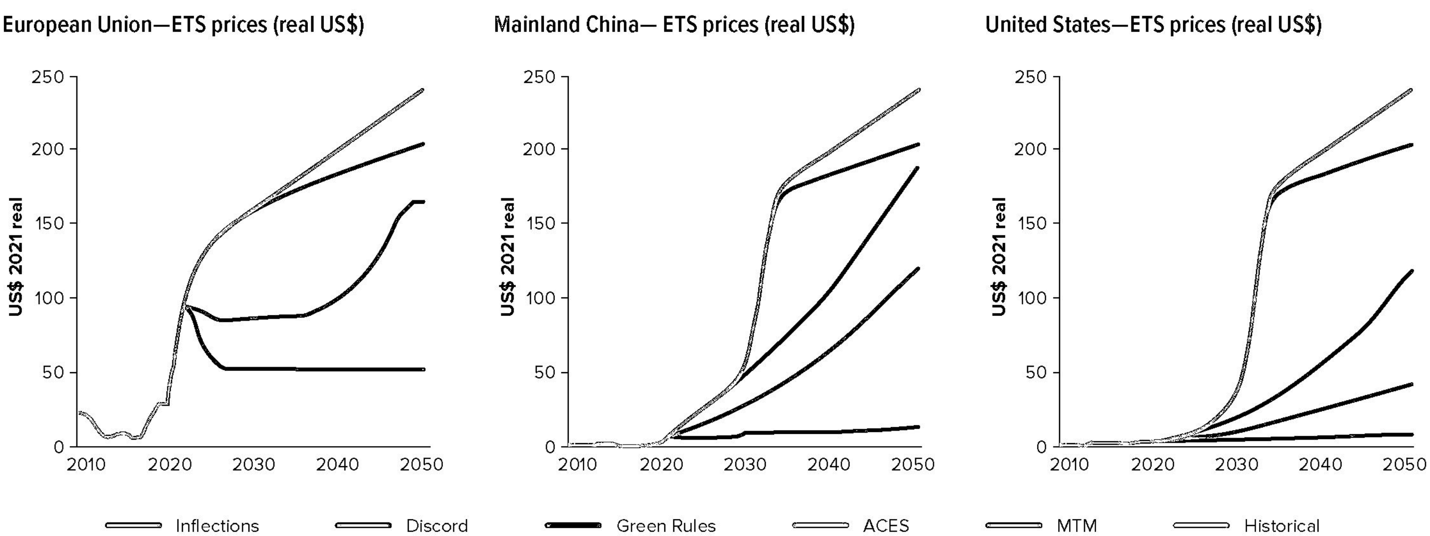


Note: *MtCO2e = million metric tons of CO_2 equivalent.*

As of 09/30/22. Source: S&P Global. Forecasts are subject to change.

Exhibit 10. Lower-carbon outlooks see emissions trading systems expand and prices rise

Net-zero cases assume global convergence of carbon pricing by 2050



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BUSINESS INSIDER

CHART OF THE DAY: Tepper, Birinyi, Damodaran, O'Neill, Ritholtz All Love This Bullish Stock Market Metric

Sam Ro
May 14, 2013, 12:36 PM

With the S&P 500 at an all-time high, many stock market pundits have grown increasingly cautious.

However, the savviest experts are reiterating their bullishness, and they are all pointing to one metric: the equity risk premium.

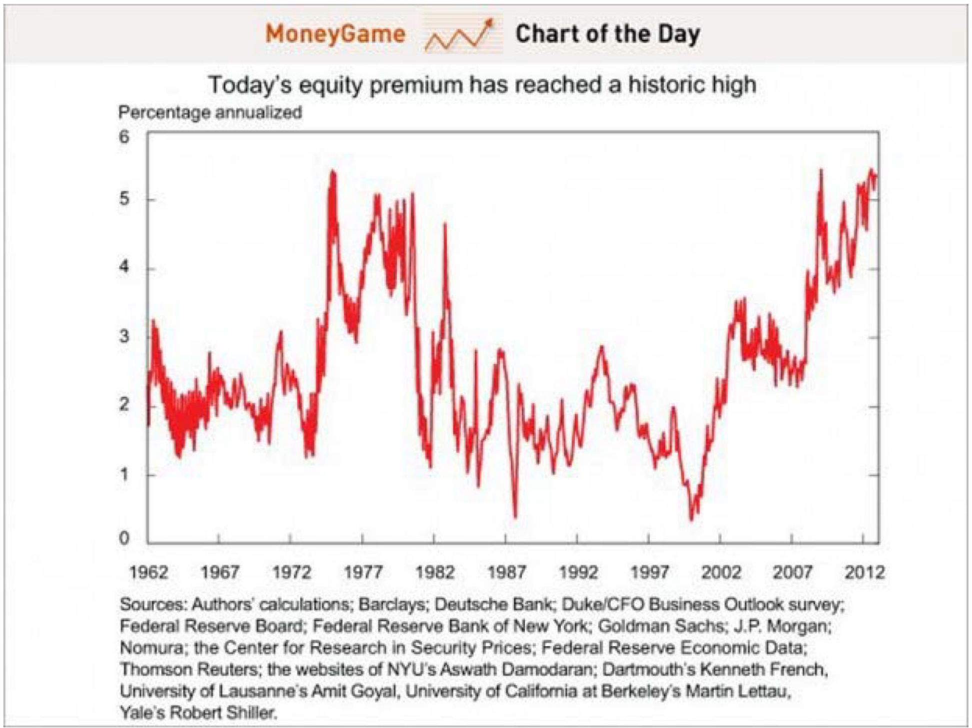
"The equity risk premium is the key to investing and valuation," says legendary NYU finance professor Aswath Damodaran,

The equity risk premium can be defined simply as the expected return on a broad stock market index in excess of the long-term risk-free rate, which is often measured by a government bond yield.

Markets spiked this morning when influential hedge fund manager David Tepper held up a chart of the equity risk premium as he presented his uber-bullish case for stocks during a CNBC appearance.

Blogger extraordinaire Barry Ritholtz and stock market legend Laszlo Birinyi each pointed us to Tepper's exact chart last week. Birinyi confident we'll see the S&P 500 pass 1,700 this year, and 1,900 relatively soon.

Jim O'Neill, the now retired economist from Goldman Sachs, has long been bullish on stocks thanks to the equity risk premium. In the final slide of his final presentation, O'Neill argued, "Current ERP levels continue to indicate that equity markets are still quite attractive in many parts of the world."



Liberty Street Economics

Industry Update — July 15, 2022

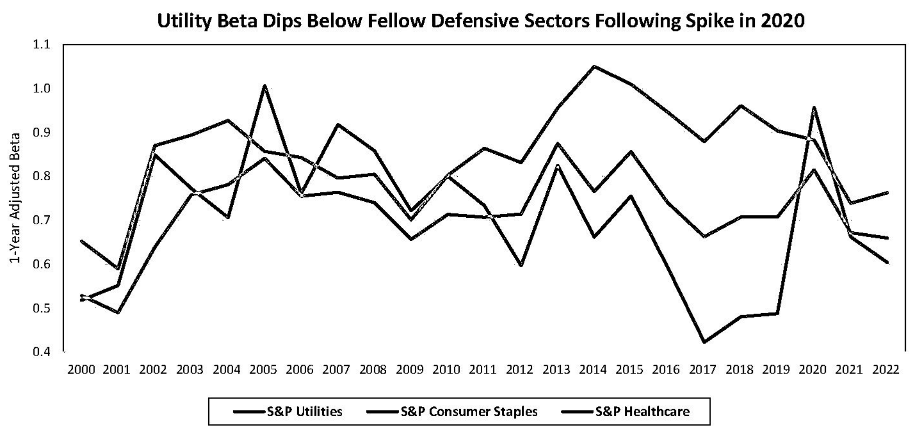
Utilities

Figure of the Week: Utility 1-Year Beta Continues Downward Trajectory

Our Call

Figure of the Week

Click image to enlarge in HTML view.



Note: 2022 beta based on trailing twelve months through 6/30/22
Source: Factset and Wells Fargo Securities, LLC

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2=Equal Weight: Total return on stock expected to be -10% to +10% over the next 12 months. HOLD

3=Underweight: Total return on stock expected to lag the Overweight- and Equal Weight-rated stocks within the analyst's coverage universe over the next 12 months. SELL

As of July 14, 2022
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Rate of Return Regulation Revisited

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Abstract

Utility companies recover their capital costs through regulator-approved rates of return on debt and equity. In the US the costs of risky and risk-free capital have fallen dramatically in the past 40 years, but utility rates of return have not. Using a comprehensive database of utility rate cases dating back to the 1980s, we estimate that the current average return on equity could be around 0.5–5.5 percentage points higher than various benchmarks and historical relationships would suggest. We discuss possible mechanisms and show that regulated rates of return respond more quickly to increases in market measures of the cost of capital than they do to decreases. We then provide empirical evidence that higher regulated rates of return lead utilities to own more capital – the Averch–Johnson effect. A 1 percentage point rise in the return on equity increases new capital investment by about 5%. Overall we find that consumers may be paying $2–20 billion per year more than they would otherwise if rates of return had fallen in line with capital market trends.

JEL Codes: Q4, L5, L9

Keywords: Utility, Rate of Return, Regulation, Electricity, Natural Gas, Capital Investment

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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. They may also be a necessary response to the clean energy transition underway in much of the gas and electric utility sector. However, it is noteworthy that over recent years, utilities have earned sizeable regulated rates of return on their capital assets, particularly when set against the unprecedented low interest rate environment post-2008. When the economy-wide cost of capital fell, utilities' regulated rates of return did not fall nearly as much. This gap raises the prospect that at least some of the growth in capital spending could be driven by utilities earning excess regulated returns.

Utilities over-investing in capital assets as a result of excess regulated returns is an age old concern in the sector (Averch and Johnson 1962). 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

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.

three main research questions. First, to what extent are utilities being allowed to earn excess returns on equity by their regulators? Second, how has this return on equity affected utilities' capital investment decisions? Third, what impact has this had on the costs paid by consumers?

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 individual utility capital spending.

We start our analysis by estimating the size of the gap between the allowed rate of return on equity (RoE) that utilities earn and some measure of the cost of equity they face. A central challenge here, both for the regulator and for the econometrician, is estimating the cost of equity. We proceed by considering a range of approaches to simulating the actual cost of equity based on available measures of capital market returns, the capital asset pricing model (CAPM) and a comparison with regulatory decisions in the United Kingdom. None of these are perfect comparisons; but taken together, our various estimation approaches result in a consistent trend of excess rates of return. These results are necessarily uncertain, and depending on our chosen benchmark the premium ranges from 0.5 to 5.5 percentage points. Importantly though, even our most conservative benchmarks come in below the allowed rates of return on equity that regulators set today.

The existence of a persistent gap between the return on equity that utilities earn and some measure of the cost of capital they face could have a number of explanations. Recent work by Rode and Fischbeck (2019) ruled out a number of financial reasons we might see increasing RoE spreads, such as changes to utilities' debt/equity ratio, asset-specific risk, or the market's overall risk premium. This leaves them looking for other explanations – for example, they highlight that regulators seem to follow some ad-hoc approaches that make them reluctant to set RoE below a nominal 10%. Azgad-Tromer and Talley (2017) also find that allowed rates of return diverge significantly from what would be expected by a standard CAPM approach. They point to a range of non-financial factors that may play an important role, including political goals and regulatory capture. Using data from a field experiment they show that providing finance training to regulatory staff does have a moderate effect on moving rates of return closer to standard asset pricing predictions.

These insights point to the broader challenges inherent in the ratemaking process. Regulators face an information asymmetry with the utilities they regulate when determining whether costs are prudent and necessary (Joskow, Bohi, and Gollop 1989). Utilities have a clear incentive to request rate increases when their costs go up, but do not have much incentive to request a rate decrease when their costs go down. If regulators are too deferential to the demands of the utilities they regulate – perhaps due to a insufficient expertise or regulatory capture (Dal Bó 2006) – we would expect rates to become detached from underlying costs.

We explore this issue by drawing on the literature on asymmetric price adjustments. It has been documented in various industries that positive shocks to firms' input costs can feed through into prices faster than negative shocks (Bacon 1991; Borenstein, Cameron, and Gilbert 1997; Peltzman 2000). This is the so-called "rockets and feathers" phenomenon. We test this hypothesis by estimating a vector error correction model for the relationship between utilities' return on equity and some benchmark measures of the cost of capital (e.g. US Treasury Bond yields). Here we do indeed find evidence of asymmetric adjustment. Increases to the benchmark cost of capital lead to rapid rises in utilities' return on equity, while decreases lead to less rapid falls.

Excess regulated returns on equity will distort the incentives for utilities 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 basic within-utility comparison, we examine instrumental variables. For our preferred approach we draw on the intuition that after a rate case is decided, the 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 cost of equity for the utility, 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 also examine a second instrument that exploits an apparent bias of regulators rounding the RoE values they approve, though ultimately this instrument is too weak for us to use.

Across the range of specifications used, we find a broadly consistent picture. In our preferred specification we find that increasing the RoE gap by one percentage point leads to a five percent increase in the approved change in the rate base. We observe similar effects for the overall size of the approved rate base.

Combining our measures of the RoE gap with the distortions to capital investment, we estimate the cost to consumers from excess rates of return reached around $2–20 billion per year by 2020, with the majority of these costs coming from the electricity sector. These costs have important distributional effects, representing a sizeable transfer from consumers to investors. Increasing the price of electricity also has important implications for environmental policy and efforts to encourage electrification (Borenstein and Bushnell 2022).

2 Background

Electricity and natural gas utility companies are typically 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 utilities (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 rate base (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 rate base 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 that competitive capital markets would provide if the utility had been a competitive company rather than a regulated monopoly. The types of capital utilities own, and their opportunities to add capital to their books, varies depending on market and regulatory conditions. Utilities that are vertically integrated 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 generally not been the norm for capital costs, despite large swings in the nominal cost of capital over the past 50 years. A few jurisdictions have introduced limited automatic updating for the cost of equity, and we discuss those approaches in more detail in section 4.1, where we consider various approaches of estimating the RoE gap.

Regulators typically employ a "test year", a single 12-month period in the past or future that will be used as the basis for the rate case analysis. Expenses and capital costs in this test year, except those with automatic update provisions, are the values used for the entire rate case.

The cost of debt financing is easier to estimate than the cost of equity financing. For historical debts, it is sufficient to use the cost of servicing those debts. For forward-looking debt issuance, the cost is estimated based on the quantity and cost of expected new debt. Issues remain for forward looking decisions – e.g. what will bond rates be in the future test year? – but these are *relatively* less severe. In our data, we see both the utilities' requested and approved return on debt. It's notable that the requested and approved rates 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 in order to invest in the utility. 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 Nat-*

> *ural 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, 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 rate base – unlike debt, there's typically no notion of paying a specific RoE for specific stock issues.

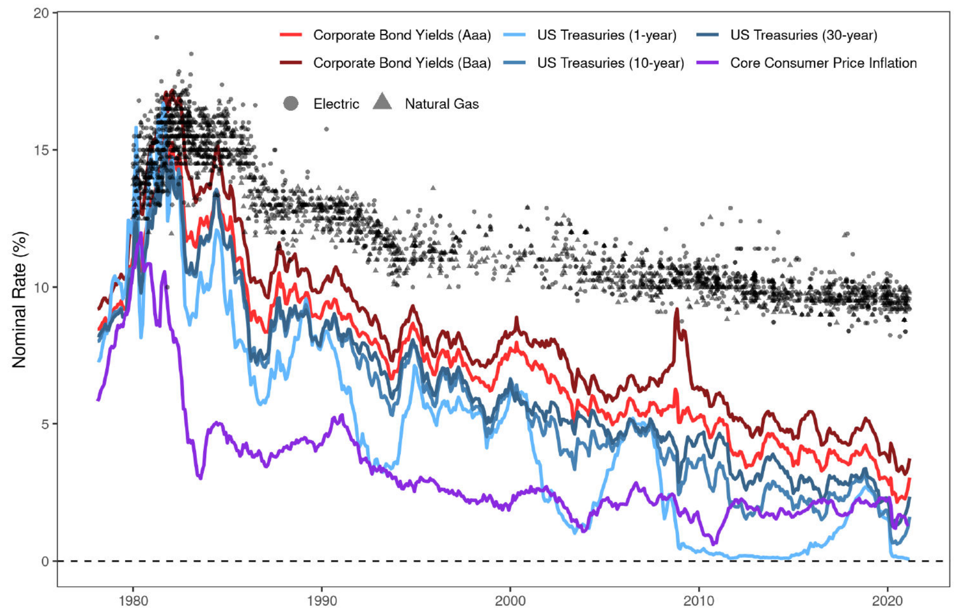
Regulators employ a mixture of models and subjective judgment. Typically, these approaches involve benchmarking against other US utilities (and often utilities in the same geographic region). There are advantages to narrow benchmarking, but when market conditions change and everyone is looking at their 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.[2] 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. For instance, Rode and Fischbeck (2019) note an apparent reluctance from to set RoE below a nominal 10%.

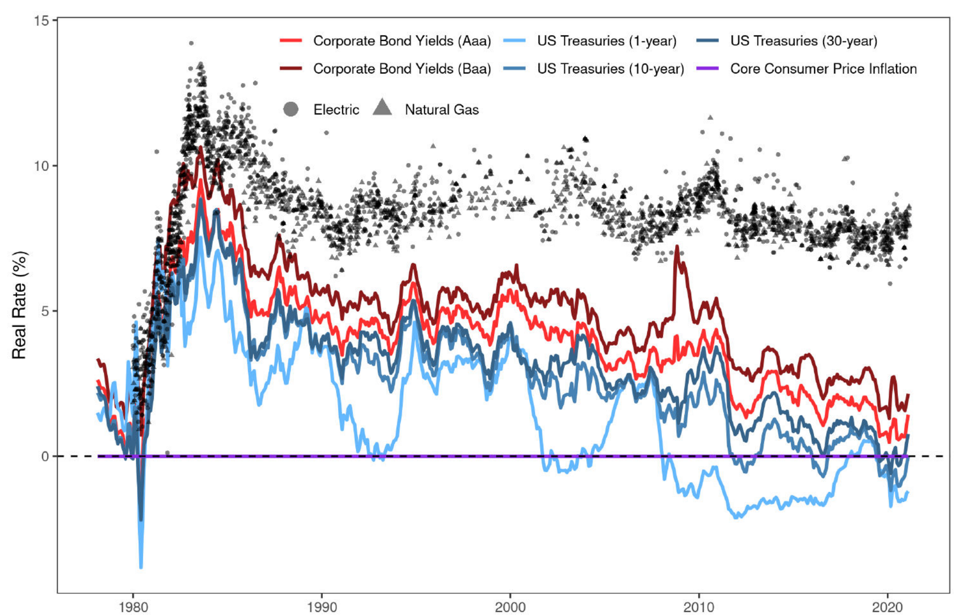
That paper, Rode and Fischbeck (2019), is the closest to ours in the existing literature. The authors use the same rate case dataset we do, and note a similar widening of the spread between the approved return on equity and 10-year Treasury rates. That paper, unlike ours, dives into the financial modeling, using the standard

2. We calculate real values by subtracting the monthly core CPI.

Figure 1: Return on Equity and Financial Indicators



(a) Nominal



(b) 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 core CPI. Between March 2002 and March 2006 30-year Treasury rates are extrapolated from 1- and 10-year rates (using the predicted values from a regressing the 30-year rate on the 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).

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 the implications of this growing RoE gap for utilities' investment decisions and costs for consumers.

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. An increasing market risk premium could explain an increased spread between RoE and riskless Treasuries, but the market risk premium has fallen over time.

Prior research has highlighted the importance of macroeconomic changes, and that these often aren't fully included 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. Until 2021, inflation has been lower and much more stable.

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.

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 rate base change of $5 million or had a rate base change of $3 million authorized (Regulatory Research Associates 2021). Summary statistics on these rate cases can be seen in Table 1. Our primary variables of interest are the rates of return and the rate base. [3] We also merge data on annual number of customers, quantity supplied and sales revenue for the electric utilities in our sample (US Energy Information Administration 2022).

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 data provider lists each company by its present-day (2021) company name, or the company's last operating name before it 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 rate base size.

We match with data on S&P credit ratings, drawn from SNL's *Companies (Classic) Screener* (2021) and 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.[4] Between these two sources, we have ratings data available

3. We focus here on proposed and approved rates of return. It is possible that utility's actual rate of return or return on equity might differ from the approved level. In general though, actual returns do tend to track allowed returns quite closely.

4. When multiple different ratings are available, e.g. different ratings for subsidiaries trading

Table 1: Summary Statistics

Characteristic	N	Electric[1]	Natural Gas[1]
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)
Customers (thous)	1,177	693 (929)	NA (NA)
Quantity (TWh)	1,177	17 (21)	NA (NA)
Revenue ($ mn)	1,177	1,470 (2,086)	NA (NA)
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)
Case Length (yr)	3,364	3.11 (3.97)	3.01 (3.34)
Rate Case Duration (mo)	3,713	9.1 (5.1)	8.1 (4.3)

[1]Mean (SD)

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), US Energy Information Administration (2022), and author calculations.

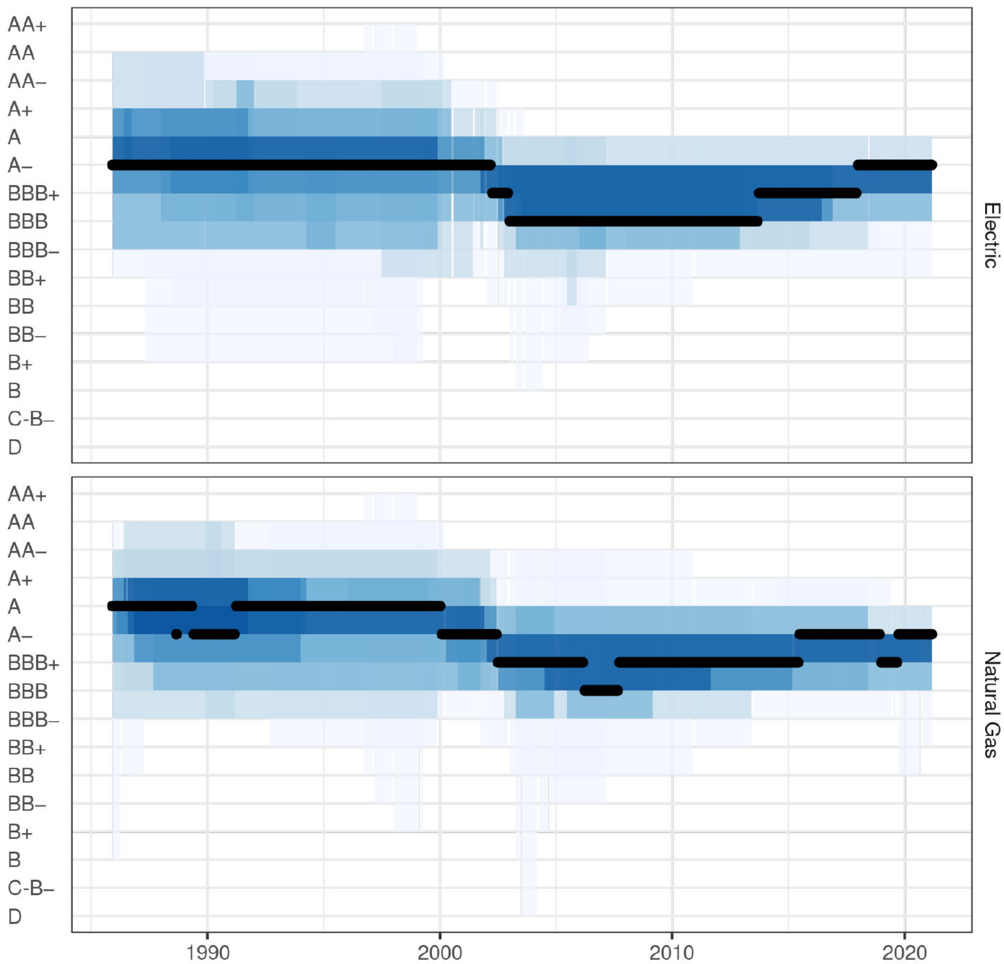
from December 1985 onward. Approximately 80% of our utility–month observations are matched to a rating. Match quality improves over time: approximately 89% of observations after 2000 are matched.

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

under the same ticker, we take the median rating. We round down (to the lower rating) in the case of an even number of ratings.

seen modest movements up and down over the past decades. 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.[5] 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.

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 rate base.) Ratings from C to B− are collapsed to save space.
Source: *Companies (Classic) Screener* (2021) and *Compustat S&P legacy credit ratings* (2019).

5. 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.

Beyond credit ratings, we also use various market rates pulled from FRED. These include 1-, 10-, and 30-year Treasury yields, the core consumer price index (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.[6]

Matching these two datasets – rate cases and macroeconomic indicators – we construct the 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. This is the key stylized fact that motivates our examination of the return on equity that utilities earn and the implications this may have for their incentives to invest in capital and the costs they pass on to consumers.

4 Empirical Strategy

4.1 The Return on Equity Gap

Knowing the size of the return on equity (RoE) gap is a challenge, and we take a couple of different approaches. None are perfect, but collectively, they shed light on the question.

4.1.1 Benchmarking to a Baseline Spread

We first consider a benchmark index of corporate bond yields. The idea here is to ask: what would the RoE be today if the average spread against corporate bond yields had not changed since some baseline date? Here we compare all utilities to the corporate bond index that is closest to that utility's own, contemporaneous debt

6. 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).

rating. [7] To calculate the RoE gap we first find the spread between the approved return on equity and the bond index rate for each utility in each state in a baseline period. We then take this spread during the baseline period and apply it to the future evolution of the bond index rate to get an estimate of the baseline RoE. The RoE gap is the difference between a given utility's allowed return on equity at some point in time and this baseline RoE.

The choice of the baseline period is also worth considering here. Throughout our analysis we use January 1995 as the baseline period. The date chosen determines where the gap between utilities' RoE and baseline RoE is zero. 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. Stated differently, the baseline year determines when the average gap is zero, but this is a constant shift that does not affect the overall trend. While January 1995 is not special, we note that picking a much more recent baseline would imply that utilities were substantially under-compensated for their cost of equity for many continuous years.

Our second measure adopts a similar approach to the first but benchmarks against US Treasuries. The idea here is to ask: what would the RoE be today if the average spread against US Treasuries had not changed since some baseline date? This measure is calculated in exactly the same way as our first approach except the spread is measured against the 10-year Treasury bond yield in the baseline period, rather than the relevant corporate bond index.

Our third measure continues with using US Treasuries but does so using an RoE update rule. This rule is consistent with the approach taken by the Vermont

7. We also examined a comparison against a single Moodys' Baa corporate bond index. Moody's Baa is approximately equivalent to S&P's BBB, a rating equal to or slightly below most of the utilities in our data (see figure 2). This avoids issues where utilities' bond ratings may be endogenous to their rate case outcomes. Using a single index also faces fewer data quality challenges. The findings using the single Moody's Baa bond index are broadly equivalent to those using a same rated bond index and our later approach using US Treasuries.

PUC, and similar approaches have been used in the past in California and Canada. Relative to some baseline period the automatic update rule adjusts the RoE at half the rate that the yield on the 10-year US Treasury bond changes over that time period. [8] The Vermont PUC uses 10-year US Treasuries and set the baseline period as December 2018, for their plan published in June 2019. (*Green Mountain Power: Multi-Year Regulation Plan 2020–2022* 2020). In our case we also use 10-year Treasuries and set the baseline to January 1995. 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. [9]

4.1.2 Benchmarking to the Capital Asset Pricing Model

Our fourth and fifth measures draw directly on the Capital Asset Pricing Model (CAPM) approach. The CAPM approach is widely used by regulators to support their decisions on utility equity returns, alongside other methods such as Discounted Cash Flow (DCF). In principle the CAPM provides an objective way to quantify the expected returns for an asset given the risk of that asset and the returns available in the market over-and-above some risk-free rate. In practice its application remains open to a significant degree of subjective interpretation, in large part through the choice of values for its key parameters. As such, even CAPM calculations can form part of the negotiation process between regulators and utilities, with the latter having a clear incentive to lobby for assumptions that result in the CAPM producing higher estimates of the cost of equity.

We calculate predictions of the equity returns for each utility using the standard CAPM formula.

$$RoE = R_f + (\beta \times MRP)$$

8. Define RoE' 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. RoE in year t is then: $RoE_t = RoE' + (0.5 \times (B_t - B'))$

9. Pre-1995 values are not particularly meaningful, but we can calculate them with the same formula.

Here R_f is the risk-free rate, MRP is the market risk premium and β is the equity beta for the asset in question – namely each utility in our sample. Our assumed values for each of these parameters are broadly in line with published data (Damodaran 2022a) and values used by regulators in the UK, Europe, Australia and at the federal level for the US (Australian Energy Regulator 2020; Economic Consulting Associates 2020; UK Regulatory Network 2020). The parameter values used by state PUCs in the US tend to fall at the higher end of the range we examine. We calculate the RoE gap by taking the contemporaneous difference between our CAPM estimate of RoE and each utility's allowed RoE.

Risk-free rate

The risk-free rate, R_f, is intended to capture the base level of returns from an effectively zero risk investment. Yields on government bonds are the common source for this information, although practitioners can differ over the choice of maturity (e.g. 10-year or 30-year) and the use of forecast future yields instead of past or current rates. These decisions can significantly affect the final cost of equity. [10] We use the contemporaneous yield on US Treasury Bonds for our measure of the risk-free rate. In our "low" case we use 10-year Treasuries and in our "high" case we use 30-year Treasuries.

Market risk premium

The market risk premium, MRP, captures the difference between the expected equity market rate of return and the risk-free rate. [11] This is generally calculated by taking the average of the difference in returns for some market-wide stock index and the returns for the risk-free rate. While this appears relatively straightforward, the final value can vary significantly depending on numerous factors. These can include: the choice of stock market index (e.g. S&P 500, Dow Jones, Wilshire 5000

10. For instance, in January 2018 the current yield on 10-year US Treasury Bonds was 2.58%, the average yield from the past 2 years was 2.09%, and the forecast yield from Wolters Klewer (2022) for the next 2 years was 2.97%.

11. $MRP = R_m - R_f$, where R_m is the market return and R_f is the risk-free return.

etc.); the choice of averaging period (e.g. previous 10, 20, 50 years etc.); the return frequency (e.g. monthly, quarterly or annual returns), and the method of averaging (arithmetic, geometric). These decisions can significantly affect the final cost of equity. [12] To capture the uncertainty in the market risk premium, in our "low" case we assume a constant *MRP* of 6 percent and in our "high" case we assume a constant *MRP* of 8 percent.

Beta

A firm's equity beta, β, is a measure of systematic risk and thus captures the extent to which the returns of the firm in question move in line with overall market returns. [13] Regulated firms like gas and electricity utilities are generally viewed as low risk, exhibiting lower levels of volatility than the market as a whole. The calculation of beta is subject to many of the same uncertainties mentioned above, including: the choice of stock market index; the choice of calculation period, and the return frequency.

It is also common to take beta estimates from existing data vendors such as Merrill Lynch, Value Line and Bloomberg. The choice of beta depends on the bundle of comparable firms used and how they are averaged. Furthermore, these vendors generally publish beta values that incorporate the so-called Blume adjustment to deal with concerns about mean reversion. [14] While plausible for many non-regulated firms, its applicability to regulated firms like utilities has been questioned (Michelfelder and Theodossiou 2013). Because utilities generally have betas below one the adjustment serves to increase beta and thus increase the estimated cost of equity produced by the CAPM calculation.

Lastly, the decision on setting beta is complicated by the fact that betas calculated

12. For instance, in January 2018 using annual returns for the S&P 500 compared to the 10-year US Treasury Bond and taking the arithmetic average over the past 5, 25 and 75 years produces market risk premiums of 14.8%, 5.2% and 7.3% respectively (Damodaran 2022b).

13. Beta is calculated by estimating the covariance of the returns for the firm in question, R_i, and the market returns, R_m, and then dividing by the variance of the market returns: $\beta = \frac{Cov(R_i,R_m)}{Var(R_m)}$

14. The Blume Adjustment equation is: $\beta_{adjusted} = 0.333(1) + 0.667(\beta)$

using observed stock returns are dependent on each firm's debt holdings and tax rate, which may differ from the particular utility being studied. To deal with this, an unlevered beta can be estimated and then the corresponding levered beta can be calculated for a specific debt-to-equity ratio, D/E, and tax rate, τ. [15] Here we take τ to be the federal marginal corporate tax rate and we can directly observe the debt-to-equity ratio, D/E, in our data.

To capture the uncertainty in beta, in our "low" case we assume a constant $beta_{unlevered}$ of 0.3 and in our "high" case we assume a constant $beta_{unlevered}$ of 0.5. This generally produces levered betas ranging from 0.6 to 0.9.

4.1.3 Benchmarking to UK utilities

Finally, our sixth measure involves benchmarking against allowed returns on equity for gas and electric utilities in the United Kingdom. Here we consider the contemporaneous gap in nominal allowed RoE 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 think this benchmark provides an interesting comparison. The data on UK RoE are taken from various regulatory reports published by the Office of Gas and Electricity Markets (Ofgem). We were able to find information on allowed rates of return dating back to 1996. The relevant disaggregation into return on debt and return on equity was more readily available for electric utilities over this entire time period. For natural gas utilities we have this information from 2013 onwards. Importantly, UK rates are set in real terms and so we converted to nominal terms using the inflation indexes cited by the UK regulator.

15. The Hamada equation relates levered to unlevered beta as follows: $\beta = \beta_{unlevered} \times \left[1 + (1 - \tau)\frac{D}{E}\right]$

4.2 Asymmetric Adjustment

The existence of a persistent gap between the return on equity that utilities earn and various measures of the cost of capital they face could have a number of explanations. One we examine here focuses on whether regulators are more responsive to the demands of the utilities they regulate than to pressures from consumer advocates. To do so we draw on the literature on asymmetric price adjustments.

It has been documented in many industries that positive shocks to firms' input costs can feed through into prices faster than negative shocks. This has been most extensively studied in the gasoline sector – see Kristoufek and Lunackova (2015) and Perdiguero-García (2013) for reviews of the literature. Building on early work by Bacon (1991) and Borenstein, Cameron, and Gilbert (1997), there are now a wealth of studies examining how positive shocks to crude oil prices lead to faster increases in retail gasoline prices than negative shocks to crude oil prices lead to decreases in retail gasoline prices. This is the so-called "rockets and feathers" phenomenon. A range of explanations for this have been explored, most notably tacit collusion and market power or the dynamics of consumer search.

In our setting we do observe that a change in some benchmark index (e.g. US Treasuries or corporate bonds) appears to feed through into the allowed return on equity for utilities. This can be seen most clearly in Figure 1 where relatively short-run spikes in US Treasuries or corporate bond yields correlate strongly with corresponding spikes in allowed returns on equity. We have also already discussed the sluggish pace at which allowed returns on equity have come down over the longer-term when compared to various benchmark measures of the cost of capital. It therefore seems plausible to think that this relationship may function differently depending on whether it is a positive or a negative shock. To test this we follow the literature on asymmetric price adjustments and estimate a vector error correction model. First we estimate the long-run relationship between the return on equity for utility i in period t ($RoE_{i,t}$) and a lagged benchmark index of the cost of capital ($Index_{i,t-1}$). [16]

$$RoE_{i,t} = \beta Index_{i,t-1} + \varepsilon_{i,t}$$

In the second step we then run a regression of the change in RoE on three sets of covariates: (1) m lags of the past changes in RoE, (2) n lags of the past change in the index, and (3) the residuals from the long-run relationship, $\hat{\varepsilon}_{i,t}$, lagged from the previous period. To examine potential asymmetric adjustment, each of these three sets of covariates is split into positive and negative components to allow the coefficients for positive changes to differ from the coefficients for negative changes.

$$\begin{aligned} \Delta RoE_{i,t} = & \sum_{j=1}^{m} \alpha_j^+ \Delta RoE_{i,t-j}^+ + \sum_{j=1}^{m} \alpha_j^- \Delta RoE_{i,t-j}^- + \\ & \sum_{j=1}^{n} \gamma_j^+ \Delta Index_{i,t-j}^+ + \sum_{j=1}^{n} \gamma_j^- \Delta Index_{i,t-j}^- + \\ & \theta^+ \hat{\varepsilon}_{i,t-1}^+ + \theta^- \hat{\varepsilon}_{i,t-1}^- + \upsilon_{i,t} \end{aligned}$$

The key coefficients of interest are the θ coefficients on the residual error correction terms. If these coefficients are statistically different from one another, we take this as evidence of asymmetric adjustment. [17]

4.3 Rate Base Impacts

Next, we turn to the rate base the utilities own. To the extent a utility's approved RoE is higher than their actual cost of equity, they will have a too-strong incentive to have capital on their books. In this section, we investigate the change in rate base

16. It is notable that the coefficient estimates we find for β are generally close to the adjustment factors used in the automatic update rules employed by the Vermont PUC and California PUC (discussed earlier). This suggest these rules appear to largely formalize existing trends.

17. That is, our null hypothesis is $\theta^+ = \theta^-$.

utilities request and receive. The change is a flow variable while the total rate base is the stock of all previous rate base changes. It includes both new investment and depreciation of existing assets. We primarily focus on the effect on the *change* in the rate base, rather than the entire rate base, because the former is actively decided in each rate case and the data is more complete. However, we observe similar effect sizes when looking at the entire rate base. 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, where we regress the rate base increase (RBI) on the estimated RoE gap, various controls, and fixed effects.

$$\log(RBI_{i,t}) = \beta RoE_{i,t}^{gap} + \gamma X_{i,t} + \theta_i + \lambda_t + \epsilon_{i,t} \tag{1}$$

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.[18] The ideal independent variable would be the gap between the allowed RoE and the utilities' costs of equity. Because the true value is unobservable, we use $RoE_{i,t}^{gap}$, the gap between the allowed RoE and the baseline RoE. 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 actual cost of equity to be equal to the 10-year Treasury yield, but our fixed effects account for any constant differences. We calculate $RoE_{i,t}^{gap}$ by taking the difference between the allowed RoE and the average of the time-varying baseline RoE, over the D years the rate case is in place.

$$RoE_{i,t}^{gap} = RoE_{i,t}^{allowed} - \frac{1}{D}\sum_{t}^{t+D} RoE_{i,t}^{benchmark} \tag{2}$$

18. Cases where the rate base shrinks are rare; we drop these cases.

4.3.1 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 rate base. 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 service type, utility company and state level. Utilities that operate in multiple states still file rate cases with each state's utility regulator. Our state fixed effects account for constant differences across states, including any persistent differences in the regulator. 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 rate base. The identifying variation is the differences in the RoE gap within the range of rate case decisions for a given utility, relative to the annual average across all utilities.

The 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. Of course, potential threats to causal identification remain. One possibility is omitted variables – perhaps regulators in some states change their posture toward utilities over time, in a way that is correlated with both the RoE and the change in rate base. Another possibility is reverse causation – perhaps the regulator pushes for more capital investment (e.g. aiming to increase local employment) and the utility, facing increasing marginal costs of capital, needs a higher RoE.

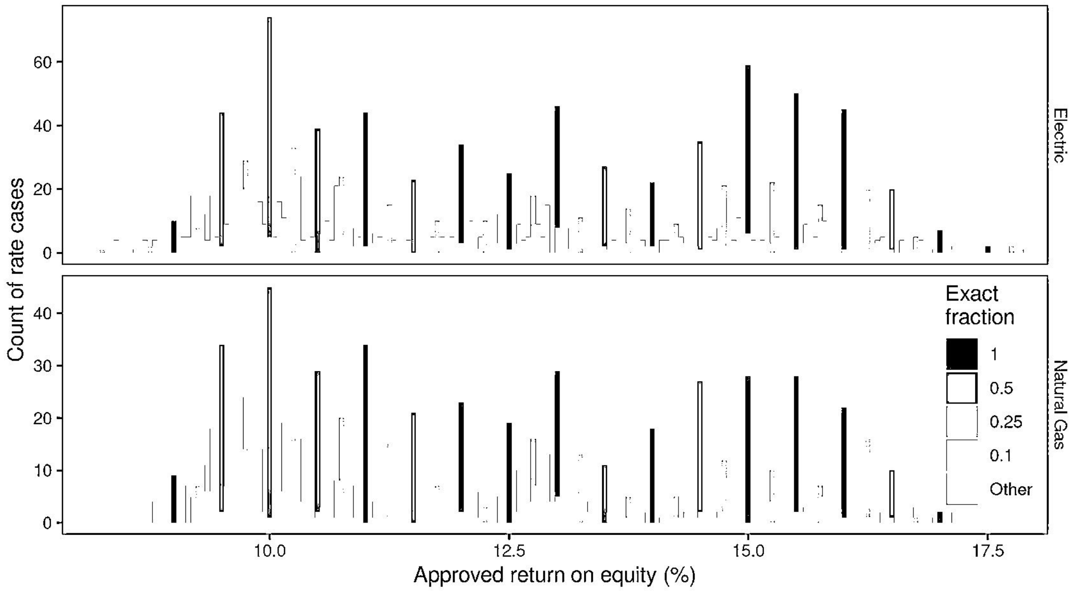
4.3.2 Instrumental Variables Specifications

To try and further deal with concerns regarding identification, we examine an instrumental variables approach based on the timing and duration of rate cases. The average utility has ten rate cases over the course of our sample period and the average rate case is in effect for about three years. Our IV analysis takes the idea that market measures of the cost of capital move around in ways that aren't always easy for the regulator to anticipate. For instance, if the allowed return on equity is set in year 0 and financial conditions change in year 2 such that the RoE gap increases, then we would expect the utility to increase their capital investments in ways that 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 capital markets 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.

A second IV strategy we explore is to exploit an apparent bias toward round numbers, where regulators tend to approve RoE values at integers, halves, quarters, and tenths of percentage points. Unfortunately this instrument does not produce a strong first-stage and so is not a core focus of our subsequent analysis. Even so, the existence of such an arbitrary phenomenon in our setting is still interesting, and can be seen clearly in figure 3. Small deviations created by rounding have large implications for utility revenues and customer payments. 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 rate base for the average electric utility in 2019 would change by $114 million (the median is lower, at $52 million).

We believe the actual, unknown, cost of equity is smoothly distributed. There is therefore some unobserved RoE* that is unrounded. The regulatory process often then rounds from RoE* to the nearest multiple of 10 or 25 basis points (bp). We argue that this introduces an exogenous source of variation into the actual approved RoE. To construct our instrument we calculate the difference between the observed RoE and the nearest rounded RoE. We take the absolute value of this difference and interact it with a dummy for the sign of the difference. When we say "rounded", we

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).

don't know the rounding rule (e.g. up, down, or nearest) and it may differ across utilities and regulators. Our preferred specification uses numbers rounded up to 25 bp, but we check multiples of 10, 50 and 100 bp. For the instrument to be valid, we need to assume that the rounding is related to rate base only via assigned RoE. As noted earlier, because any rounding only accounts for a small portion of the variation in overall RoE, this instrument does not have a strong first stage.

5 Results

5.1 Return on Equity Gap Results

Beginning with the RoE gap analysis from section 4.1, we find there has been an increase in the gap between utilities' allowed return on equity and various measures of their estimated cost of capital. Our results on the RoE gap show this has increased

Table 2: RoE gap, by different benchmarks (percentage points)

A: Electric	Corp	UST	UST auto	CAPM low	CAPM high	UK
1985	0.693	0.415	1.39	1.50	−2.84	
1990	−0.238	0.459	0.412	1.36	−3.09	
1995	0.788	1.09	0.139	2.09	−2.49	
2000	0.666	1.41	0.153	2.42	−1.76	2.79
2005	2.99	2.84	0.722	3.91	−0.552	1.93
2010	3.04	3.21	0.517	4.50	−0.448	−0.585
2015	3.57	3.64	0.416	4.99	0.446	2.77
2020	4.25	4.49	0.706	5.60	0.786	1.88
B: Natural Gas						
1985	1.14	0.798	1.78	1.68	−2.35	
1990	−0.0272	0.848	0.819	1.59	−2.50	
1995	0.873	1.18	0.238	1.99	−2.27	
2000	0.757	1.35	0.0924	2.18	−1.65	
2005	2.85	2.70	0.623	3.54	−0.635	
2010	3.25	3.35	0.707	4.31	−0.516	
2015	3.98	4.01	0.850	5.04	0.646	2.43
2020	4.58	4.86	1.09	5.67	1.06	1.55

Note: Gap percentage figures are a weighted average across utilities, weighted by rate base. For cases where it's relevant the benchmark date is January 1995. See text for details of each benchmark calculation.

over time and are summarized in Table 2.

When benchmarking against changes in market measures of the cost of capital (e.g. 10-yr US Treasury bonds or Moody's corporate bonds) the RoE gap is around 4–4.5 percentage points. It seems plausible that such a large divergence should not arise over the long-term unless the utility sector were to undergo substantial changes.

It is not clear that the cost of equity should necessarily move in a one-for-one manner with these two measures of bond yields. Using the more conservative automatic update rule, which adjusts at half the rate of changes in bond yields, produces an RoE gap by 2020 of around 0.5–1 percentage points. Whether adjusting at 50% of the change in bond yields is the correct approach is unclear. For instance, Canada has used a 75% adjustment ratio in the past. What is clear is that even using this more conservative approach, we still see a divergence between allowed equity returns today and changes in the benchmark cost of capital.

Benchmarking against changes in bond yields relative to some baseline year is necessarily quite simplistic. Our two implementations of the CAPM approach allow us to see how a standard method used in the industry performs. Our "low" version of the CAPM uses assumptions for the risk-free rate, beta and market risk premium that are on the lower end of what has been historically used in the industry. This is particularly true when looking at the practices of US regulators, which appear to utilize higher values than regulators in the UK, Europe and Australia. The result is an RoE gap by 2020 of around 5.5 percentage points.[19] Looking back to the 1980s and 1990s though, the RoE gap becomes much smaller, with predictions of the cost of equity from our "low" CAPM version only showing a 2 percentage point gap against allowed rates of return.

Our "high" version of the CAPM uses assumptions for the risk-free rate, beta and

19. At this point average allowed RoE for US utilities is around 10%, compared with a CAPM prediction for the cost of equity of 4–5%.

market risk premium that are on the higher end of what has been historically used in the industry. This produces an RoE gap by 2020 of around 1 percentage points. Allowed rates of return are therefore still above the predictions from our "high" CAPM case, although much more closely aligned with the current approach of US state PUCs. Notably though, projecting this same approach back in time appears to suggest that past allowed returns in the 1980s and 1990s were well below the estimated cost of equity. This seems implausible given the large capital expenditures the industry has continued to engage in over the last four decades.

Lastly, when comparing against UK utilities we see a fairly consistent premium, with an RoE gap in 2020 of around 2 percentage points. A similar premium would likely emerge when comparing to utilities in other countries in Europe which have tended to approve similar rates of return to those we find for the UK. There are good reasons to think that US state PUCs should not simply adopt UK rates of return – there are many differences between the utility sector and investor environment in the US and UK. Even so, it is striking that other countries are able to attract sufficient investment in their gas and electric utilities while guaranteeing lower regulated returns than are available in the US context.

5.2 Asymmetric Adjustment Results

One mechanism for the emergence of the RoE gap is asymmetric adjustment of allowed return on equity to underlying benchmark rates of return. Table 3 provides the results of this analysis. Here we do find some potential evidence of asymmetric adjustment. Focusing on the US Treasury Bond benchmark and proposed returns on equity (column 1), the coefficient on the positive error correction term, θ^{+}, is -0.0111. This estimate indicates that where the actual return on equity is above the long-run equilibrium (e.g. due to a negative shock to the benchmark) there will be slow convergence back toward equilibrium at a rate of 1.11% of the difference

Table 3: Asymmetric Adjustments in Return on Equity

Model:	(1)	(2)	(3)	(4)
Variables				
θ+	-0.0111***	-0.0085***	-0.0120***	-0.0097***
	(0.0018)	(0.0022)	(0.0020)	(0.0020)
θ-	-0.0274***	-0.0320***	-0.0207***	-0.0229***
	(0.0075)	(0.0107)	(0.0057)	(0.0073)
Approved RoE			Yes	Yes
Index Baa Corp		Yes		Yes
Index UST 10yr	Yes		Yes	
Time Series				
LR coef.	0.5775	0.6054	0.5173	0.5411
θ+=θ- Fstat	4.132	3.631	2.146	2.504
θ+=θ- pval	0.0421	0.0567	0.1430	0.1136
Fit statistics				
Observations	116,537	116,537	94,012	94,012
R^2	0.02	0.01	0.01	0.01
Adjusted R^2	0.02	0.01	0.01	0.01

Clustered (Year) standard-errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: θ^+ is the coefficient on the positive error correction term (convergence when actual RoE is above long-run equilibrium). θ^- is the coefficient on the negative error correction term (convergence when actual RoE is below long-run equilibrium). "LR Coef" refers to the long-run β coefficient from the initial regression: $RoE_{i,t} = \beta Index_{i,t-1} + \varepsilon_{i,t}$.

each month. Conversely, the coefficient on the negative error correction term, θ^{-}, is -0.0274. This indicates that where the actual return on equity is below the long-run equilibrium there will be more rapid convergence back toward equilibrium at a rate of 2.74% of the difference each month. To put it more clearly, a sudden increase in the benchmark cost of capital will result in a faster subsequent rise in utilities' return on equity, while a sudden decrease in the benchmark cost of capital will result in a slower subsequent fall in utilities' return on equity.

Across all specifications we consistently see this pattern repeated whereby long-run adjustments occur faster for increases in the benchmark cost of capital than for decreases ($\theta^{+} < \theta^{-}$). Notably though, this difference is more clearly statistically significant for proposed rates of return (columns 1–2) rather than for approved rates of return (columns 3–4). This is consistent with the rates that utilities propose being more likely to exhibit this kind of asymmetric behavior. The regulatory approval process may serve to dampen the asymmetry somewhat, although given the consistent differences in the magnitudes of the coefficients it does not appear to eliminate it entirely.

5.3 Rate Base Impact Results

We next consider how the RoE gap affects capital ownership in Table 4. Across our fixed effects specifications (columns 1–3) we find broadly consistent results. A 1 percentage point increase in the approved RoE gap leads to a 5.6–8.7% higher increase in approved rate base. Our IV specification using rate case timing (column 4) has a strong first stage (Kleibergen–Paap F-stat of 69). [20] Using this approach we find an effect of 5.3% which broadly aligns with our fixed effects estimates. This is our preferred specification.

In addition to looking at the increase in the rate base, we also look at the total

20. Our IV specification using rounding has a weak first stage (Kleibergen–Paap F-stat of 2.1) and so is not presented here.

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

	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				
Service Type	Yes	Yes	Yes	Yes
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	0.01	0.004	0.01	0.009
Wald (1st stage), RoE gap (%)				69.1
Dep. var. mean	38.63	38.63	38.63	38.63

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

Notes: The table uses approved RoE. The dependent variable is log of the utility's rate base increase in millions of $. Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.3. Our preferred specification is column 4 of table 4. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

Table 5: Relationship Between Approved Rate of Return and Approved Total Rate Base (both absolute and per MWh; electric utilities only)

Model:	Total, FE (1)	Total, IV (2)	per MWh, FE (3)	per MWh, IV (4)
Variables				
RoE gap (%)	0.0524***	0.0779**	0.1202**	0.1204
	(0.0188)	(0.0301)	(0.0571)	(0.0751)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,787	1,787	705	705
R^2	0.85	0.85	0.84	0.84
Within R^2	0.006	0.004	0.02	0.02
Wald (1st stage), RoE gap (%)		25.6		21.2
Prop. or Appr.	Appr.	Appr.	Appr.	Appr.
Dep. var. mean	1,516.5	1,516.5	379.5	379.5

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

NOTES: The table uses approved RoE. Dependent variables are the total rate base in millions of $ (Columns 1–2) and the rate base per quantity delivered in $ per MWh (Columns 3–4). The FE results correspond to the specification used for column 3 in table 4 and the IV results correspond to the specification used for column 4 in table 4. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

rate base and the total rate base per MWh. These results are in Table 5. We find similar effects for the total rate base, and the effects for total rate base per MWh are potentially even larger. However, these findings are less precisely estimated, in part due to data quality challenges. [21] Overall we take these results as providing evidence that higher equity returns do lead utilities to increase their capital holdings. [22]

As a caveat, we note that an utility can increase their capital holdings in two

21. The total rate base data is less complete. Also when calculating on a per MWh basis, we are only able to merge quantity data for a subset of years for electric utilities.

22. The equivalent results from looking at the proposed changes to the rate base can be found in the appendix.

distinct ways. One option is to reshuffle capital ownership, either between subsidiaries or across firms, so that the utility 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.

5.4 Excess Consumer Cost Results

Table 6: Excess costs, by different benchmarks (2019$ billion per year)

A: Electric		Corp	UST	UST auto	CAPM low	CAPM high	UK
Fixed	2000	1.03	2.37	0.250	4.21	−2.74	4.71
	2020	8.58	9.40	1.43	11.8	1.83	3.90
Adjust	2000	1.06	2.55	0.252	4.76	−2.48	5.42
	2020	10.5	11.7	1.49	15.4	1.91	4.29
B: Natural Gas							
Fixed	2000	0.165	0.371	0.0226	0.620	−0.415	
	2020	2.44	2.76	0.624	3.24	0.655	0.886
Adjust	2000	0.171	0.398	0.0227	0.693	−0.378	
	2020	3.05	3.48	0.661	4.23	0.692	0.959

Note: Excess payments are totals for all IOUs in the US, in billions of 2019 dollars per year. Missing rate base data for utilities in our sample was interpolated based on the estimated average growth rate of the rate base over time. The "fixed" rows take the observed rate base as fixed and estimates excess payments. The "adjust" rows also account for changes in the rate base size, as estimated in table 4 column 4. For cases where it's relevant the benchmark date is January 1995. See text for details of each benchmark calculation.

Table 6 summarizes our estimates of the excess cost for utility customers. Here we multiply the rate base by the RoE gap to come up with a measure of the additional payments made to cover the premium in equity returns. To ensure these excess costs are calculated for all utilities in our sample, we must remedy the missing rate base data for some utilities, particularly in the earlier years of our sample. [23] To do this we interpolate using an estimate of the average growth rate for the rate base over time. [24]

Across our five benchmark measures and using the existing rate base we find excess costs to consumers in 2020 of $2–15 billion per year. These excess costs, like the RoE gap, depend on the choice of baseline. The economic welfare loss is likely smaller than these excess cost measures – the excess capital provides non-zero benefit, and the ultimate recipients of utility revenues place some value on the additional income.[25]

Accounting for the way the RoE gap can affect capital ownership increases our estimate of the excess cost to consumers to $2–20 billion per year. The majority of these costs come from the electricity sector.[26]

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 correct, particularly the return on equity, is challenging, but is a first-order important task for utility regulators.

Our analysis shows that the RoE that utilities are allowed to earn has changed

23. Approved rate base data is available for 95% of utilities in 2020 and 65% of utilities in 2000.

24. We regress approved rate base on time, controlling for utility by state by service type fixed effects. Within each grouping of utility, state and service type, we start with the first non-missing value and linearly interpolate backwards assuming the rate base changes from period to period according to our estimated growth rate.

25. The RoE gap will ultimately affect utility rates, including the costs of buying electricity, but the ultimate impact on consumption decisions will depend on each utility's rate structure. Analyzing these is outside the scope of this paper.

26. 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 US Energy Information Administration 2020b. These figures include sales to residential, commercial, industrial, and electric power, but not vehicle fuel. They also include all sales, not just those by investor owned utilities.

dramatically relative to various financial benchmarks in the economy. We estimate that the current approved average return on equity is substantially higher than various benchmarks and historical relationships would suggest. These results are necessarily uncertain, and depending on our chosen benchmark for the cost of equity the premium ranges from 0.5–5.5 percentage points. Put another way, even our most conservative benchmarks come in below the allowed rates of return on equity that regulators set today.

We link this divergence to the apparent asymmetric adjustment of rates to changes in market measures of the cost of capital. Increases to benchmark measures of the cost of capital lead to faster rises in utility returns on equity than is the case for decreases. This is the so-called "rockets and feathers" phenomenon and could be indicative of regulators being more responsive to pressures from the utilities they regulate than from consumers' demands to keep prices down.

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. Depending on our chosen benchmark for the gap, the excess rates collected from consumers could amount to $2–20 billion per year.

If utilities are earning excess equity returns, a key challenge is to identify what changes to the ratemaking process may help remedy this. Regulators have taken numerous steps over the past few decades to improve the way costs are passed through into rates. For instance, explicit benchmarking and automatic update rules were introduced for fuel costs decades ago. It seems plausible that they could also be used to help equity costs adjust more quickly to changing market conditions, and do so in ways that are less prone to the subjective negotiations of the ratemaking process.

However, the cost of equity is unlikely to perfectly track any single benchmark in the same way as the cost of fuel. Also the automatic update rules for equity returns that have already been put in place by some PUCs have done little to prevent the trends we highlight.[27] As such, a significant degree of regulatory judgment is inevitable in this area.

A clear first step for improving the decisions regulators make over the cost of equity is to avoid some of the arbitrary "rules of thumb" that have been employed to date – see for instance the evidence we find of whole number rounding, or the reluctance to set rates below a nominal 10% that Rode and Fischbeck (2019) highlight.

Bolstering the financial expertise of regulators is another promising path forward.[28] Seemingly objective methods like the capital asset pricing model cannot provide a definitive answer on the cost of equity. As we have documented, a range of plausible input assumptions can lead to widely divergent estimates of the cost of equity. When incorporating evidence from these methods regulators need to have the expertise to understand their limitations and push back on the assumptions utilities put forward when using them.

Lastly, process reforms may also be beneficial. In most rate case proceedings, utilities submit their planned expenditures and then regulators decide whether they are prudent. This relies on the notion that utilities are best placed to forecast their detailed needs for labor, materials and equipment (e.g. numbers of new transformers needed and where). However, it is less clear that utilities possess the same unique level of insight when it comes to the cost of equity, especially given that this is so dependent on wider market forces, the performance of peer companies and general investor sentiment. For this component of utility costs the regulator could conduct its own independent internal analysis of the cost of equity first, and then consult on their proposals. In this way it is the regulator that is anchoring the starting point of

27. For instance, 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)

28. Azgad-Tromer and Talley (2017) found that providing finance training to regulatory staff did have a moderate effect on moving rates of return closer to standard asset pricing predictions.

the discussion, not the utility.

Our findings have important implications beyond just the additional cost they place on consumers. From a distributional standpoint, higher rates create a transfer from ratepayers to utility stockholders. A high rate of return for *regulated* utilities may also lead to a reshuffling of which assets are owned by regulated versus non-regulated firms. Finally, efficiently pricing energy has important implications for environmental policy, particularly with regard to encouraging electrification which is a key component of efforts to tackle climate change.

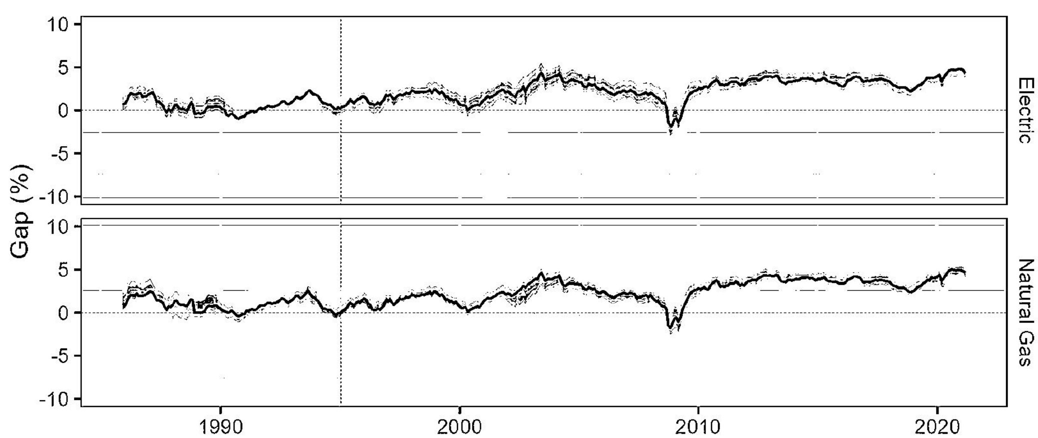
Appendix

A Detail on RoE gap benchmarks

For each of the strategies we utilize, we plot the timeseries of the RoE gap. These are plotted in figures 4, 5, 6, 7, 8, and 9.

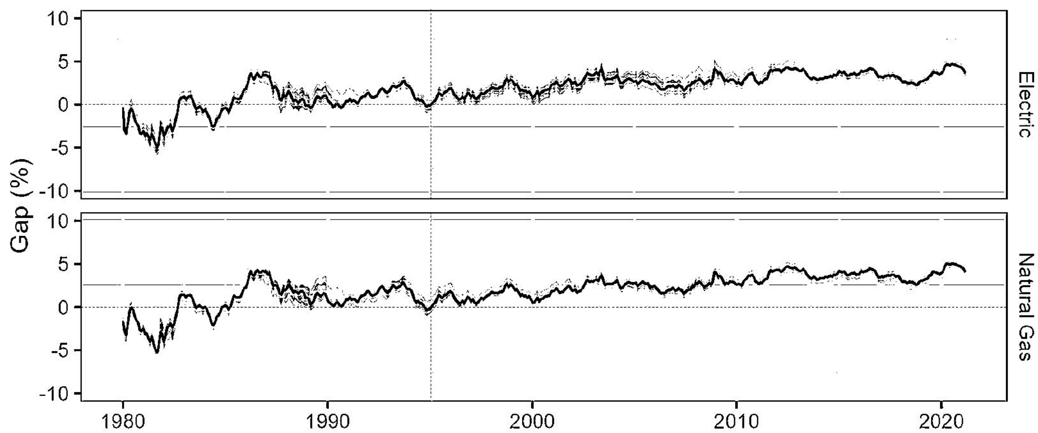
In each plot, we present the median of our RoE gap estimates, weighting by the utility's rate base (in 2019 dollars). Our goal is to show the median of rate base dollar value, rather than the median of utility companies, as the former is more relevant for understanding the impact of the RoE gap. We also 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 rate base).

Figure 4: Return on equity gap, benchmarking to same-rated corporate bonds



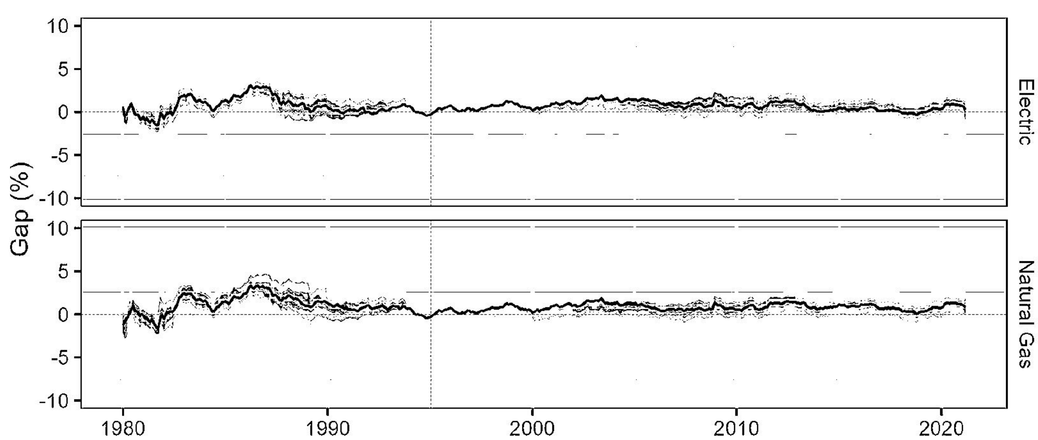
Base year is 1995. Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

Figure 5: Return on equity gap, benchmarking to 10-year Treasuries



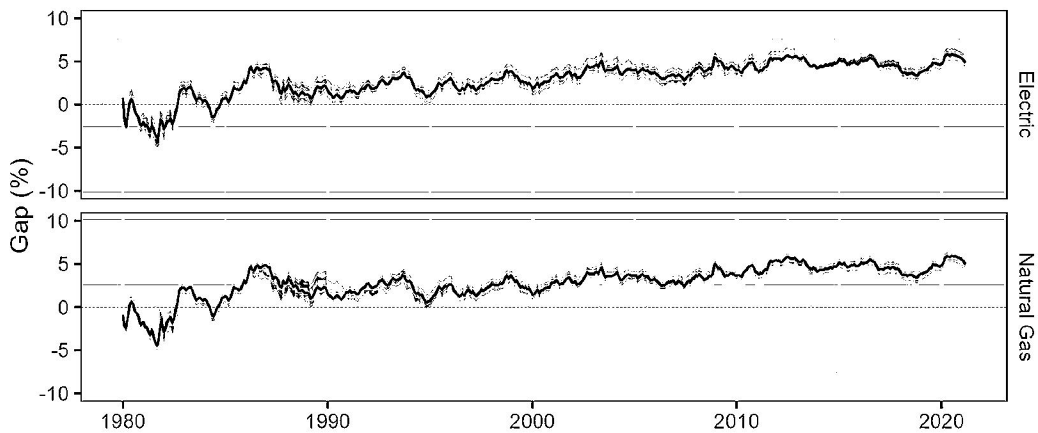
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

Figure 6: Return on equity gap, using automatic update rule



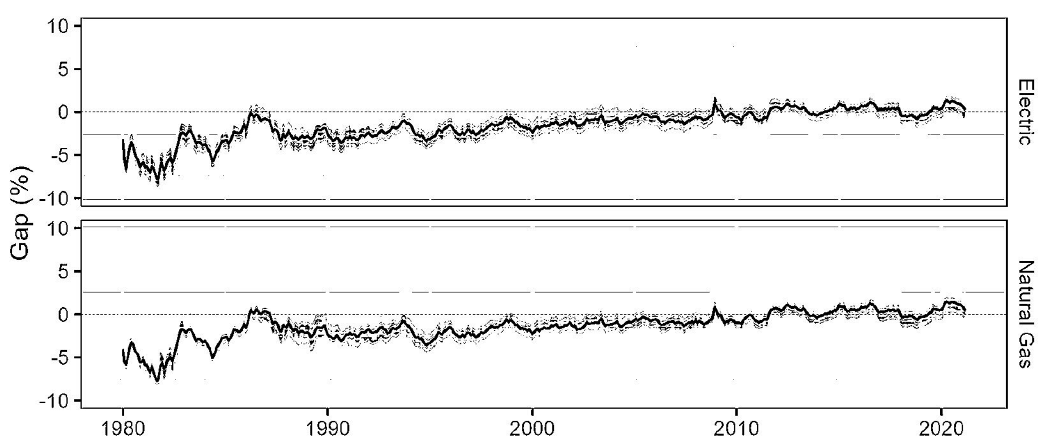
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

Figure 7: Return on equity gap, benchmarking to CAPM (low)



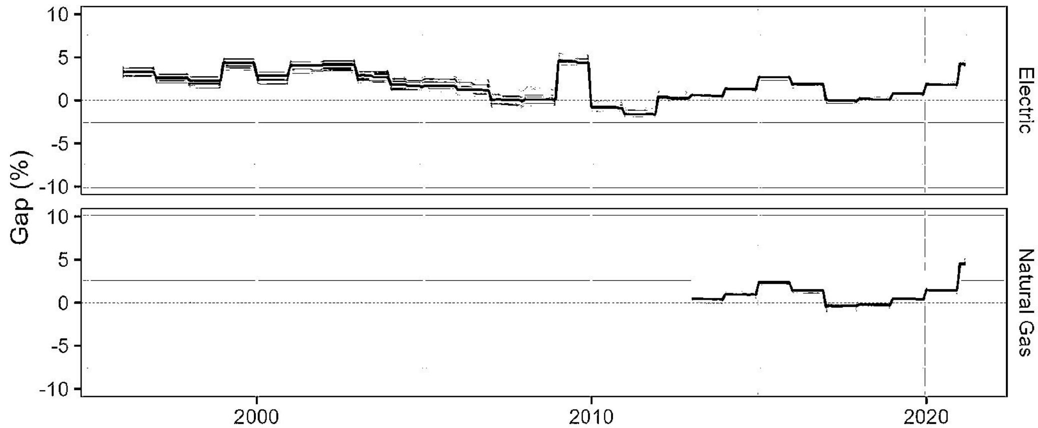
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

Figure 8: Return on equity gap, benchmarking to CAPM (high)



Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

Figure 9: Return on equity gap, compared to UK utilities



Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total IOU rate base. See calculation details in section 4.1.

B Detail on Rate Base Impacts

Here we include additional information on our analysis of rate base impacts. The results include estimates using proposed (instead of approved) rate base changes, as well as estimates using the total rate base.

Table 7: Relationship Between Proposed Rate of Return and Proposed Rate Base Increase

	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				
Service Type	Yes	Yes	Yes	Yes
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	0.02	0.002	0.01	0.008
Wald (1st stage), RoE gap (%)				50.9
Dep. var. mean	63.69	63.69	63.69	63.69

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

NOTES: The table uses proposed RoE. The dependent variable is log of the utility's rate base increase in millions of $ Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.3. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

Table 8: Relationship Between Proposed Rate of Return and Proposed Total Rate Base (both absolute and per MWh)

Model:	Total, FE (1)	Total, IV (2)	per MWh, FE (3)	per MWh, IV (4)
Variables				
RoE gap (%)	0.0384	0.0704**	0.1490**	0.1610**
	(0.0232)	(0.0348)	(0.0702)	(0.0720)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Fit statistics				
Observations	2,140	2,140	919	919
R^2	0.83	0.83	0.83	0.83
Within R^2	0.003	0.0008	0.03	0.03
Wald (1st stage), RoE gap (%)		19.7		15.1
Prop. or Appr.	Prop.	Prop.	Prop.	Prop.
Dep. var. mean	1,583.5	1,583.5	404.4	404.4

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

Notes: The table uses proposed RoE. Dependent variables are the total rate base in millions of $ (Columns 1–2) and the rate base per quantity delivered in $ per MWh (Columns 3–4). The FE results correspond to the specification used for column 3 in table 4 and the IV results correspond to the specification used for column 4 in table 4. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

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How Is The S&P 500 Different From GDP?

November 4, 2014 2:36 pm by LPL Financial

S&P Is Not GDP by LPL Financial

It is important to recognize that the S&P 500 is not GDP. S&P 500 companies have different drivers for earnings than the components that drive GDP.

The backdrop of solid business spending within a slower trajectory of overall GDP growth can be a favorable one for the stock market.

Although stocks are at the low end of our target 10–15% S&P 500 return range for 2014, we see further gains between now and year end as likely, with profit growth as a primary driver.

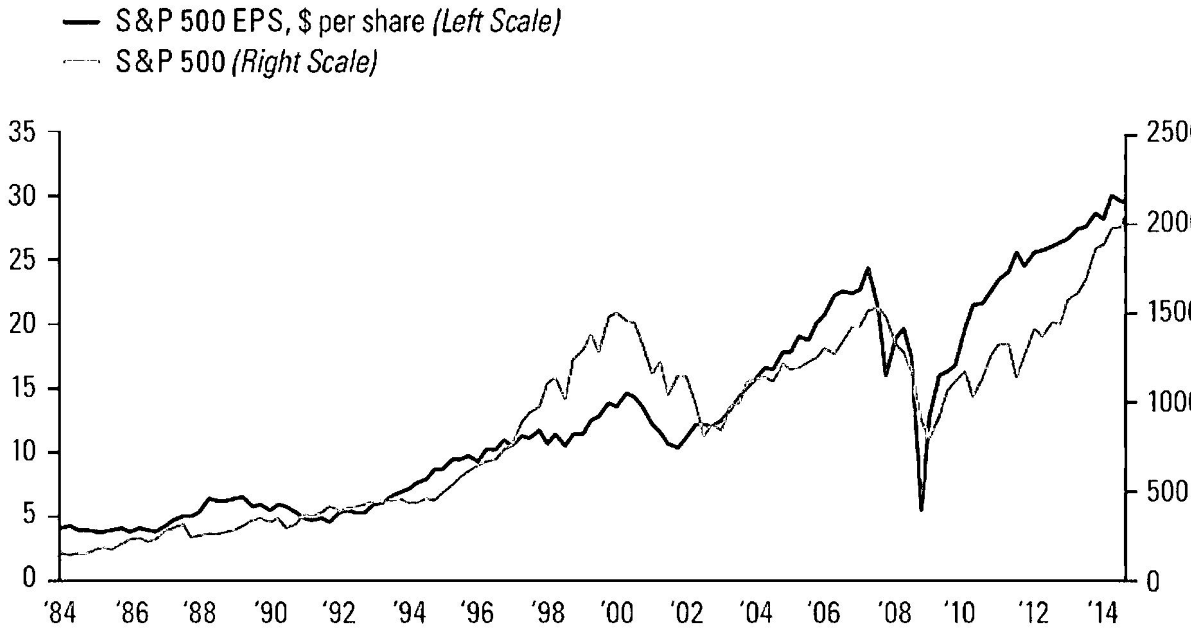
S&P Is Not GDP

U.S. economic growth has been subpar—right around 2%—during much of the ongoing economic expansion. Yet, the S&P 500 has returned nearly 230% cumulatively since the bear market low on March 9, 2009. How did that happen and is it justified?

Before trying to answer to those questions, it is worth pointing out that this situation is not all that unusual. In fact, since 1950, the S&P 500 median return is 13% (average is 12%) when real gross domestic product (GDP) grows less than 3%, with the S&P generating a positive return 68% of the time. However, a good portion of those returns come during recessions—historically, the best time to buy stocks is at recession troughs. But even if we take those periods in and around recessions out of the equation and look at annual returns when GDP growth is between 1–3%, the median (and average) S&P 500 return is a respectable 7–8%. Stocks tend to like average (or slightly below average) growth, which is not strong enough to generate worrisome inflation.

Now back to the question of what has driven this stock market to far outperform economic growth. Some might say quantitative easing (QE), which ended at the end of October 2014 in the United States (the Bank of Japan expanded its QE program last week on Halloween). While QE has benefitted U.S. stocks (how much is up for debate) by helping keep interest rates low and encouraging investors to buy riskier assets (see this week's Weekly Economic Commentary for details), the bull market has been driven by much more than that. Increasing confidence in the economic recovery—albeit a slow one?—?and greater policy clarity in Washington have also been factors. But we think the best answer is earnings. In fact, over the past four decades, earnings have provided solid support for equity market gains [Figure 1].

1 Earnings Have Supported 40 Years of Bull Market Gains



Source: LPL Financial Research, Bloomberg, Thomson Reuters, FactSet 10/30/14

Quarterly data.

S&P GDP

But this commentary is not a deep dive into earnings (that's coming soon). Instead, this week we highlight the differences between the S&P 500 and GDP, i.e., the U.S. economy, to shed some light on how corporate profits can grow so much faster than the economy, and bring stock prices right along with them.

S&P GDP

S&P		GDP	
2/3	manufacturing	2/3	consumption
20–25%	business spending	70%	consumer spending
15%	consumer discretionary spending	20–25%	discretionary consumer categories
40%	overseas	10%	international trade
higher commodity prices	BOOST	higher commodity prices	DRAG

Source: LPL Financial Research 11/03/14

How Is S&P Different from GDP?

S&P 500 companies have different drivers for earnings than the components that drive GDP. There are several key factors that differentiate the economic data from the earning power of corporate America that we think are important for investors to keep in mind:

Corporate profits are more manufacturing driven. Two-thirds of S&P 500 profits are from manufacturing, while two-thirds of U.S. consumption in GDP is services. The Institute for Supply Management (ISM) Manufacturing Survey has exceeded a solidly expansionary 55 level for five consecutive months, a positive signal for U.S. manufacturers. The recently released report on GDP for the third quarter of 2014 showed capital spending growth of 7% annualized, double the 3.5% growth rate of the overall U.S. economy. Many U.S. industrial and materials companies are benefiting from the U.S. energy renaissance that has brought greater access to cheaper energy sources and demand for infrastructure. The strength of the U.S manufacturing economy continues to support our positive industrials sector view.

Corporate profits are less consumer driven. While 70% of GDP is consumer spending, only one-third of it is from discretionary categories, while an even lower 15% of S&P 500 profits come from consumer discretionary spending. A more significant portion of S&P 500 earnings?—?estimated 20–25%?—?comes from business spending. As we move into the latter half of the economic cycle, we expect a stronger contribution from the business spending side than consumer spending side, suggesting the S&P 500 is better positioned than GDP as 2014 comes to a close and we enter 2015. Still, we expect U.S. GDP to sustain a growth rate at or around 3% through year end and well into 2015.

Corporate profits are more international trade driven. International trade only accounts for about 10% of GDP and acts as a drag on growth for most quarters because the United States imports more than it exports. Today, we estimate that 40% of S&P 500 profits are earned overseas?—?with about half of that from rapidly emerging market economies, including China. This makes S&P 500 earnings less dependent upon U.S. growth than 15–20 years ago, when roughly 20% of S&P profits were earned overseas, and 30 years ago when only a small portion of earnings were foreign sourced.

Corporate profits are hurt much less by higher commodity prices than the S&P 500. In fact, higher commodity prices generally benefit S&P 500 companies because most of them either produce commodities (energy and materials), supply commodity producers with equipment (largely industrials), or are not heavy commodity users and are therefore not impacted much by higher commodity prices (technology, healthcare, financials, and telecommunications). U.S. corporations are increasingly benefiting from access to cheaper energy as the energy renaissance continues, although the pace of oil and gas production and the corresponding infrastructure build-out may slow and be a modest drag on S&P 500 earnings should oil prices fall much further. Our view is that oil stabilizes at or near $80 and begins to move higher; but lower oil prices are a risk for energy producers and equipment manufacturers.

Solid Business Spending with Slower GDP Growth Trajectory

We believe the backdrop of solid business spending within a slower trajectory of overall GDP growth can be a favorable one for the stock market. The economic data, while good recently, do not accurately reflect the earning power of corporate America, which remains quite strong. The S&P is not GDP?—?S&P 500 companies have different drivers for earnings than the components that drive GDP growth. Stocks are fundamentally driven by earnings, which have supported the gains during the current bull market and left valuations still within a reasonable range. The earnings picture still looks quite good today, with the S&P 500 on track for 9% year-over-year earnings growth in the third quarter, with about three quarters of the index constituents having reported.

Although stocks are at the low end of our target 10–15% S&P 500 return range for 2014, we see further gains between now and year end may be likely, with profit growth as a primary driver—with perhaps some help from the calendar, as midterm elections have historically been positive for stock returns.

Facebook

Markets

Penalty for Being Rated Junk Drops to Lowest Level Since 2007

By Alex Wittenberg
May 4, 2021, 12:51 PM EDT

- Spread between high grade and high yield now 197 basis points
- Gap narrows amid rally in high yield as risk appetite grows

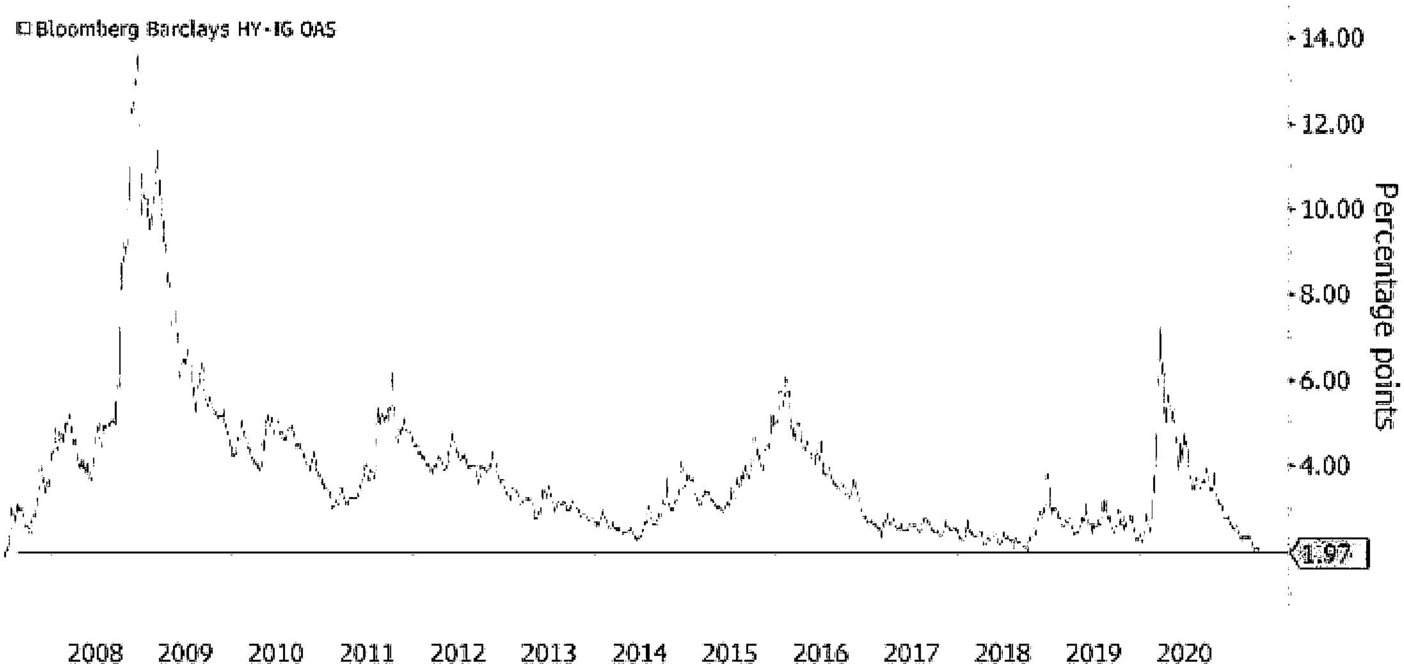
For investment-grade companies on the cusp of junk, it might not be so bad on the other side.

The additional cost for firms to borrow in the U.S. high-yield market versus high grade narrowed to 197 basis points Monday, the tightest since before the global financial crisis, according to Bloomberg Barclays index data. The spread last dipped below 200 basis points in 2007, the data show.

A relentless rally in junk-rated debt is narrowing the gap, as high-yield spreads also hit a pre-crisis tight Monday. Yields dropped to an all-time low as investors pile into riskier assets for higher returns, betting a recovery will boost particularly the most speculative names.

Tighter and Tighter

Spread between HY and IG bonds hits lowest since 2007



Source: Bloomberg Barclays index

Cheap borrowing costs are encouraging a barrage of high-yield issuance, which has broken records in every month this year after setting a new high mark in 2020. It's especially helping the lowest-rated companies tap the market, with CCC yields dropping 34 basis points to a new low of 5.72%.

Request Date: 20060619

Borrower: UPM

Lending String: *OSU,OSU,EEM,GZM,GZM

Patron: Sridharan, Shrinivas

Journal Title: Journal of the Midwest Finance Association.

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UTILITY STOCKS AND THE SIZE EFFECT: AN EMPIRICAL ANALYSIS

Annie Wong*

I. Introduction

The objective of this study is to examine whether the firm size effect exists in the public utility industry. Public utilities are regulated by federal, municipal, and state authorities. Every state has a public service commission with board and varying powers. Often their task is to estimate a fair rate of return to a utility's stockholders in order to determine the rates charged by the utility. The legal principles underlying rate regulation are that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks," and that the return to a utility should be sufficient to "attract capital and maintain credit worthiness." However, difficulties arise from the ambiguous interpretation of the legal definition of *fair and reasonable rate of return* to an equity owner.

Some finance researchers have suggested that the Capital Asset Pricing Model (CAPM) should be used in rate regulation because the CAPM beta can serve as a risk measure, thus making risk comparisons possible. This approach is consistent with the spirit of a Supreme Court ruling that equity owners sharing similar level of risk should be compensated by similar rate of return.

The empirical studies of Banz (1981) and Reinganum (1981) showed that small firms tend to earn higher returns than large firms after adjusting for beta. This phenomenon leads to the proposition that firm size is a proxy for omitted risk factors in determining stock returns. Barry and Brown (1984) and Brauer (1986) suggested that the omitted risk factor could be the differential information environment between small and large firms. Their argument is based on the fact that investors often have less publicly available information to assess the future cash flows of small firms than that of large firms. Therefore, an additional risk premium should be included to determine the appropriate rate of return to shareholders of small firms.

The samples used in prior studies are dominated by industrial firms, no one has examined the size effect in public utilities. The objective of this study is to extend the empirical findings of the existing studies by investigating whether the size effect is also present in the utility industry. The findings of this study have important implications for investors, public utility firms, and state regulatory agencies. If the size effect does exist in the utility industry, this would suggest that the size factor should be considered when the CAPM is being used to determine the fair rate of return for public utilities in regulatory proceedings.

II. Information Environment of Public Utilities

In general, utilities differ from industriales in that utilities are heavily regulated and they follow similar accounting procedures. A public utility's financial reporting is mainly regulated by the Securities and Exchange Commission (SEC) and the Federal Energy Regulatory Commission (FERC). Under the Public Utility Holding Company Act of 1935, the SEC is empowered to regulate the holding company systems of electric and gas utilities. The Act requires registration of public utility holding companies with the SEC. Only under strict conditions would the purchase, sale or issuance of securities by these holding companies be permitted. The purpose of the Act is to keep the SEC and investors informed of the financial conditions of these firms. Moreover, the FERC is in charge of the interstate operations of electric and gas companies. It requires utilities to follow the accounting procedures set forth in its Uniform Systems of Accounts. In particular, electric and gas utilities must request their Certified Public Accountants to certify that certain schedules in the financial reports are in conformity with the Commission's accounting requirements. These detailed reports are submitted annually and are open to the public.

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*Western Connecticut State University. The author thanks Philip Perry, Robert Hagerman, Eric Press, the anonymous referee, and Clay Singleton for their helpful comments.

The FERC requires public utilities to keep accurate records of revenues, operating costs, depreciation expenses, and investment in plant and equipment. Specific financial accounting standards for these purposes are also issued by the Financial Accounting Standards Board (FASB). Uniformity is required so that utilities are not subject to different accounting regulations in each of the states in which they operate. The ultimate objective is to achieve comparability in financial reporting so that factual matters are not hidden from the public view by accounting flexibility.

Other regulatory reports tend to provide additional financial information about utilities. For example, utilities are required to file the FERC Form No. 1 with the state commission. This form is designed for state commissions to collect financial and operational information about utilities, and serves as a source for statistical reports published by state commissions.

Unlike industriales, a utility's earnings are predetermined to a certain extent. Before allowed earnings requests are approved, a utility's performance is analyzed in depth by the state commission, interest groups, and other witnesses. This process leads to the disclosure of substantial amount of information.

III. Hypothesis and Objective

Due to the Act of 1935, the Uniform Systems of Accounts, the uniform disclosure requirements, and the predetermined earnings, all utilities are reasonably homogeneous with respect to the information available to the public. Barry and Brown (1984) and Brauer (1986) suggested that the difference of risk-adjusted returns between small and large firms is due to their differential information environment. Assuming that the differential information hypothesis is true, then uniformity of information availability among utility firms would suggest that the size effect should not be observed in the public utility industry. The objective of this paper is to provide a test of the size effect in public utilities.

IV. Methodology

1. Sample and Data

To test for the size effect, a sample of public utilities and a sample of industriales matched by equity value are formed so that their results can be compared. Companies in both samples are listed on the Center for Research in Security Prices (CRSP) Daily and Monthly Returns files. The utility sample includes 152 electric and gas companies. For each utility in the sample, two industrial firms with similar firm size (one is slightly larger and the other is slightly smaller than the utility) are selected. Thus, the industrial sample includes 304 non-regulated firms.

The size variable is defined as the natural logarithm of market value of equity at the beginning of each year. Both the equally-weighted and value-weighted CRSP indices are employed as proxies for the market returns. Daily, weekly and monthly returns are used. The Fama-MacBeth (1973) procedure is utilized to examine the relation between risk-adjusted returns and firm size.

2. Research Design

All utilities in the sample are ranked according to the equity size at the beginning of the year, and the distribution is broken down into deciles. Decile one contains the stocks with the lowest market values while decile ten contains those with the highest market values. These portfolios are denoted by MV_1, MV_2, ..., and MV_{10}, respectively.

The combinations of the ten portfolios are updated annually. In the year after a portfolio is formed, equally-weighted portfolio returns are computed by combining the returns of the component stocks within the portfolio. The betas for each portfolio at year t, $\hat{\beta}_{pt}$'s, are estimated by regressing the previous five years of portfolio returns on market returns:

$$\tilde{R}_{pt} = \alpha_p + \hat{\beta}_{pt}\tilde{R}_{mt} + \tilde{U}_{pt} \qquad (1)$$

where

R_{pt} = periodic return in year t on portfolio p

R_{mt} = periodic market return in year t

U_{pt} = disturbance term.

Banz (1981) applied both the ordinary and generalized least squares regressions to estimate β; and concluded that the results are essentially identical (p.8). Since adjusting for heteroscedasticity does not necessarily lead to more efficient estimators, the ordinary least squares procedures are used in this study to estimate β in equation (1).

The following cross-sectional regression is then run for the portfolios to estimate γ_{it}, i = 0, 1, and 2:

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt} + \gamma_{2t}\hat{S}_{pt} + U_{pt} \qquad (2)$$

where

$\hat{\beta}_{pt}$ = estimated beta for portfolio p at year t, t=1968, ..., 1987

$\hat{S}_{pt}$ = mean of the logarithm of firm size in portfolio p at the beginning of year t

U_{pt} = disturbance term.

Depending on whether daily, weekly or monthly returns are used, a portfolio's average return changes periodically while its beta and size only change once a year. The γ_1 and γ_2 coefficients are estimated over the following four subperiods: 1968-72, 1973-77, 1978-82 and 1983-1987. If portfolio betas can fully account for the differences in returns, one would expect the average coefficient for the beta variable to be positive and for the size variable to be zero. A t-statistic will be used to test the hypothesis. The coefficients of a matched sample are also examined so that the results between industrial and utility firms can be compared.

V. Analysis of Results

1. Equity Value of the Utility Portfolios

The mean equity values of the ten size-based utility portfolios are reported in Table 1. Panels A and B present the average firm size of these portfolios at the beginning and end of the test period, 1968-1987. The first interesting observation from Table 1 is that the difference in magnitude between the smallest and the largest market value utility portfolios is tremendous. In Panel A, the average size of MV_1 is about \$31 million while that of MV_{10} is over \$1.4 billion. In Panel B, that is twenty years later, they are \$62 million and \$5.2 billion, respectively. Another interesting finding is that there is a substantial increase in average firm size from MV_9 to MV_{10}. Since these two findings are consistent over the entire test period, the average portfolio market values for interim years are not reported. These results are similar to the empirical evidence provided by Reinganum (1981).

The utility sample in this study contains 152 firms whereas Reinganum's sample contains 535 firms that are mainly industrial companies. Two conclusions may be drawn from the results of the Reinganum study and this one. First, utilities and industriales are similar in the sense that their market values vary over a wide spectrum. Second, the fact that there is a huge jump in firm size from MV_9 to MV_{10} indicates that the distribution of firm size is positively skewed. To correct for the skewness problem, the natural logarithm of the mean equity value of each portfolio is calculated. This variable is then used in later regressions instead of the actual mean equity value.

2. Betas of the Utility and Industrial Samples

The betas based on monthly, weekly and daily returns are reported for the utility and industrial samples. For simplicity, they will be referred to as monthly, weekly, and daily betas. In all cases, five years of returns are used to estimate the systematic risk. The betas estimated over the 1963-67 time period are used to proxy for the betas in 1968, which is the beginning of the test period. By the same token, the betas obtained from the time period 1982-86 are used as proxies for the betas in 1987, which is the end of the test period.

The betas from using the equally-weighted and value-weighted indices are calculated in order to check whether the results are affected by the choice of market index. Since the results are similar, only those obtained from the equally-weighted index are reported and analyzed.

Table 2 reports the monthly, weekly and daily betas of the two samples at the beginning and end of the test period. Panel A shows the various betas of the industrial portfolios. Two conclusions may be drawn. First, in the 1960's, smaller market value portfolios tend to have relatively larger betas. This is consistent with the empirical findings by Banz (1981) and Reinganum (1981). Second, this trend seems to vanish in the 1980's, especially when weekly and daily returns are used.

The betas of the utility portfolios are presented in Panel B. The table shows that none of the utility betas are greater than 0.71. A comparison between Panels A and B reveals that utility portfolios are relatively less risky than industrial portfolios after controlling for firm size. The comparison also reveals that, unlike industrial stocks, betas of the utility portfolios are not related to the market values of equity.

The negative correlation between firm size and beta in the industrial sample may introduce a multicolinearity problem in estimating equation (2). Banz (p.11) had addressed this issue and concluded that the test results are not sensitive to the multicolinearity problem. For the utility sample, this problem does not exist.

3. Tests on the Coefficients of Beta and Size

The beta and firm size are used to estimate γ_1 and γ_2 in equation (2). A t-statistic is used to test if the mean values of the gammas are significantly different from zero. The tests were performed for four 5-year periods which are reported in Table 3. The mean of the gammas and their t-statistic are presented in Panel A for the utilities and in Panel B for the industrial firms.

The empirical results for the utility sample are reported in Panel A of Table 3. When monthly returns are used, 60 regressions were run to obtain 60 pairs of gammas for each of the 5-year periods. When daily returns are used, over 1200 regressions were run for each period to obtain the gammas. The results are similar: in all of the time periods tested, none of the average coefficients for beta and size are significantly different from zero. When weekly returns are used, 260 pairs of gammas were obtained. The average coefficients for beta are not significant in any test period, and the average coefficients for size are not significant in three of the test periods. For the test period of 1978-82, the average coefficient for size is significantly negative at a 5% level.

The test results for the industrial sample are reported in Panel B of Table 3. When monthly returns are used, the average coefficient estimates for size and beta are significant and have the expected sign only in the 1983-87 test period. When weekly returns are used, only the size variable is significantly negative in the 1978-82 period. When daily returns are used, the coefficient estimates for betas and size are not significant at any conventional level.

According to the CAPM, beta is the sole determinant of stock returns. It is expected that the coefficient for beta is significantly positive. However, the empirical findings reported in this study and in Fama and French (1992) only provide weak support for beta in explaining stock returns. The empirical findings in this study also suggest that the size effect varies over time. It is not unusual to document the firm size effect at certain time periods but not at others. Banz (1981) found that the size effect is not stable over time with substantial differences in the magnitude of the coefficient of the size factor (p.9, Table 1). Brown, Kleidon and Marsh (1983) not only have shown that size effect is not constant over time but also have reported a reversal of the size anomaly for certain years.

The research design of this study allows us to keep the sample, test period, and methodology the same with the holding-period being the only variable. The size effect is documented for the industrial sample in one of the four test periods when monthly returns are used and in another when weekly returns are used. When daily returns are used, no size effect is observed. For the utility sample, the size effect is significant in only one test period when weekly returns are used. When monthly and daily returns are used, no size effect is found. Therefore, this study concludes that the size effect is not only time-period specific but also holding-period specific.

VI. Concluding Remarks

The fact that the two samples show different, though weak, results indicates that utility and industrial stocks do not share the same characteristics. First, given firm size, utility stocks are consistently less risky than industrial stocks. Second, industrial betas tend to decrease with firm size but utility betas do not. These findings may be attributed to the fact that all public utilities operate in an environment with regional monopolistic power and regulated financial structure. As a result, the business and financial risks are very similar among the utilities regardless of their sizes. Therefore, utility betas would not necessarily be expected to be related to firm size.

The objective of this study is to examine if the size effect exists in the utility industry. After controlling for equity values, there is some weak evidence that firm size is a missing factor from the CAPM for the industrial but not for the utility stocks. This implies that although the size phenomenon has been strongly documented for the industriales, the findings suggest that there is no need to adjust for the firm size in utility rate regulations.

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Table 1

Average Equity Size of the Utility Portfolios at the Beginning and End of the Test Period (Dollar figures in millions)

	A: Beginning (1968)	B: End (1987)
MV_1	$31	$62
MV_2	$77	$177
MV_3	$113	$334
MV_4	$161	$475
MV_5	$220	$715
MV_6	$334	$957
MV_7	$437	$1,279
MV_8	$505	$1,805
MV_9	$791	$2,665
MV_{10}	$1,447	$5,399

Table 2

Betas of the Two Samples at the Beginning and End of the Test Period

	Monthly Betas		Weekly Betas		Daily Betas	
	1963-67	1982-86	1963-67	1982-86	1963-67	1982-86
Panel A: Industrial Firms						
MV_1	0.89	1.00	1.15	0.95	1.11	0.92
MV_2	0.94	0.87	1.07	1.01	1.14	1.01
MV_3	0.88	0.82	1.12	0.86	1.14	1.04
MV_4	0.69	0.74	1.00	0.83	1.03	0.86
MV_5	0.73	0.80	1.05	0.96	1.13	1.01
MV_6	0.66	0.82	1.03	1.01	1.05	1.04
MV_7	0.64	0.81	0.97	1.04	0.98	1.09
MV_8	0.62	0.75	0.97	1.11	1.00	1.20
MV_9	0.52	0.78	0.84	1.06	0.94	1.16
MV_{10}	0.43	0.65	0.78	1.01	0.86	1.22
Panel B: Public Utilities						
MV_1	0.30	0.37	0.31	0.43	0.30	0.40
MV_2	0.28	0.38	0.37	0.47	0.36	0.44
MV_3	0.22	0.42	0.33	0.42	0.31	0.49
MV_4	0.27	0.35	0.36	0.52	0.34	0.54
MV_5	0.25	0.45	0.37	0.61	0.35	0.62
MV_6	0.25	0.41	0.39	0.54	0.40	0.65
MV_7	0.20	0.35	0.34	0.54	0.37	0.63
MV_8	0.17	0.38	0.34	0.65	0.33	0.68
MV_9	0.19	0.34	0.35	0.60	0.34	0.71
MV_{10}	0.18	0.29	0.38	0.59	0.39	0.71

Table 3

Tests on the Mean Coefficients of Beta (γ_1) and Size (γ_2)

$$R_{pt} = \gamma_{ot} + \gamma_{1t}\hat{\beta}_{pt} + \gamma_{2t}\hat{S}_{pt} + U_{pt}$$

Returns Used:		Monthly (t-value)	Weekly (t-value)	Daily (t-value)
Panel A: Utility Sample				
1968-72	γ_1	-0.46% (-0.26)	-0.32% (-0.42)	-0.02% (-0.18)
	γ_2	-0.07% (-0.78)	-0.01% (-0.51)	-0.00% (-0.46)
1973-77	γ_1	-0.28% (-0.13)	0.14% (0.14)	-0.03% (-0.21)
	γ_2	-0.11% (-0.70)	-0.03% (-0.67)	-0.00% (-0.53)
1978-82	γ_1	0.55% (0.36)	0.54% (1.00)	0.05% (0.43)
	γ_2	-0.10% (-0.75)	-0.05% (-1.71)*	-0.01% (-1.60)
1983-87	γ_1	1.74% (1.28)	-0.24% (-0.51)	-0.02% (-0.18)
	γ_2	-0.16% (-1.54)	-0.03% (-0.86)	-0.01% (-0.63)
Panel B: Industrial Sample				
1968-72	γ_1	-0.36% (-0.27)	-0.28% (-0.55)	-0.02% (-0.32)
	γ_2	0.07% (0.43)	-0.01% (-0.19)	0.00% (0.51)
1973-77	γ_1	1.34% (0.64)	-0.23% (-0.31)	0.14% (1.45)
	γ_2	-0.01% (-0.06)	-0.04% (-0.85)	-0.00% (-0.64)
1978-82	γ_1	-0.84% (-0.28)	-0.56% (-0.91)	-0.09% (-0.81)
	γ_2	-0.29% (-0.75)	-0.01% (-1.72)*	-0.00% (-1.33)
1983-87	γ_1	2.51% (1.83)*	0.34% (0.64)	0.11% (1.40)
	γ_2	-0.25% (-1.90)*	-0.01% (-0.43)	0.00% (0.14)

* Significant at the 5% level based on a one-tailed test.

The Accuracy of Analysts' Long-Term Earnings Per Share Growth Rate Forecasts

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ABSTRACT: In this study we examine the accuracy of analyst long-term and one-year earnings per share growth rate forecasts over the last 20 years. We find that analysts' earnings growth rate estimates are consistently overly-optimistic and are about two times the level of GDP growth. Analyst predictions of earnings are better for one-year projections than for long-term projections, but are still overly-optimistic. We find that analyst coverage does not have a significant impact on the optimistic bias in analysts EPS growth rate forecasts. We do find that a contributing factor for the bias in analysts' earnings estimates is the resistance of analysts to project negative earnings growth. Furthermore, we find that earnings estimates have a continued bias after the 2003 Global Analyst Research Settlements.

Introduction

The expected growth rate of long-term earnings plays a critical role in investment management and corporate finance. An essential element in valuation modeling and cost of capital estimation, long-term earnings growth is periodically forecasted by Wall Street analysts to provide investors with a better understanding of the current and future cash flows likely to be generated by a firm's operations. Periods of high earnings growth rates are usually accompanied with bull markets, and periods of low or negative earnings growth rates tend to produce bear markets. In addition, companies with high earnings growth rates usually sell at high price-to-earnings (P/E) ratios, and stocks with low earnings growth rates trade at low P/E ratios.

A number of studies have indicated that analysts' forecasts of earnings are upwardly biased. For example, Barefield and Comiskey (1975), DeBondt and Thaler (1990), Butler and Lang (1991), Abarbanall (1991), and Brown (1997) find an overall optimism in analysts' earnings forecasts. Becchetti, Hasan, Santoro, and Anandarajan (2007) find evidence that an over-optimism bias is highest during bull markets. Hong and Kubik (2003) find that brokerage houses reward optimistic analysts who promote stocks. In addition, the popular press occasionally highlights evidence of analysts forecast bias.[1]

However, these studies assessing the accuracy of analysts' earnings estimates are based on forecasts of quarterly earnings. That is, these studies evaluate the accuracy of analysts' earnings forecasts for periods up to one quarter before a quarterly EPS figure is released. Our study examines analysts' long-term (three- to five- year) and one-year

[1] See for example, Brown (2003) and Smith (2003).

ahead EPS growth rate forecasts. According to financial theory, long-term expected earnings growth drives the valuation of the overall stock market and individual common stocks. As such, long-term EPS growth rate forecasts are an essential component of cash flow valuation models for firms and the market and are used in estimating the cost of capital.

We begin by evaluating historic EPS growth. Many have argued that there is an upward limit on EPS growth as determined by sustainable GDP growth. Bernstein and Arnott (2003) and Arnott (2004) indicate that EPS growth must be below sustainable growth in economic productivity. We show that the historic growth rate in EPS and GDP in the U. S. is in the 7.0% range. As an initial indication of accuracy of analysts' forecasts, we find that analysts' estimates of long-term EPS growth are substantially above this level.

We examine the accuracy of analysts' long-term earnings and one-year ahead EPS growth rate estimates over the last 20 years. We find that analysts' earnings growth rate estimates are consistently overly-optimistic. Analyst predictions of earnings growth are better for one-year growth rate projections than for long-term growth rate projections, but are still significantly overly-optimistic. Analysts only underestimate EPS growth following periods of economic recession which are associated with EPS recovery after large declines in earnings. We also evaluate whether the number of analysts covering a company is associated with the overly-optimistic bias in projected EPS growth rates. We find that analyst coverage does not have a significant impact on the bias in projected EPS growth rates. We do find that a contributing reason for the bias in analysts' long-term and one-year EPS growth rate estimates is the resistance of analysts to project negative earnings growth. We find that analysts rarely project negative EPS growth, despite the fact that companies commonly experience negative earning growth over three- to –five-year time periods. Based on the research of others, we suggest three explanations for the upward bias in analysts' earnings estimates. The first explanation is based on career concerns or conflicts of interest. Analysts are rewarded for biased forecasts by their employers (brokerage houses) who want them to hype stocks so that the brokerage house can garner trading commissions and win underwriting deals. The second explanation is based on selection bias. Analysts only follow stocks that they recommend and do not issue forecasts on those that they do not like. The third explanation is a cognitive or behavioral bias. Analysts become attached to the companies that they cover and lose objectivity. This would imply that analysts are systematically biased. Since they are only projecting the companies they follow, and not the market, the end result is a strong upward bias on earnings projections.

Finally, we assess the optimistic bias in analysts' EPS growth rate estimates for the period after the Global Analyst Research Settlements in 2003. Presumably, any bias in the research of Wall Street investment firms should have been impacted by New York Attorney General (now Governor) Elliot Spitzer's investigation and the $1.5B payment made by nine major brokerage firms. Nonetheless, we find a continued optimistic bias in long-term earnings growth rate estimates after the Settlements.

This study is organized as follows. Initially, the historic growth of earnings on S&P 500 companies is compared to the growth in GDP to establish the historic relationship between corporate earnings growth and economic growth. Then, analysts' forecasts of earnings growth for long-term and one-year time horizons are compared to actual earnings growth. We also evaluate analyst coverage as a possible contributing factor in earnings forecast bias. Next, negative earnings growth projections are examined as a possible explanation for the earnings estimate bias. Finally we investigate analysts' earnings estimates following the Global Research Regulatory Settlement to see if analysts have adjusted their bias.

Data and Methodology

One of the most common approaches to estimating the long-term earnings growth rates for companies is to use the mean estimates of the forecasts of Wall Street securities' analysts as published by such services as Zack's Investment Research, Thomson First Call Research, or the Institutional Brokers' Estimate System (I/B/E/S). I/B/E/S has a more comprehensive coverage of brokerage firms and financial analysts than the other databases. It includes many more analysts from smaller brokerage firms, and also includes important brokerage firms such as Merrill Lynch, Goldman Sachs, and Donaldson, Lufkin & Jenrette that are not included in Zack's Investment Research.

Using the I/B/E/S database, we collect long-term and one-year ahead annual growth rate estimates for all firms from 1984 to 2006, inclusive. We require that companies not only have projected EPS growth rate estimates, but also have EPS figures for the four-year ahead period (for the long-term forecasts) and the one-year ahead period (for the one-year forecasts) so that forecasted and actual EPS growth rates can be compared. Based on projected and actual earnings per share, we calculate implied geometric growth rates. We compare analysts' projected and actual EPS growth rates for long-term EPS growth rate forecasts and one-year EPS growth rate estimates. The data result in an average of 1,383 firms and 1,275 firms per year, for one-year and long-term growth rates, respectively. The descriptive statistics for the data are reported by year in Table 1.

Table 1
Number of Companies and Average Number of Analysts:
One-Year and Long-Term Analyst Forecast Data

	One-Year Forecasts		Long-Term Forecasts	
Year	Number of Companies	Average Number of Analysts	Number of Companies	Average Number of Analysts
1984	1,245	8.61	--	--
1985	1,154	10.30	--	--
1986	1,140	10.44	--	--
1987	1,047	11.02	--	--
1988	1,095	10.70	808	6.09
1989	1,245	10.64	899	6.29
1990	1,260	10.78	892	6.49
1991	1,138	10.01	921	6.34
1992	1,192	9.60	1,003	5.49
1993	1,314	9.55	1,125	5.90
1994	1,475	9.71	1,175	5.69
1995	1,557	9.11	1,148	5.86
1996	1,652	8.74	1,158	5.68
1997	1,489	8.33	1,218	5.51
1998	1,375	7.75	1,466	4.99
1999	1,258	8.54	1,490	4.95
2000	1,176	8.26	1,503	5.08
2001	1,469	7.68	1,467	5.26
2002	1,367	7.13	1,518	5.39
2003	1,464	7.78	1,577	5.56
2004	1,565	8.60	1,663	5.24
2005	1,620	8.73	1,578	5.07
2006	2,502	6.92	1,628	5.59
Mean	1,383	9.08	1,275	5.61
Median	1,314	8.74	1,218	5.56

Source: I/B/E/S. Long-term numbers are based on the average of quarterly numbers for each year.

Analysts Long-Term EPS Growth Rate Forecasts

For the analysts' long-term growth rate estimates, I/B/E/S reports the number of analysts as well as the mean and median EPS growth rate estimates for a 'three-to-five' year period. Given that I/B/E/S projected EPS growth rate is for a 'three-to-five' year period, the projected EPS growth rate is assumed to be four years. For each company in the I/B/E/S database with long-term analysts' EPS growth rate forecasts, as of the end of each quarter we obtain the annual EPS, EPS_t, as the sum of the trailing four quarters' EPS and the mean projected three-to-five year projected EPS growth rate, g. As an example, assume that EPS_t for a particular company as of the end of the fourth quarter of 2000 is $1.00 and g is 10%, as shown in Table 2. The projected EPS in four years, EPS_{t+4}, for this company is calculated as:

$$EPS_{t+4} = (EPS_t)(1+g)^4$$

Table 2
Example: EPS and Projected Growth for a Hypothetical Company

Actual Quarterly EPS					
First Quarter 2000	**Second Quarter 2000**	**Third Quarter 2000**	**Fourth Quarter 2000**	**Actual Annual EPS**	**I/B/E/S Projected EPS Growth**
0.25	0.35	0.25	0.15	1.00	10.0%

In this example, the company's projected EPS is calculated as:

$$EPS_{t+4} = (1.00)(1.10)^4 = \$1.46.$$

This figure is compared to the company's actual annual EPS growth rate from the end of 2000 to the end of 2004. The actual EPS growth rate is calculated as the compound annual growth rate in earnings over the time period, g_a, as shown below:

$$g_a = 1 - \left(\frac{EPS_{t+4}}{EPS_t} \right)^{.25}$$

As an example, if the company's actual annual EPS as of the fourth quarter of 2004 is $1.25; the company's actual four-year EPS growth rate is calculated as 5.74%. This is shown in Table 3. In this example, analysts projected this company to grow EPS at 10% over the four-year time period, and the company had an actual EPS growth rate of 5.74%. This procedure is repeated on a quarterly basis for each company in the I/B/E/S database.

Table 3
Example: Actual Long-Term EPS
Growth Rate Calculation for a Hypothetical Company

Actual Quarterly EPS					
First Quarter 2004	**Second Quarter 2004**	**Third Quarter 2004**	**Fourth Quarter 2004**	**Actual Annual EPS**	**Actual EPS Growth (2000 – 2004)**
0.30	0.35	0.25	0.35	1.25	5.74%

Analysts' One-Year EPS Growth Rate Estimates

For one-year EPS estimates, I/B/E/S reports the number of analysts as well as the mean and median one-year EPS estimates. We compare the growth rates associated with the one-year projected EPS estimates with the actual EPS as of the end of the calendar year. For this reason, we limit this analysis to firms with December 31st fiscal year-ends.

As an example, using the hypothetical company in Table 4, of the end of the fourth quarter of 2004, the company's EPS_t is \$1.00. If the analysts' projected one-year growth in EPS, EPS_{t+1}, is \$1.15, the company's projected one-year EPS growth rate is calculated as 15.0%. This figure is compared to the company's actual EPS growth rate based on quarterly earnings in 2005. In the example in Table 4, the company's actual one-year EPS growth rate is 10.0%. This procedure is then repeated on an annual basis for each company in the I/B/E/S database

Table 4
Example: Actual Annual EPS Growth
Rate Calculation for a Hypothetical Company

Actual EPS						
First Quarter 2004	**Second Quarter 2004**	**Third Quarter 2004**	**Fourth Quarter 2004**	**2004 Actual Annual EPS**	**2005 Actual Annual EPS**	**Projected One-Year EPS Growth (2004 – 2005)**
0.30	0.30	0.20	0.20	1.00	1.10	15.0%

We calculate forecast errors, *FE*, based on the ratio of the forecasted and actual estimated growth rates, as follows:

$$FE = \frac{g}{g_a} - 1$$

Based on this calculation, a positive forecast error indicates an upward bias in forecasted earnings and a negative forecast error indicates a downward bias in forecasted earnings.

The tabulated growth rates are based only on firms who survive for the following one or four years, for one-year and long-term growth rates, respectively. The survivorship bias may induce an upward bias in actual earnings growth rates. Moreover, we do not calculate growth rates when the base-year value is negative.

Historic Growth Rate in Earnings

The historic record for EPS and GDP growth provides a benchmark for long term growth estimates. Ibbotson and Cheng (2003) show that growth in earnings is in line with overall growth in economic productivity. Bernstein and Arnott (2003) and Arnott (2004) make the point that corporate earnings growth rates cannot exceed sustainable GDP growth, even though analysts consistently forecast growth rates that indicate the opposite.

We begin by examining the actual five-year earning per share (EPS) growth for the S&P 500 and five-year Gross Domestic Product (GDP) growth from 1960 to 2006. EPS for the S&P 500 has averaged 7.02% with a median of 7.08%. GDP has averaged 7.42% with median of 7.40%. The results are presented in Figure 1.

Historically, EPS growth has been is more volatile than GDP growth. EPS growth rates range from -2.71% to 16.89% with a standard deviation of 4.51%. Growth rates for GDP range from 4.62% to 11.38% with a standard deviation of 2.03%. In addition, average GDP growth has exceeded EPS growth. This result corresponds with previous research.

Figure 1
Five-Year S&P 500 EPS Growth Versus Five-Year GDP Growth

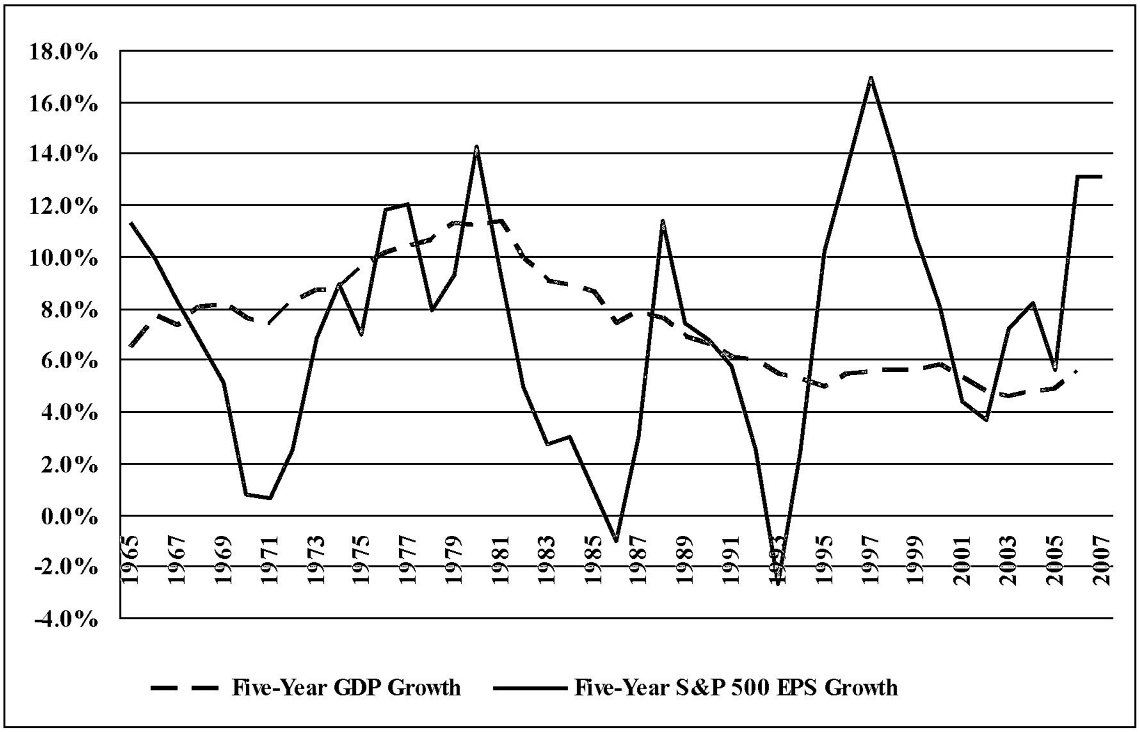
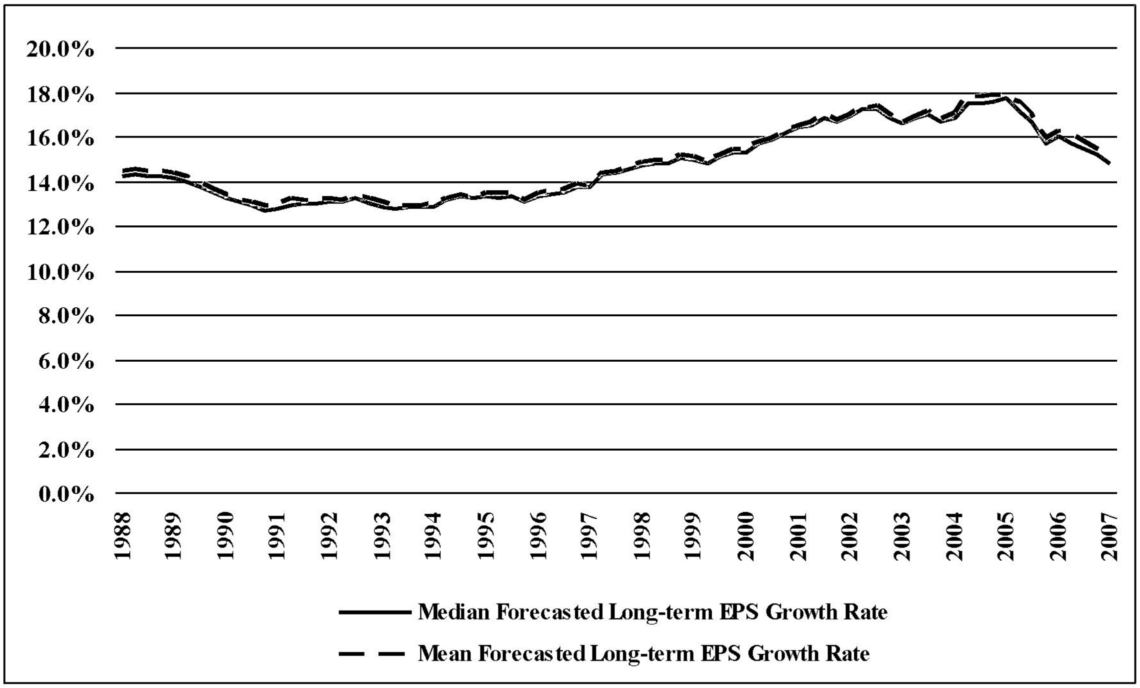


Figure 2 shows the mean and median long-term analysts EPS forecasts from 1988 through the first quarter of 2007. Although GDP growth has averaged 7.42% with median of 7.40% over the last 40 years, analysts over our sample period project long-term growth at an average rate of 14.71%. This suggests that analysts consistently forecast long-term EPS growth at a level that is two times that of historic GDP growth.

Several observations can be made from Figure 2. First, analysts consistently project long-term growth rates in a range of 13% to 18%. Second, mean and median observations are practically identical suggesting that these results are not driven by outliers. Finally, analysts' forecasts have increased over time, even though GDP growth has decreased over time.

In the sections that follow, we examine analysts' long-term and one- year ahead forecasts relative to actual EPS growth rates.

Figure 2
Long-Term IBES Forecasted EPS Growth Rates
1988-2006



Analysts IBES Forecast Versus Actual EPS Growth Rates: Long-Term Projections

We examine forecasted long-term EPS growth versus actual three-to-five-year EPS growth based on IBES data from 1984 to 2006. The results are presented by quarter in Table 5 and Figure 3.

. Over the entire time period, analysts continually forecast long-term EPS growth for the sample between 13% and 18%. Actual EPS growth for the sample ranges between 1.23% and 19.93%. Firm's meet or exceed analysts' expectations in periods around 1996 and 2006, both of which followed a large decline in corporate earnings. This is the most likely scenario for corporations to attain the lofty growth rates projected by analysts. This pattern is seen clearly in Figure 3.

Over the entire period analysts' long-term forecasted EPS growth averaged

14.71% per year, but companies only averaged long-term EPS growth of 9.10%. The analyst bias is obvious and clearly significant. A test for a difference in means--the null hypothesis is the difference in the mean actual EPS growth is equal to the mean projected EPS growth--has a t-stat of -10.68 which is significant at the .005 level (n=77).

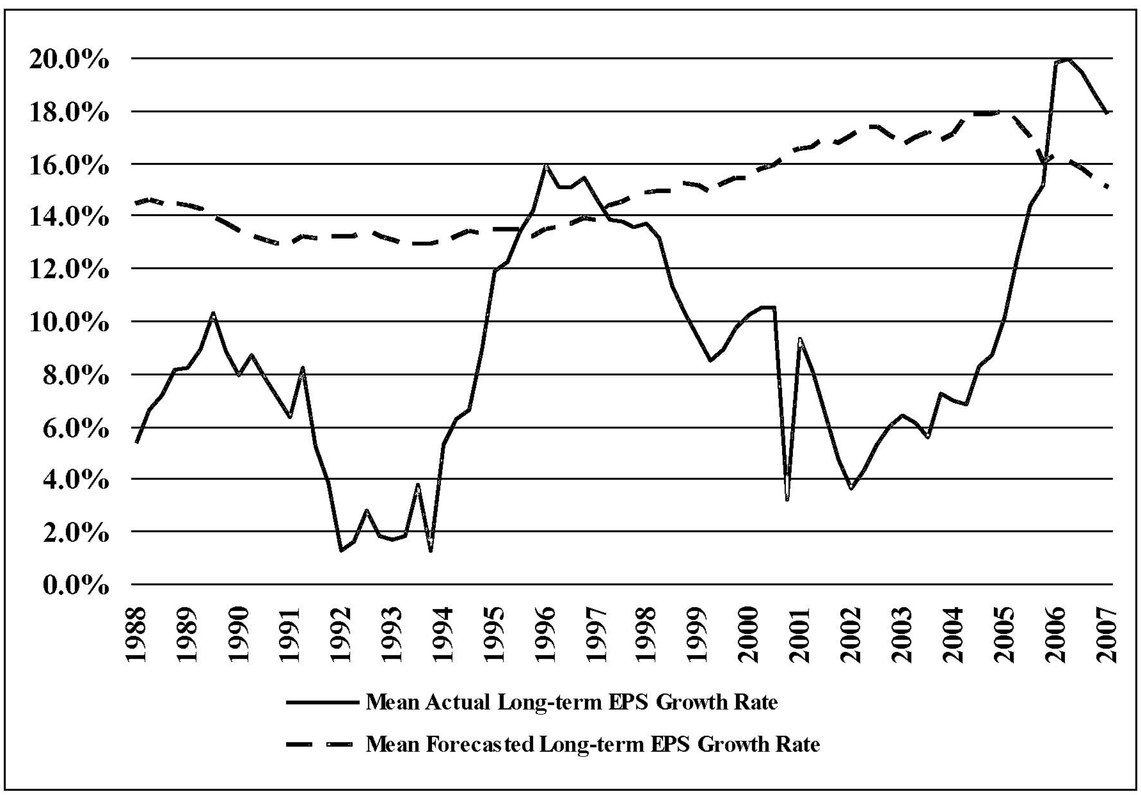
Table 5
Summary of Forecasted and Actual Long-Term EPS Growth Rates by Quarter

Year	Quarter Ended	Mean Actual Long-term EPS Growth Rate	Mean Forecasted Long-term EPS Growth Rate	Forecast Error for Mean (%)	Number of Companies	Average Number of Analyst Estimates
1988	Mar-88	5.36%	14.47%	170.07%	768	6.24
	Jun-88	6.61%	14.55%	120.32%	797	6.26
	Sep-88	7.12%	14.45%	102.96%	817	5.96
	Dec-88	8.12%	14.46%	78.13%	850	5.88
1989	Mar-89	8.20%	14.35%	75.08%	910	6.09
	Jun-89	8.92%	14.21%	59.34%	892	6.36
	Sep-89	10.28%	13.88%	35.03%	889	6.57
	Dec-89	8.81%	13.65%	55.00%	905	6.15
1990	Mar-90	7.94%	13.41%	68.98%	907	6.42
	Jun-90	8.66%	13.23%	52.76%	863	6.46
	Sep-90	7.84%	13.05%	66.44%	880	6.48
	Dec-90	7.10%	12.89%	81.48%	916	6.62
1991	Mar-91	6.35%	12.89%	103.13%	939	6.70
	Jun-91	8.21%	13.19%	60.63%	914	6.68
	Sep-91	5.20%	13.14%	152.80%	897	6.07
	Dec-91	3.84%	13.18%	243.60%	932	5.90
1992	Mar-92	1.25%	13.22%	955.21%	950	5.58
	Jun-92	1.57%	13.18%	737.49%	986	5.41
	Sep-92	2.75%	13.40%	387.75%	1008	5.47
	Dec-92	1.83%	13.22%	621.01%	1068	5.52
1993	Mar-93	1.64%	13.04%	697.33%	1062	5.79
	Jun-93	1.81%	12.90%	612.01%	1183	5.93
	Sep-93	3.76%	12.89%	243.17%	1115	5.98
	Dec-93	1.23%	12.92%	951.11%	1140	5.90
1994	Mar-94	5.31%	12.98%	144.61%	1143	5.66
	Jun-94	6.27%	13.21%	110.79%	1158	5.56
	Sep-94	6.61%	13.42%	103.17%	1207	5.75
	Dec-94	8.89%	13.34%	49.99%	1192	5.81
1995	Mar-95	11.88%	13.47%	13.39%	1166	5.88
	Jun-95	12.20%	13.44%	10.21%	1144	5.84
	Sep-95	13.37%	13.45%	0.61%	1147	5.87

	Dec-95	14.14%	13.18%	-6.78%	1134	5.87
1996	Mar-96	15.88%	13.47%	-15.20%	1115	5.76
	Jun-96	15.05%	13.59%	-9.74%	1154	5.62
	Sep-96	15.07%	13.65%	-9.38%	1177	5.70
	Dec-96	15.42%	13.87%	-10.04%	1185	5.63
1997	Mar-97	14.62%	13.83%	-5.37%	1213	5.55
	Jun-97	13.82%	14.36%	3.92%	1223	5.55
	Sep-97	13.72%	14.49%	5.61%	1260	5.48
	Dec-97	13.52%	14.69%	8.67%	1174	5.45
1998	Mar-98	13.67%	14.88%	8.85%	1477	5.14
	Jun-98	13.13%	14.95%	13.85%	1448	4.92
	Sep-98	11.33%	14.91%	31.68%	1475	4.98
	Dec-98	10.27%	15.22%	48.16%	1462	4.93
1999	Mar-99	9.37%	15.13%	61.49%	1510	4.88
	Jun-99	8.50%	14.90%	75.28%	1480	4.96
	Sep-99	8.89%	15.20%	70.90%	1490	4.89
	Dec-99	9.70%	15.39%	58.64%	1481	5.06
2000	Mar-00	10.21%	15.45%	51.25%	1491	5.00
	Jun-00	10.48%	15.78%	50.53%	1515	4.94
	Sep-00	10.48%	15.93%	51.96%	1503	5.12
	Dec-00	3.19%	16.31%	412.19%	1502	5.25
2001	Mar-01	9.30%	16.53%	77.61%	1502	5.26
	Jun-01	8.09%	16.63%	105.58%	1485	5.26
	Sep-01	6.36%	16.97%	166.79%	1465	5.33
	Dec-01	4.72%	16.76%	255.42%	1414	5.18
2002	Mar-02	3.63%	17.02%	369.17%	1461	5.37
	Jun-02	4.28%	17.35%	305.30%	1517	5.26
	Sep-02	5.27%	17.38%	229.93%	1541	5.45
	Dec-02	5.98%	16.98%	183.88%	1553	5.50
2003	Mar-03	6.37%	16.68%	161.92%	1537	5.55
	Jun-03	6.11%	16.92%	177.12%	1566	5.46
	Sep-03	5.52%	17.15%	210.57%	1598	5.58
	Dec-03	7.25%	16.85%	132.37%	1605	5.65
2004	Mar-04	6.93%	17.08%	146.39%	1629	5.70
	Jun-04	6.80%	17.76%	161.30%	1664	5.18
	Sep-04	8.28%	17.81%	115.12%	1687	5.23
	Dec-04	8.70%	17.84%	104.95%	1670	4.87
2005	Mar-05	10.11%	17.92%	77.23%	1616	4.93
	Jun-05	12.45%	17.53%	40.74%	1578	4.87
	Sep-05	14.39%	16.96%	17.82%	1599	5.16
	Dec-05	15.15%	15.95%	5.32%	1517	5.33
2006	Mar-06	19.82%	16.22%	-18.18%	1563	5.33
	Jun-06	19.93%	16.07%	-19.40%	1580	5.65
	Sep-06	19.45%	15.75%	-19.05%	1644	5.83
	Dec-06	18.60%	15.41%	-17.14%	1723	5.57
2007	Mar-07	17.81%	15.07%	-15.39%	1734	5.25
	Mean	**9.10%**	**14.89%**	**143.06%**	**1,281**	**5.60**
	Median	**8.50%**	**14.55%**	**75.08%**	**1,223**	**5.56**

Also presented in Table 5 are forecast errors. Previous studies based on quarterly estimates (see, for example, Kwag and Shrieves (2006)) find that forecast errors are mixed. Our findings indicate that forecast errors for long-term estimates are predominantly positive, which indicates an upward bias in growth estimates. The mean and median forecast errors over the observation period are 143.06% and 75.08%, respectively. They are only negative for 11 time periods: five consecutive quarters starting at the end of 1995 and six consecutive quarters starting in 2006. As can be seen in Figure 3, the negative forecast errors clearly follow periods of declined earnings growth when higher growth rates can be attained. Overall, there is evidence of a persistent upward bias in long-term EPS growth forecasts.

Figure 3
Long-Term Forecasted Versus Actual EPS Growth Rates
1988-2006



Long-Term EPS Forecasts: Breakdown by Number of Analysts

It is possible that the results from the previous section are affected by the level of analyst coverage. Smaller and newly-traded companies tend to have less analyst coverage. It is possible that companies with fewer analysts would bias the results. Earnings for small or newly-traded companies are more difficult to forecast and would be expected to lead to higher forecasted earnings growth rates. For this reason we divide the sample into two groups: companies with three or fewer analysts and companies with more than three analysts.

While our data averages 5.61 analysts per company, many companies have three or fewer analysts. The two groups evenly divide the data. On average, of 1,273 companies, 628 have three or fewer analysts and 645 have more than three analysts. The data is described in Table 6 and displayed in Figure 4.

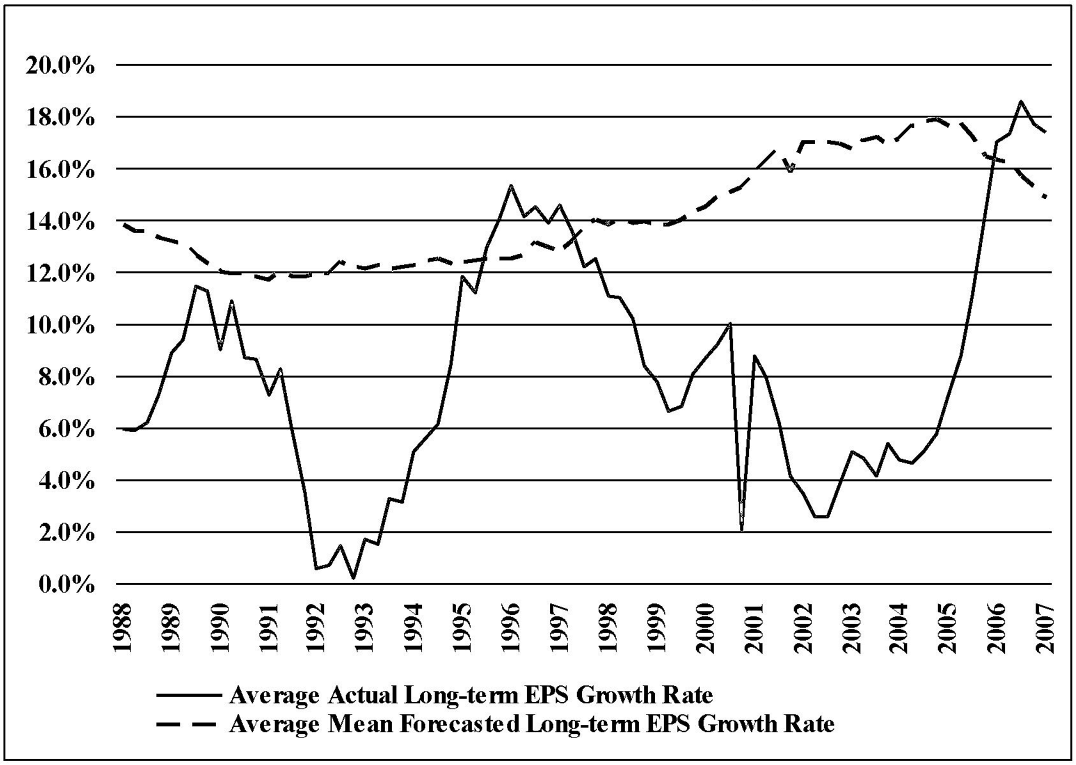
The results indicate that the group of companies with more than three analysts has lower long-term earnings growth rate forecasts. However, that group also has significantly lower actual growth in earnings, as indicated by a difference in means test (t-stat = -5.77, n = 77). Furthermore, while there is no significant difference between the forecasted growth rates by group since 2002, actual earnings continue to be lower for the group with more than three analysts. Overall, the forecast errors by group are very close. The median forecast error for the group with fewer than three analysts is 48.65%. For the group with more than three analysts the median forecast error is 48.68%.

Table 6
Number of Companies by
Analyst Coverage for Long-Term IBES Data

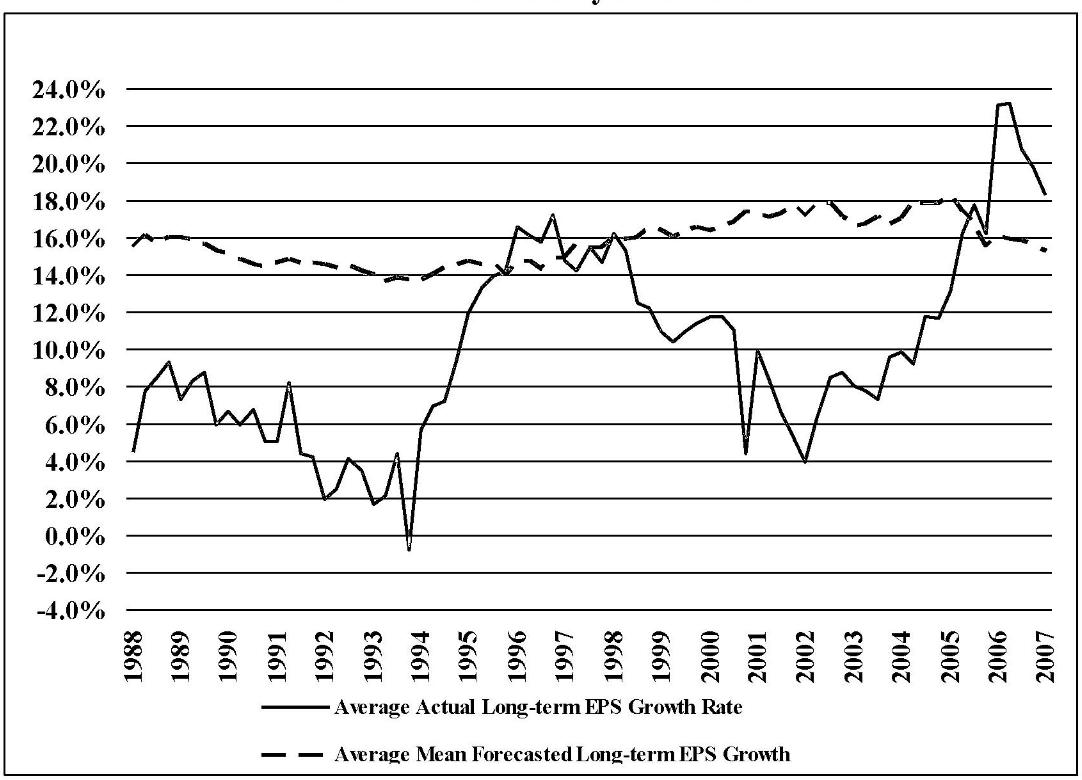
Year	Total Number of Companies	Companies with 3 and fewer Analysts	Companies with more than 3 Analysts
1988	808	325	485
1989	899	379	522
1990	892	389	508
1991	921	410	511
1992	1,003	502	505
1993	1,125	535	577
1994	1,175	561	615
1995	1,148	533	616
1996	1,158	530	633
1997	1,218	576	646
1998	1,466	731	735
1999	1,490	735	756
2000	1,503	747	756
2001	1,467	759	707
2002	1,518	825	693
2003	1,577	871	705
2004	1,663	875	788
2005	1,578	809	769
2006	1,628	898	730
Mean	**1,273**	**628**	**645**
Median	**1,218**	**576**	**646**

Source: I/B/E/S. Based on the average of quarterly numbers for each year.

Figure 4
Long-Term IBES Forecasted EPS Growth Rates by Analysts Coverage
Panel A: Greater Than Three Analysts



Panel B: Three Analysts of Fewer



Analysts IBES Forecast Versus Actual EPS Growth Rates: One-Year Projections

Although we have shown a significant bias in growth rate forecasts, we realize that long-term growth is difficult to forecast. Over longer forecast periods, analysts face a greater probability of unexpected events that will lead to inaccurate estimates. One possible explanation for the persistent bias is that analysts consistently project long-term growth estimates higher than short-term estimates to allow for the possibility of unforeseen events. For this reason, we extend the analysis to one-year EPS growth rate forecasts, expecting that analysts' estimates will be more accurate over a shorter period of time with less event risk.

We collect forecasted and actual one-year EPS growth rate data for firms from 1984 to 2006. We compare the analysts' forecasted EPS growth rates to the actual annual growth rates over the year. The results are presented by year in Table 7.

Analysts consistently project upwardly biased growth rates, even for shorter time horizons. Analysts forecasted one-year EPS growth at an average rate of 13.80% while the actual EPS growth rate over the time period averaged 9.77%. These growth rates are significantly different as indicated by a difference in means test (t-stat = -4.91, n=23).

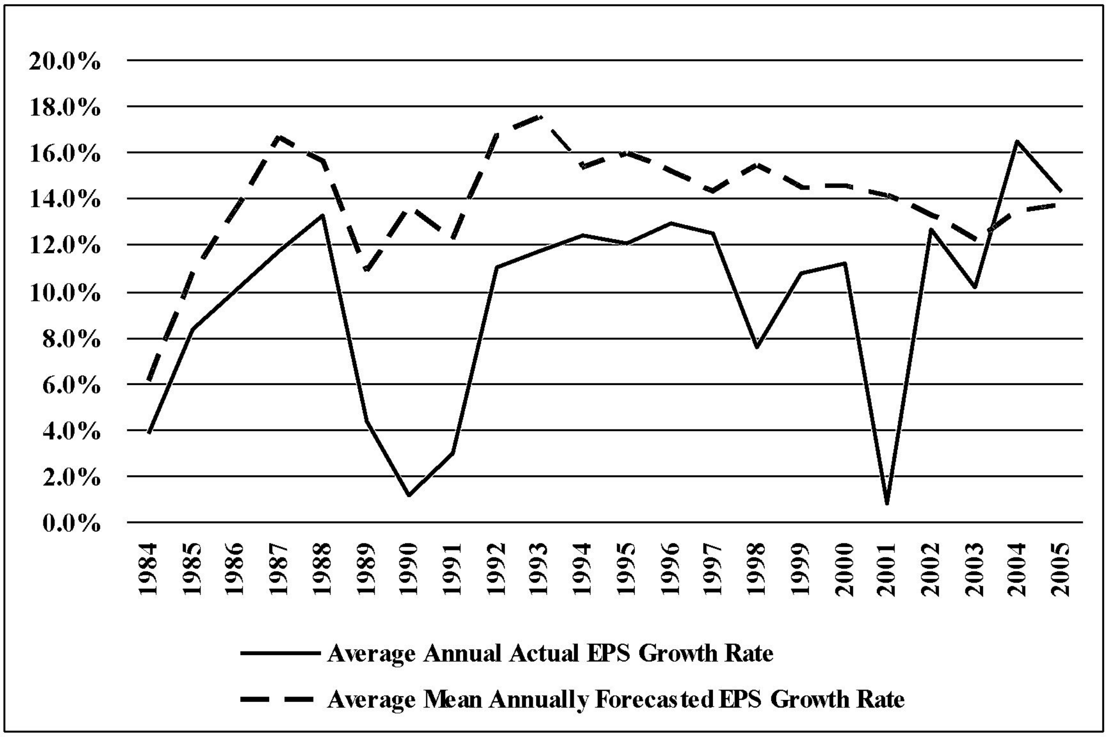
Although the one-year forecast errors are lower, they are still large and predominantly positive. The mean and median forecast errors over the observation period are 165.94% and 32.51%, respectively. Forecast errors are only negative for the last three years, indicating an overall negative bias to earnings estimates.

Table 7
Summary of IBES Forecasted and Actual One-Year Growth Rates by Year

Year	Mean Annual Actual EPS Growth Rate	Mean Annual Forecasted EPS Growth Rate	Forecast Error for Mean Growth Rate	Number of Companies	Average Number of Analyst Estimates
1984	3.79%	6.10%	61.24%	1245	8.61
1985	8.33%	10.77%	29.40%	1154	10.30
1986	9.96%	13.43%	34.84%	1140	10.44
1987	11.68%	16.67%	42.71%	1047	11.02
1988	13.22%	15.62%	18.16%	1095	10.70
1989	4.32%	10.81%	150.19%	1245	10.64
1990	1.15%	13.60%	1082.97%	1260	10.78
1991	2.97%	12.20%	311.26%	1138	10.01
1992	10.98%	16.72%	52.24%	1192	9.60
1993	11.66%	17.49%	50.09%	1314	9.55
1994	12.42%	15.31%	23.34%	1475	9.71
1995	12.05%	15.97%	32.51%	1557	9.11
1996	12.88%	15.15%	17.63%	1652	8.74
1997	12.50%	14.26%	14.11%	1489	8.33
1998	7.52%	15.38%	104.62%	1375	7.75
1999	10.76%	14.46%	34.32%	1258	8.54
2000	11.20%	14.51%	29.55%	1176	8.26
2001	0.77%	14.08%	1730.98%	1469	7.68
2002	12.64%	13.27%	5.04%	1367	7.13
2003	10.16%	12.23%	20.37%	1464	7.78
2004	16.46%	13.40%	-18.62%	1565	8.60
2005	14.25%	13.79%	-3.20%	1620	8.73
2006	13.10%	12.17%	-7.09%	2502	6.92
Mean	**9.77%**	**13.80%**	**165.94%**	**1383**	**9.08**
Median	**11.20%**	**14.08%**	**32.51%**	**1314**	**8.74**

The one-year analysts' forecasts and actual EPS growth rates are presented in Figure 5. The persistent upward bias is evident from the graph. As with long-term analyst forecasts, the only negative forecast errors follow a period of lower actual EPS growth. Higher growth is most likely to be attained after such a period.

Figure 5
One-Year Forecasted versus Actual EPS Growth Rates



Negative Earnings Growth Rate Forecasts

One explanation of the persistent bias of analysts' projections is a resistance to report negative earnings growth rates. A resistance to report negative earnings growth could be linked to the investment banking influences addressed by the Global Analyst Research Settlements. It could also be caused by a cognitive bias often called familiarity. Familiarity is a behavioral flaw common to investors. Investors have a tendency to favor investments they know, such as the common stock of their employer. Similarly, analysts may become attached to companies they follow and lose objectivity.

Using long-term growth projections, we begin by comparing the number of companies with projected negative EPS growth rates to those with actual negative EPS growth rates in each time period. The differences are striking. The results are summarized in Panel A and Panel B of Figure 6.

Panel A shows the percent of companies with actual negative EPS growth. The average number of companies with actual negative EPS growth is 391 with a minimum of 227 and a maximum of 644. An average of 31.12% of all companies had negative earnings growth in each quarter.

Shown in Panel B is the percent of companies with forecasted negative EPS growth. The average number of companies with forecasted negative EPS growth by quarter is only 2.10 with a minimum of 0 and a maximum of 13. Only 0.17% of all companies were projected to have negative earnings growth. [2]

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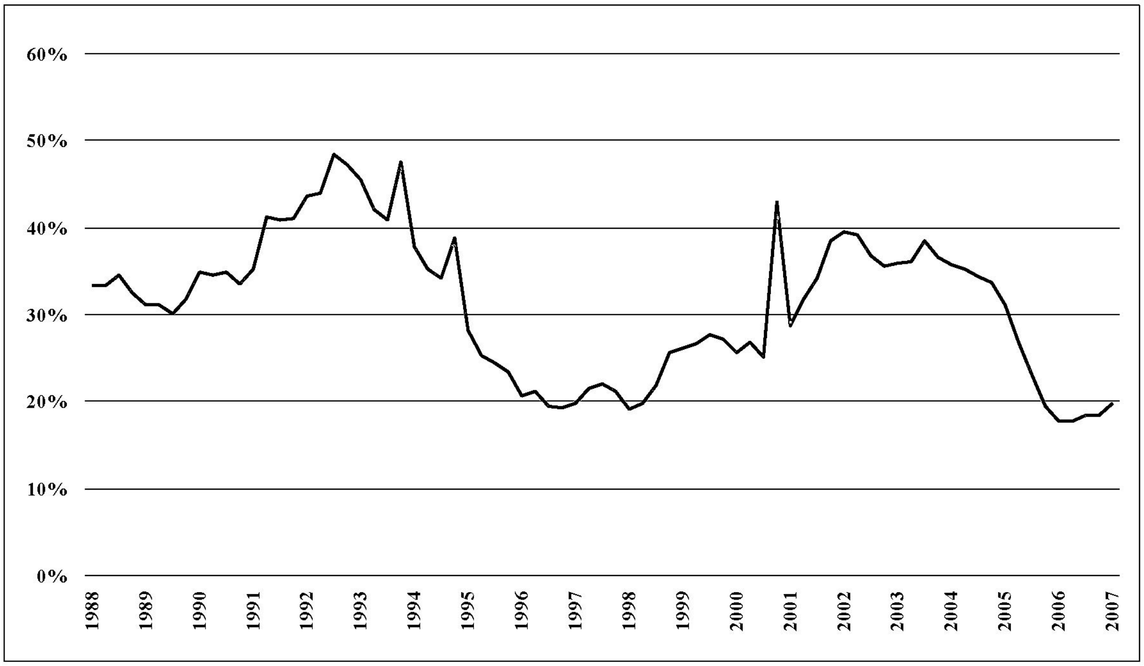
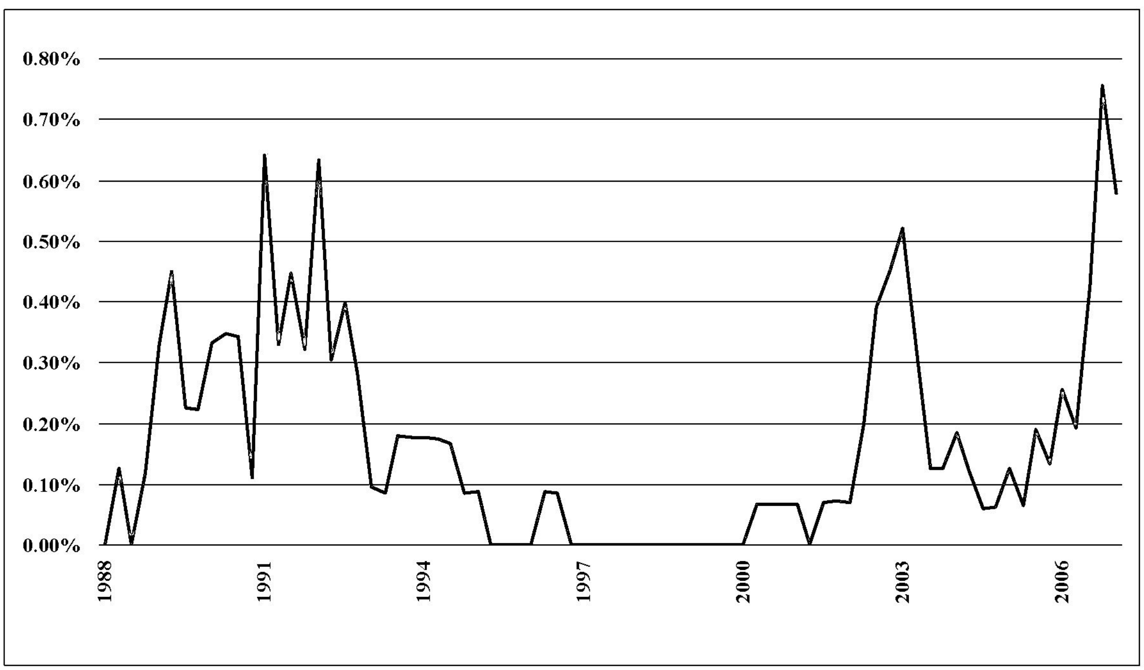
[2] We also examine the percentage of negative earnings growth that is captured by analysts' projections. We begin by collecting all companies that experienced negative long-term growth in each time period. Then we calculate the percentage of those companies that were project to have long-term negative EPS growth. An average of 0.55% of companies that reported negative EPS growth was captured by analysts' estimates. The average number of companies with negative earnings growth that were missed by analysts was 389 out of an average 391 companies that reported an actual decline in earnings. There is clear resistance by analysts to project negative growth.

Figure 6
Comparison of Companies with
Actual and Forecasted Negative EPS Growth
Panel A: Percent of Companies with Actual Negative EPS Growth



Panel B: Percent of Companies with Forecasted Negative EPS Growth



Results after the Global Analyst Research Settlements

The Global Analysts Research Settlements (GARS) is a set of agreements reached on April 23, 2003 between the SEC, NASD, NYSE and ten of the largest U.S. investment firms. GARS, as outlined by the Securities and Exchange Commission (2003), addresses conflicts of interest within firms that have investment banking and analysts operations. A conflict of interest can exist between the investment banking and analysis departments of the large investment firms. The investment firms involved in the settlement had engaged in practices involving the influence by investment bankers seeking favorable analysts' projections within their firm.

As part of the settlement decision several regulations were introduced to prevent investment bankers from pressuring analysts to provide favorable projections. These regulations include (1) firms must separate their investment banking and analysis departments with firewalls; (2) budget allocation to management in research departments must be independent of investment departments; (3) research analysts are prohibited from attending pitches with investment bankers during advertising and promotion of IPOs; and (4) historical analysts' ratings must be made available to investors.

One possible explanation for the upward bias in analysts' forecasts is the conflict of interest that exists between analysts and investment bankers. This presumably would have been removed by the GARS. For this reason, we compare long-term actual and forecasted growth rates for the periods prior to and following the GARS. The persistence of a bias following the GARS would indicate another explanation for the bias.

Table 8 shows descriptive statistics for long-term analysts' earnings growth rates estimates before and after the GARS. Actual and forecasted growth rate estimates are higher since the GARS and forecast errors have decreased. While forecast errors have decreased, they are still significantly positive.

It is evident that analysts' growth rate forecasts have remained around their historic levels of about 15%. Growth rates remain at levels that are unattainable given historic and expected GDP growth. Hence, there is no evidence that analyst behavior has changed since the GARS.

Table 8
Comparison of Long-Term Analysts' EPS Growth Rate Forecasts Before and After GARS

1988 – 2002(1)			
	Actual	Forecasted	FE
Mean	8.25%	14.40%	141.65%
Median	8.20%	13.88%	65.29%
SD	4.06%	1.36%	197.57%
n	61	61	61
2003 – 2007(2)			
Mean	12.33%	16.77%	66.94%
Median	11.28%	16.94%	51.60%
SD	5.49%	0.92%	61.70%
n	16	16	16

(1) Based on data beginning in 1984. (2) From April 2003 to and including the first quarter of 2007.

Possible Explanations for the Upward Bias

There are three suggested explanations for the upward bias. The first, as suggested by previous research, is based on career concerns or conflicts of interest. Analysts are rewarded for biased forecasts by their employers who want them to hype stocks so that the brokerage house can garner trading commissions and win underwriting deals. However, the scrutiny of the GARS should have removed this influence. We find little evidence of a change in forecast bias following the GARS. Therefore another explanation is likely.

A second explanation is based on selection bias. Analysts only follow stocks that they recommend and do not issue forecasts on those that they do not like. A third explanation is a cognitive or behavioral bias commonly called familiarity. Analysts become attached to the companies that they follow and lose objectivity.

The second and third explanations imply that analysts are systematically biased. If analysts systematically believe that they follow companies that are superior to others, they will be reluctant to issue negative earnings forecasts. Since they are only projecting the companies they follow, and not the market, the end result is a strong upward bias on earnings projections.

Summary

In this study we examine the accuracy of analysts' long-term and one-year ahead EPS growth rate forecasts over the last 20 years. Unlike previous studies, we examine long-term and one-year analysts' earnings growth rate forecasts and not quarterly EPS forecasts. Long-term EPS growth rate projections are consistently overly-optimistic. Analysts' growth rate forecasts of earnings are better for one-year than for three- to five-years, but are still over-optimistic. We discover that analysts only underestimate EPS growth rates for periods of earnings recoveries after economic recession. We find that analyst coverage does not have an impact on the overly-optimistic bias in projected EPS growth rates. We do discover that a contributing factor in the bias in analysts' long-term and one-year EPS growth rate estimates is the resistance of analysts to project negative earnings growth rates. We show that analysts' projections fail to capture the majority of negative earnings growth realized by corporations they follow. Finally, we examine the level of long-term analysts' EPS growth rate forecasts following the GARS. We find that analysts' forecasts have not significantly changed and continue to be overly-optimistic. Analysts' long-term EPS growth rate forecasts before and after the GARS, are about two times the level of historic GDP growth.