The Effect of Debt On the Cost of Equity
In a Regulatory Setting

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January 2005
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ACKNOWLEDGMENTS

The Brattle Group thanks Eric Ackerman and Mike Oldak of EEI for helpful comments on initial drafts of this document. Within Brattle, the authors of this document are Drs. A. Lawrence Kolbe, Michael J. Vilbert and Bente Villadsen, all from The Brattle Group in Cambridge, Massachusetts office.
I. INTRODUCTION AND SUMMARY

Until recently, the focus of many regulators has been on whether and how to implement restructuring in the electric industry, but regulators are now turning their attention to proceedings in which setting the cost of capital will be an issue. In some jurisdictions, there has not been a fully litigated cost of capital rate case for a number of years. The cost of capital skills of the commission staff as well as those of the commissioners in those jurisdictions may have atrophied from lack of use. Even if the old skills have not decayed, the more recent developments in the art and science of the estimation of the cost of capital are not likely to be well understood if for no other reason than there has simply been no impetus to study them to decide issues in a proceeding.

At the same time, concerns are being raised about whether investment in the infrastructure of the electric industry has kept pace with the growth in demand. One factor affecting the decision to invest in the electric industry is whether the allowed rate of return on investment provides an adequate rate of return compared to alternative investments. As discussed below, failure to provide a return equal to the cost of capital will inevitably lead to under investment in the industry.

Of course, commissions will be faced with conflicting points of view as to exactly how high the cost of capital may be for a regulated company. It is frequently the case that the costs of capital recommendations by intervenor and company expert witnesses diverge widely due to differences in implementation of estimation models, differences in samples, and differences in analysis of the data. One major difference in

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1 A number of recent articles have addressed the need for investment, particularly in transmission. For example, Eric Hirst and Brendan Kirby, "Transmission Planning for a Restructuring U.S. Electricity Industry," Edison Electric Institute Paper, June 2001, estimate that to maintain transmission adequacy an investment of $56 billion is required during this decade and that twice that is needed for generation. The need for significant transmission investments are confirmed in, for example, Eric Hirst, " Transmission Investment: All Talk and Little Action," Public Utilities Fortnightly July 2004 pp. 48-54. The paper notes that the estimates of the required investment range from $27 billion to $100 billion just for transmission. However, Value Line Investment Survey July 2, 2004 projects the total increase in net plant for electric utilities in the period 2007-09 to amount to only $57.6 billion. Leonard S. Hyman in "The Next Big Crunch: T&D Capital Expenditure," Energy Industry Commentary, January 2004, argues that "The evidence suggests that investor-owned utilities have reduced transmission and distribution spending to bare-bones levels ..."

2 The average allowed rate of return on equity among electric utilities followed by Regulatory Research Associates was 10.6% in 2003 (Regulatory Research Associates, Major Rate Case Decisions - January 2002 - December 2003 Supplemental Study). The allowed returns vary widely from a low of 9.50 percent (New Jersey) to a high of 12.45 percent (South Carolina). Additionally, other utility industries such as a water utility have been awarded rates of return as low as 7 percent. Numerous parties have expressed concerns regarding very low allowed rates of return. For example, Standard & Poor's on August 7, 2003 in "Why Utilities Lack Spark" lowered its recommended weighting for the sector because, among other factors, "[w]e see normally modest growth for regulated operations restricted by an unfavorable regulatory environment and rising costs. In May 2002 William R Ferara of Standard & Poor's argued that "insufficient regulated authorized returns" contributed to the "downward pressure" in credit quality ("Regulatory Support for U.S. Electric Utility Credit Continues to Disappoint, Standard & Poor's, May 27, 2002). Standard & Poor's in March 2003 issued a report discussing the rating agency's reassessment of Canadian utility regulation as a ratings factor, and noted that the high leverage of the financial profiles of Canadian utilities were a significant contributing factor in the downward trend of the utilities ratings and "[t]he leverage financial profiles of Canadian utilities generally stem from regulatory directives, which essentially dictate the financial profiles of most utilities." (Standard & Poor's, "Canadian Utility Regulation Reassessed as a Ratings Factor," March 6, 2003).
methodology is whether and how to adjust the allowed cost of equity for differences in financial risk between the sample companies and the regulated utilities.

This difference in opinion among cost of capital experts leaves a commission with the difficult problem of determining the cost of capital in a setting with vastly different recommendations; a task made more difficult if the theoretical underpinnings of setting the cost of capital are not well understood.

The main focus of the paper is on the effect of debt on the cost of equity capital, and in particular, the theoretically appropriate way to adjust the cost of equity for differences in capital structure. At the current time, ignoring this issue as some cost of capital experts do, results in a lower estimate of the cost of equity for the regulated company. The remaining portions of the paper discusses the related issues of the deleterious effect on new investment of not providing an adequate rate of return for a regulated company. Finally, the effects of regulatory procedures that result in the inability of the regulated company to earn the allowed rate of return are also discussed.

The following is a summary of the main points:

1. As Figure 1 illustrates, companies raise money for investment by issuing securities. Different securities have different claims on the firm's earnings, and if necessary, on its assets. Debt has a senior claim on a specified portion of the earnings. Common equity, the most junior security, gets what's left after everyone else has been paid. Since equity bears more risk, investors require a higher rate of return on equity than on debt. Except at extreme debt levels, the overall level of risk of the firm does not change materially due to the addition of debt. The various securities just divvy that risk up.

Key Points:
1. Overall firm risk does not change materially with modest levels of debt, it merely is divided among the firm's securities.
2. The higher the risk, the higher the rate of return required to induce investors to bear it.
2. When a company uses modest amounts of debt, the overall risk of the company's assets falls on a fraction of its capital, the equity. The required return per dollar of equity goes up. Suppose a risk produces earnings fluctuations equal to plus or minus ("+/-") 2 percent of the company's assets. At 100 percent equity, this risk produces earnings fluctuations of +/- 2 percent of the company's equity, too. But at a 50-50 debt-equity ratio, the same risk produces earnings fluctuations of +/- 4 percent of the company's equity. At a 75-25 debt-equity ratio, these fluctuations become +/- 8 percent of the company's equity. Figure 2 illustrates this point for debt-equity ratios of 0-100, 25-75, 50-50, and 75-25. Higher risk means a higher required rate of return, so the cost of equity goes up at an ever increasing rate as a company adds debt, which offsets the cheaper cost of debt. In short, there is no magic in financial leverage.

3. An accurate estimate of the cost of equity for a rate-regulated company needs to consider (1) the levels of financial risk in the sample companies used to estimate the cost of equity and (2) how those levels compare to the level implied by the company's regulatory capital structure. The associated capital structure affects the estimated cost of equity estimate just as a life insurance applicant's age affects the required life insurance premium. An insurance agent wouldn't measure the required insurance premium for one person and charge the same premium to an otherwise identical person who was much older. Neither should a cost of equity analyst measure the cost of equity at one capital structure and apply the same cost of equity to a regulated capital structure with much more (or much less) debt.

4. The sample company's market-value capital structure determines the level of risk that a cost of equity analyst measures from market data, because market values determine the level of risk that equity bears due to debt. Example: suppose you buy a home for $50,000 with a mortgage of $40,000. Ten years later your home is worth $100,000 and the mortgage is down to $35,000. Your equity in the home is now $65,000. If home prices then drop by 10 percent, or $10,000, your $65,000 equity falls by that amount, and the resulting rate of return on your equity is -15 percent (= -$10,000/$65,000), versus -10 percent if you had no mortgage. The 15 percent loss would affect the measured risk of your home if it were represented by a publicly traded stock (e.g., the "beta" risk measure). The "discounted cash flow" approach starts from the publicly traded price of your home, too, and that price reflects the level of risk borne in the market. The risk that underlies every cost of

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<sup>3</sup> If you kept books on the house, the book equity would be $15,000 (the original $50,000 less the current $35,000 mortgage), or less if you were depreciating your investment. But a publicly traded stock for your house would not fall by $10,000/$15,000, or 67%, if housing prices fell 10 percent.
5. Failure to recognize and adjust for differences in the financial risk of sample companies and the regulated entity can result in material errors in cost of equity estimation. Ignoring such differences results in a disconnect between the cost of capital information provided by the sample and the allowed return for the regulated entity, because the market value capital structure is as important to estimating the cost of equity as an insured age is for life insurance.

6. Investment is a voluntary activity. Investment will only occur if the expected rate of return justifies the risks involved. The plain language of the U.S. Supreme Court's opinions on return standards for utilities is consistent with this principle. These opinions focus on (1) the returns investors could earn if they put their money elsewhere at a comparable level of risk, and (2) the company's financial integrity. Whatever the legal reasons for these standards (which may arise out of the Constitutional prohibition against the uncompensated taking of property), they recognize basic economic reality: 

\textbf{you can't push on a rope,} and you can't force investors to throw good money after bad.\footnote{Phrases in boldface in this introduction are titles to later sections.}

7. Therefore, policies that systematically deny utility investors a fair opportunity to earn the cost of capital achieve a short-run gain for today's customers, but at a material long-run cost to future customers and possibly to the economy of the jurisdiction involved. Once the long-run costs emerge, they cannot be overcome in a hurry. Investors, once burned, will be loath to trust that the regulatory jurisdiction won't repeat the same pattern should it ask for quick investments to shore up a system that the previous policies let decay. The safest way for once-burned investors to avoid inadequate returns on future major investments is to keep the system capital-starved. Research shows that nations around the world that do not protect investor rights have less investment and more costly conditions imposed on the investment that is made, to the detriment of their economies. States that make investment unattractive or unremunerative risk the same fate.

8. The return investors actually expect to earn is what matters. If a regulatory mechanism claims to allow one rate of return but actually allows a lower one, the lower one is what must pass the comparable return standard. For example, if I promise to pay someone $10 to wash my car but s/he has learned I always actually pay 10 percent less than I promise, that person will assume the actual payment will only be $9, and s/he will wash my car only if $9 is enough. The phantom dollar in my stated payment is irrelevant, because \textit{empty promises buy nothing}. (The same problem arises if I pay the $10 most of the time but welsh and pay nothing 10 percent of the time. In that case, the expected payment would again be $9, not $10.)

The remainder of this paper is organized as follows: \textit{Section II} provides a simple example on how to adjust for differences in financial leverage (capital structures) in a regulatory setting. \textit{Section III} discusses the effect of the use of debt (financial leverage) on the cost of equity, points one to four above. \textit{Section IV} reviews these issues in the context of a regulatory proceeding in which setting the cost of equity is an issue. \textit{Section V} addresses the conditions necessary for voluntary investment, points six and seven above. \textit{Section VI} addresses the distinction between the allowed rate of return and the return investors require, point eight above. \textit{Section VII} concludes.
II. AN EXAMPLE OF ADJUSTING FOR FINANCIAL LEVERAGE

Before discussing the need to adjust for financial leverage in detail, an illustration of the basic principles may be in order. Throughout this paper, financial leverage refers to the use of debt in the capital structure of a company which results in financial risk for the company's equity holders. The cost of equity, or the required rate of return on equity, refers to the market determined cost of equity capital for a company. The cost of debt is the market determined cost of debt, not the embedded cost of debt.

In a regulatory setting, the typical way that differences in financial leverage are ignored occurs when a cost of capital expert applies the standard cost of equity estimation techniques (the risk positioning model or the discounted cash flow model) to a sample of comparable risk companies to estimate the cost of equity. If this cost of equity is applied to the regulated entity without any consideration of differences in capital structure between the sample companies and the regulated entity, the result is a potential mismatch between the financial risk of the sample companies and the regulated company. However, it is frequently the case that when making a recommendation for the return on equity, the expert makes no explicit consideration of the differences between the capital structure of the sample companies and the capital structure of the regulated entity for which the cost of equity is being determined. Note that the cost of equity estimated by the standard techniques is a result of the business and financial risk of the sample companies. That is, the return on equity estimated by the standard techniques using market data is affected by the market value capital structures of the sample companies.

To make matters more confusing, it is also frequently the case that there is no agreement among cost of capital experts on the proper method to adjust for differences in capital structure when an adjustment is made or whether an adjustment is even necessary. As a result, commissions are faced with a bewildering array of conflicting recommendations all seemingly based upon similar data and estimation methods, but with wildly different results.

To illustrate the problem, assume that an electric utility company, Utility A, is filing a rate case. As a first step in determining the cost of equity for Utility A, the cost of capital analyst selects a sample of companies in the electric utility industry whose business risk is considered to be comparable to Utility A. Then the analyst determines the sample companies' cost of equity using capital market information, which depends upon the market value capital structures of the sample companies. Thus, the measured equity risk level depends on the sample companies' market-value capital structures, not their book-value capital structures.

The capital structures of the sample companies will typically differ among themselves so the level of financial risk will also differ among the sample companies. But even if it were the case that the capital structures of the sample companies were identical, their capital structures are likely to differ from that of the regulated company for which cost of capital is being estimated. This means that the cost of equity estimates from the sample companies would not be consistent in terms of financial risk among themselves or with

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5 Typically, a cost of capital analyst will estimate the sample companies' cost of equity using estimation models such as the Capital Asset Pricing Model ("CAPM") or the Discounted Cash Flow ("DCF") model. Both models rely on market based information.
Utility A. Fortunately, there is a simple way to handle differences in financial risk (capital structure differences) for both the sample companies and Utility A: calculate the overall cost of capital, an approach described next.

A. CALCULATING THE AFTER-TAX WEIGHTED-AVERAGE COST OF CAPITAL

The overall cost of capital is known in business textbooks as the "weighted-average cost of capital" or "WACC," but here a different term is used in order to prevent confusion with a measure of the weighted-average cost of capital that is often used in rate regulation to determine the revenue requirement. (Specifically, the regulatory WACC is a book value weighted-average of the after-tax cost of equity and the pre-tax average interest rate on the company's outstanding debt).\(^6\) We will use the term after-tax weighted-average cost of capital ("ATWACC") to denote the after-tax value of all of the components of the WACC. To determine the ATWACC, the cost of capital analyst must also use the market cost of debt and market value capital structure for each sample company.\(^7\)^8 With these values, the ATWACC for each sample company can be calculated. Table 1 on the next page illustrates the calculation using an average sample company.\(^9\)

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\(^6\) The cost of capital portion of the revenue requirement is determined by multiplying the regulatory WACC times the rate base and then combining it with an estimate of the income taxes owed. In the terminology of this paper, the sum of after-tax equity return, income taxes and interest expense is equal to the before-tax weighted-average cost of capital or the "BTWACC". Note that regulatory interest expense is an estimate of embedded cost as opposed to the market cost of debt.

\(^7\) While the cost of equity must be estimated using one or more estimation techniques, estimates of the market cost of debt is widely available from indices of utility bond yields for different debt ratings, e.g., the Mergent Bond Record. Book value capital structure information is available from sources such as Value Line or Compustat. The market capital value structure can be calculated by substituting the market value of debt and equity for their book values.

\(^8\) For simplicity, the example ignores the presence of preferred stock.

\(^9\) Currently, the yield on long-term government bonds is unusually low as are the beta-estimates (e.g., risk estimates) of utilities using standard methods. Because the examples in this paper relies on standard estimation methods and makes no attempt to adjust for low interest rates or risk-estimates, the reported cost of equity estimates are also low.
Table 1: Computing After-Tax Weighted-Average Cost of Capital for a Sample Company

<table>
<thead>
<tr>
<th>Cost of Equity</th>
<th>Abbreviation</th>
<th>Numerical Value in Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Value Equity (%)</td>
<td>E</td>
<td>53%</td>
</tr>
<tr>
<td>Weighted Cost of Equity</td>
<td>( r_E H_E )</td>
<td>4.82%</td>
</tr>
<tr>
<td>Cost of Debt</td>
<td>( r_D )</td>
<td>6.75%</td>
</tr>
<tr>
<td>Market Value Debt (%)</td>
<td>D</td>
<td>47%</td>
</tr>
<tr>
<td>Weighted Cost of Debt</td>
<td>( r_D H_D )</td>
<td>3.17%</td>
</tr>
<tr>
<td>Marginal Tax Rate</td>
<td>( T )</td>
<td>35%</td>
</tr>
<tr>
<td>After-Tax Weighted Cost of Debt</td>
<td>( r_D H_D (1-T) )</td>
<td>2.06%</td>
</tr>
<tr>
<td>ATWACC</td>
<td>( r_E H_E + r_D H_D (1-T) )</td>
<td>6.88%</td>
</tr>
</tbody>
</table>

Notes: The cost of equity was assumed for illustration purpose. For the example, we assume that Utility A has a marginal tax rate of 35 percent. The capital structure corresponds to a five-year average for a selected sample of electric utilities, and the market cost of debt corresponds to the June 2004 weighted yield on A and Baa-rated utility bonds as reported by the Mergent Bond Record.

B. ADJUSTING FOR DIFFERENCES IN FINANCIAL RISK

Having determined the cost of capital (the ATWACC) for a sample of comparable companies, the next step is to determine the cost of equity for Utility A that is consistent with the both the sample information and the financial risk (capital structure) in its regulatory filing. To recap the steps up to this point. The cost of capital analyst has selected a sample of regulated electric utilities considered to be comparable in terms of business risk. To insure that any differences in financial risk that results from differences in capital structure are properly recognized, the average ATWACC for the sample companies was calculated. The remaining question is how to calculate the return on equity for Utility A that takes into consideration both the business risk evidence of the sample companies and the financial risk of Utility A. As discussed below, the adjustment for financial risk is based upon the observation that the ATWACC is constant over a broad middle range of capital structures.

10 The assumption of a 35 percent tax rate corresponds to the statutory Federal tax rate of 35 percent. In reality, the tax rate for a company's rate filing would include a provision for state income taxes and would have to be determined on a case by case basis.

11 The yield on A-rated utility bonds is weighted by 3/11, and the yield on a Baa-rated utility bonds is weighted by 8/11. These weights correspond to a sample of 11 electric utilities relied upon for illustration purposes.
Continuing with the example, based upon the sample's ATWACC information, Utility A's expected after-tax weighted-average cost of capital is 6.88 percent. In other words, the sample's market value information says that the regulated entity should earn a 6.88 percent ATWACC on its invested capital, i.e., its rate base. Knowing the percentage of debt and equity in the rate base, the cost of equity consistent with both the business risk of the sample and the capital structure of Utility A can be determined as the cost of equity \( r_E \) that would give rise to an ATWACC of 6.88 percent given Utility A's capital structure, market cost of cost of debt, and marginal tax rate.

For simplicity, assume that Utility A is filing its rate case with a capital structure consisting of 40 percent equity and 60 percent long-term debt. Further, assume Utility A has a Baa-rating from Moody's which has a market yield of 6.84 and an income tax rate of 35 percent. Table 2 below computes the cost of equity for Utility A given its regulatory capital structure, cost of debt, and tax rate.

<table>
<thead>
<tr>
<th>Table 2: Utility A's Cost of Equity at 40 Percent Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>After-Tax Weighted-Average Cost of Capital</strong></td>
</tr>
<tr>
<td>Sample Average ATWACC</td>
</tr>
<tr>
<td>6.88%</td>
</tr>
<tr>
<td>Utility A's Equity (%)</td>
</tr>
<tr>
<td>Utility A's Cost of Debt</td>
</tr>
<tr>
<td>Utility A's Debt (%)</td>
</tr>
<tr>
<td>Marginal Tax Rate (%)</td>
</tr>
<tr>
<td><strong>Utility A's Cost of Equity</strong></td>
</tr>
</tbody>
</table>

Notes: the estimated cost of equity corresponds to that of a utility with a rate base with 40 percent equity, a Baa bond rating, a marginal tax rate of 35 percent and business risk comparable to that of the sample companies.

Note the effect of differences in financial risk between the sample's average market value capital structure and the capital structure for Utility A. In the example, the cost of equity for the sample was 9.10 percent for a sample of electric utilities with an average market value capital structure with 53 percent equity. Utility A is filing a rate case in which it has only 40 percent equity, so it has more financial leverage (more financial risk) resulting in a cost of equity of 10.5 percent. Applying the sample's 9.10 percent estimated cost of equity to the regulated entity would ignore the differences in financial risk between the sample companies and the regulated company. Investors require a greater expected return for bearing additional risk, so Utility A requires a higher expected cost of equity than measured in the sample companies. The calculated cost of equity of 10.5 percent for Utility is exactly enough to offset the additional financial risk of Utility A. Note that after the adjustment for financial leverage, the ATWACC for Utility A remains the same as the

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This assumes that the regulatory capital structure is within the broad middle range over which the ATWACC is constant.

Again, financing means other than equity and long-term debt are ignored for simplicity.
ATWACC for the sample. In other words, Utility A would earn the same ATWACC on its rate base as the ATWACC estimated for the sample companies.

The relationship between the cost of equity and the percentage of debt in the capital structure is illustrated in Figure 3 below which displays the cost of equity for debt levels ranging from 30 to 70 percent using the sample ATWACC from Table 1 on page 7.

![Figure 3](image)

As can be seen from Figure 3, the cost of equity increases at an increasing rate as more debt is used in the company's capital structure. Figure 3 also shows that for companies with identical business risk, the cost of equity for a company with 40 percent equity is not the same as the cost of equity for a company with 60 percent equity. The slope of the curve in Figure 3 indicates the increase in cost of equity that is required to compensate investors for the additional risk they carry when debt is added to the capital structure.

Having provided a simplified example of how to take differences in financial leverage into account when estimating a utility's cost of equity, the remainder of the paper focuses on the specifics of the adjustment, the financial theory underlying the reason that an adjustment for differences in financial risk is required, and other issues related to the adjustment. The paper concludes with a discussion of the likely effect on new investment of failing to provide an allowed rate of return equal to the cost of capital, and a discussion of the importance of regulatory procedures that provide the regulated company with an opportunity to expect to earn the allowed rate of return.
III. "THERE IS NO MAGIC IN FINANCIAL LEVERAGE"

As noted at the outset (Figure 1), when companies use debt the risk of the assets is divided up among the various types of securities in the capital structure. Equity bears the bulk of the risk, so the cost of equity goes up as debt is added to the capital structure. Therefore, to compare validly the costs of equity from a sample of companies and the cost of equity of a regulated company, analysts must consider any differences among the equity risks generated by differences in capital structures. This section explains this issue in more detail, using various examples.

A. EXAMPLE OF WHY DEBT ADDS RISK TO EQUITY

The reason that the risk of equity increases as debt is added to the capital structure is because debt magnifies the variability of the equity return. Consider a simple example. Most people who participate in regulatory hearings do own or will own a home at some point in their lives. Suppose someday you decide to take money out of your savings and buy a dwelling for $100,000. The home's future value is uncertain. If housing prices go up, you win. If housing prices go down, you lose. Figure 4 depicts the outcome of a 10 percent fluctuation in the residence's price.

Now suppose you don't want to take the full $100,000 out of your savings, or you don't have that much saved, so you take out a mortgage for half the money you need to buy the dwelling. Your mortgage lender does not expect to share in the benefits of rising housing prices, nor to bear the pain of falling ones. You owe your lender the $50,000 you borrow either way. That means your equity investment bears the entire risk of changing housing prices. Figure 5 illustrates this effect (see page 12).

Now the variability of your equity return due to the dwelling's price fluctuations doubles. The entire variability of a 10 percent increase in housing prices now falls on the $50,000 in original equity.

14 Preferred equity acts much like debt in magnifying common equity's risk. However, it simplifies the discussion to focus on debt and common equity alone.

15 The example ignores the effect of taxes, interest payments and depreciation to keep things simple, but only the details would be affected by including them not the main message.
The rate of return calculations when the entire purchase price is paid using savings are as follows: If the price falls to $90,000, the rate of return on your equity due to the decrease was:

**Figure 4:**

\[
\text{Rate of return on equity} = \frac{(\text{New Market Value} - \text{Old Market Value})}{\text{Old Market Value}}
\]

\[
= \frac{($90,000 - $100,000)}{$100,000}
\]

\[
= -$10,000 = -10%
\]

Halving the amount of equity doubles its variability.

The equity return gets ever more variable as the mortgage proportion grows. Figure 6 shows the outcome for mortgages that are 0 percent, 20 percent, 50 percent and 80 percent of the dwelling purchase price.
Figure 6

The Bigger the Mortgage, the More Variable the Equity Return due to a 10% Dwelling Price Change

Value of Your Equity Investment After Change in Dwelling Prices (000s)

- $100,000 +/- $10,000 is +/-10%
- $80,000 +/- $10,000 is +/-12.5%
- $50,000 +/- $10,000 is +/-20%
- $20,000 +/- $10,000 is +/-50%

Figure 7 depicts the same point in a different way. It shows the growing variability of the equity return as the mortgage proportion increases for a more nearly continuous set of cases. The basic message is the same either way: a higher mortgage (more debt) means ever more risk for equity. This same effect is present in the equity returns of a company that finances a portion of its assets with debt. The equity returns are more variable as the percentage of debt in a company's capital structure increases.

Figure 7

Equity Rate of Return Range due to +/- 10 Percent Change in Dwelling Price Increases Ever More Quickly as Mortgage Proportion Changes from 0% to 80% of Initial Cost
As illustrated in Section II, the same principle applies to the equity of a regulated utility in general. The equity rate of return on a capital structure with a 60 percent equity component is not the correct rate of return for the identical company with a 40 percent equity component because the financial risk is different. *(see Tables 1 and 2 on pages 7 and 8).* As obvious as this seems, it is frequently the case that commissions as well as some cost of capital experts make recommendations that ignore this fact.

The next section discusses the theory underlying the effect of debt on the required rate of return for equity. Section IV discusses the theoretically correct method to adjust for differences in financial leverage applicable in a regulatory setting.

**B. IMPACT OF DEBT ON THE COST OF EQUITY**

Investors do not like risk. For the same expected rate of return on equity, rational investors would choose to be on the left edge of Figure 7 (or Figure 3), not somewhere to the right. No risk-adverse investor would choose an investment with an expected return of, say, 10 percent plus or minus 50 percent over one with an expected return of 10 percent plus or minus 5 percent. Investors demand a higher rate of return to bear more risk.

The messages of this example are simple:

1. **Debt magnifies equity's risk.**
2. **Debt magnifies equity's risk at an ever increasing rate.** Therefore,
3. **The required rate of return on equity goes up at an ever increasing rate as you add more and more debt.**

This is not only basic finance theory, it is the everyday experience of anyone who buys a home. The bigger your mortgage, the more percentage risk your equity faces from changes in housing prices. The same principle is applicable to the equity of a regulated electric utility.

Note that although up to now nothing has been said in the mortgage example about the effect of rent, mortgage interest and taxes on the three "messages," *not one word* of these three messages needs be changed to accommodate such factors. Such factors do affect the precise magnitude of the cost of equity and the precise way in which it changes as additional debt is added, but all three messages remain completely correct as stated regardless of these details. This is true not only for the mortgage example but also for the equity of corporations.

There is sometimes confusion, particularly in a regulated setting, on whether it is appropriate to use market-value or book-value capital structures to assess the degree to which financial risk affects the cost of equity. The answer is that it is the market-value capital structure that is the relevant quantity for analyzing the cost of equity evidence, not the book-value capital structure.  

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16 See, for example, Richard A. Brealey and Stewart C. Myers, *Principles of Corporate Finance*, New York: McGraw-Hill/Irwin, 7th ed. (2003), at 525-26. Book values may be relevant for some issues, e.g., for covenants on individual bond issues, but as explained in the text, market values are the determinant of the impact of debt on the cost of equity.
The variability of the equity in the housing example depends on the market-value shares of the mortgage and the equity, not the book-value shares. Suppose you bought your home 10 years ago, and you've been renting it out. Suppose depreciation has reduced the original book value from $100,000 to $75,000. Suppose also that you've paid off about 20 percent of the original mortgage, leaving 80 percent still owed. Suppose as well that your original mortgage was for 80 percent of the purchase price, or $80,000. That means your mortgage balance is now ($80,000 x 0.80) = $64,000. On a book value basis, you have $75,000 - $64,000 = $11,000 in equity.

What happens now if housing prices increase or decrease 10 percent? You cannot even start to answer this question unless you also know how housing prices have changed over the last ten years. If the market value of the home is now $200,000, you can calculate a 10 percent change as $20,000. A 10 percent decrease in housing prices is therefore almost twice your book equity of $11,000. Does that mean a 10 percent decrease will wipe you out?

Of course not. Your real equity is the market value equity in your home. Suppose interest rates are unchanged, so the market value of the mortgage equals its remaining unpaid balance. The relevant measure of equity for risk-reward calculations is

\[
\text{True Equity} = \text{Market Value of Dwelling} - \text{Market Value of Mortgage} = \$200,000 - \$64,000 = \$136,000
\]

Therefore, the percentage rate of return on equity due to a 10 percent change in housing values is

\[
\text{Rate of return on equity} = \frac{\text{Change in Dwelling Value}}{\text{Starting Equity Value}} = \frac{\pm \$20,000}{\$136,000} = \pm 15\%
\]

Figure 8 (see page 16) depicts the actual risk-return tradeoff after 10 years. A 10 percent decline in home prices would be painful, but it wouldn't come close to wiping you out, no matter what the books say. Nor would the 10 percent price decline even show up on the books, despite its still material impact on your actual investment.

No landlord would assess his or her risk due to a mortgage by comparing fluctuating property values to the remaining book value of the property. The risk that debt imposes on the cost of equity is a function of relative market values, not relative book values. This is equally true for the sample companies when estimating the cost of equity using cost of equity estimation models based on market information.
Suppose that you have refinanced your dwelling. While it still is worth $200,000 ten years after you bought it, your new market-value debt-equity proportions are consistent with the above example's book capital structure. That is, given an undepreciated book value of $75,000 consisting of $11,000 of equity and $64,000 of debt, your post-refinancing capital structure gives you a mortgage of \([200,000 \times (64/75)] = 171,667\) and equity of \([200,000 \times (11/75)] = 29,333\). Now a plus or minus 10% swing in housing prices gives you an equity rate of return of:

\[
\begin{align*}
\text{Rate of Return} & = \frac{\text{Change in Dwelling Value}}{\text{Refinanced Starting Equity Value}} \\
& = \frac{\pm \$20,000}{\$29,333} \\
& = \pm 68\%
\end{align*}
\]

Contrast this value with the \(\pm 15\) percent in Figure 7, in the case where the home's market value had gone up the same amount but there was no refinancing. A cost of equity analyst who estimated the "beta" risk measure on a stock like this would get a much higher value than in the earlier example, because the stock would be much more volatile. In short,

Market values, not book values, determine the risk impacts of capital structure on the market cost of equity for all companies, even those regulated on a book-value rate base.

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17 Technical note: debt magnifies the stock's entire variability, diversifiable and non-diversifiable alike. Therefore, the stock's beta (or "betas," if more than one risk factor matters to investors) will in fact be affected by the company's market-value capital structure.
The conclusion of this section is that the risk of equity depends directly on the market-value capital structure of the company or asset in question. It is therefore impossible to compare validly the costs of equity of different companies without taking capital structure into account. Capital structure and the cost of equity are unbreakably linked, and any effort to treat the two as separate and distinct questions violates both everyday experience and basic financial principles. In particular, capital structure differences between sample companies and the regulated company must be properly considered in establishing the cost of capital.
IV. CAPITAL STRUCTURE ISSUES IN A REGULATORY SETTING

This section discusses how the ideas on the effect of capital structure on the cost of equity should be addressed in a regulatory setting. There are two aspects of this problem. First, the standard cost of equity estimation techniques rely upon sample companies which have capital structures that generally differ among themselves. Proper interpretation of the market information provided by the sample companies requires considering the differences in their market value capital structures, because of the effect of financial leverage on the cost of equity. But note, as the discussion above demonstrates, the equity risk level depends on the sample company's market-value capital structure, not its book-value capital structure. Second, even if it were the case that the capital structures of the sample companies were identical, it still remains to consider the capital structure of the regulated entity in comparison to the sample companies. As discussed above, there is a simple way to handle both of these issues: calculate the overall cost of capital or ATWACC. The next section elaborates on this approach.

A. THE AFTER-TAX WEIGHTED AVERAGE COST OF CAPITAL

As discussed above, business textbooks uses the "weighted-average cost of capital" or "WACC," but here a different term is used in order to prevent confusion with a measure of the weighted-average cost of capital that is often used in rate regulation (specifically, the regulatory WACC is a book-value-weighted average of the after-tax cost of equity and the pre-tax average interest rate on the company's outstanding debt).\textsuperscript{18} We will call the above textbook formula for the overall cost of capital the "after-tax weighted-average cost of capital," or "ATWACC". The formula for the ATWACC was given in Table 1.

The ATWACC is not a new concept and is routinely used in the business world. The value of a proposed investment project is normally calculated as the Net Present Value ("NPV") of its expected after-tax cash flows discounted at the ATWACC.\textsuperscript{19}

The overall costs of capital (the ATWACCs) of different companies or industries depends primarily on the business risk, or the risk the business would have with no debt. Biotech firms have more business risk than automobile manufacturers, which in turn have more risk than gas distribution companies or electric utilities. Business risk depends on the nature of the variability of the company's operating cash flows, which are the cash flows to all investors including bondholders. Operating cash flows are the net result of uncertain revenues minus uncertain operating costs. All else equal, business risk grows as revenues become more

\textsuperscript{18} The regulatory WACC is combined with an estimate of the income taxes owed to determine the return on invested capital for the revenue requirement. In the terminology of this paper, the sum of after-tax equity return, income taxes and interest expense is equal to the before-tax weighted-average cost of capital or the "BTWACC".

\textsuperscript{19} "Cash flow" means the change due to the project in the actual amount of money the company has that year C dollars you can buy books with. The usual calculation of a project's NPV is the sum of the project's expected after-tax all-equity cash flows (i.e., the expected cash flow if the investment were financed entirely with common equity), discounted at the ATWACC: where the first cash flow occurs right away, at time 0, and need not be discounted. The initial cash flow is usually an investment outlay, i.e., a negative cash flow.
uncertain and more highly correlated with the forces that drive the economy. Business risk also grows, all else equal, and as costs become less uncertain and less correlated with the general economy.

Calculation of the ATWACC captures both the business and financial risk of the company. This makes it easy to compare the cost of capital evidence from sample companies with different capital structures. As discussed below, deriving the cost of equity consistent with different capital structures is also easy with this approach. Table 1 provides an illustration of the calculation.

Before proceeding further, it is worth addressing three objections that are frequently voiced in regulatory proceedings when a cost of capital expert recommends a cost of equity adjusted for differences in financial risk. The three objections are addressed next.

It is sometimes argued that the use of market values to calculate the impact of capital structure on the risk of equity is incompatible with use of a book-value rate base for a regulated company. This is not the case any more than it would be inappropriate to use market-based cost of equity estimation methods (such as the Discounted Cash Flow method or the Capital Asset Pricing Model) with a book value rate base. That is, the cost of capital is the fair rate of return on regulatory assets for investors and customers alike. Most regulatory jurisdictions in North America measure the rate base using the net book value of assets, not current replacement value or historical cost trended for inflation, but the jurisdictions still apply market-derived measures of the cost of equity to that net book value rate base. In essence, the cost of capital expert should strive to determine the market cost of capital for companies of comparable risk to the regulated entity. In this way, the regulated entity will be allowed a market determined cost of capital on its book value rate base which is a measure of the amount of unrecovered investment in the company's assets.

The second objection is that any adjustment for differences in financial leverage should be based upon differences in the book value not the market value capital structures of the sample firms. This objection was addressed in Section III above. The market value capital structure is the correct measure of financial risk.

The third objection is based on the assertion that adjusting the cost of capital estimate for differences in financial leverage will result in an ever increasing market to book value of equity ratio, because the need for an adjustment for differences in financial leverage is the result of the fact that the market to book value ratio for the sample companies is generally greater than one. Adjusting the allowed rate of return on equity for differences in financial risk will not result in an ever increasing market to book ratio, because the adjusted return simply awards the market-determined overall cost of capital to the regulated entity. However, responding to this objection is complicated by the fact that financial theory does not have a complete explanation of market prices even for regulated companies. In the past, a market to book ratio near one was regarded as evidence that the regulated rate of return was being set at appropriate levels, but this measure is no longer considered reliable by most cost of capital experts.  

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20 For a further explanation of this issue, see, for example, Stewart C. Myers, "Fuzzy Efficiency," *Institutional Investor*, December 1988.
B. THE EFFECT OF DEBT ON THE OVERALL COST OF CAPITAL

As discussed above, increased use of debt in a company's capital structure increases the cost of equity because equity is bearing an increasing portion of the variability of returns. The question addressed in this section is the effect of debt and the corresponding tax deduction for interest expense on the overall cost of capital. In other words, does the use of debt decrease the overall cost of capital for the firm?

1. THE EFFECT OF TAXES ON THE OVERALL AFTER-TAX COST OF CAPITAL CURVE

This section discusses the effect of taxes on the after-tax weighted-average cost of capital. For most companies, the ATWACC decreases initially as a company financed entirely with equity substitutes debt for equity because of the corporate income tax shield provided by interest payments. At some point, the disadvantages of debt begin to outweigh the benefits so that using more debt actually increases the overall cost of capital. A firm with too much debt begins to suffer from the effects of financial distress so there is generally considered to be a tradeoff between the costs and benefits of debt in the overall cost of capital. There is debate about the precise effects of taxes and the costs of financial distress, but the effect on the cost of equity is basically unchanged. This is why the three messages listed above remain true despite such details as the precise impact of taxes or of the possible use of excessive debt.

Repeating the three messages:

*The cost of equity of any company or investment increases at an ever increasing rate as you add more and more debt, regardless of the "true" effect of taxes or the "true" shape of the overall after-tax weighted-average cost of capital curve.*

Indeed, debt is known as "leverage" C or "gearing" C precisely because it amplifies the risk and expected return of equity. The examples above demonstrate the reason, which every property owner who has used a mortgage should be able to confirm by reflecting on his or her own experience. If it were otherwise, the average level of, and the variability of, the rate of return on the equity in your home would be much different. The effect of taxes and other effects on the shape of the ATWACC curve are details that do not affect the message of this paper: the cost of equity is a function of both business and financial risk.

There is no theory to explain definitively how to pick the "best" capital structure for a firm. In fact, the evidence is consistent with the view that the ATWACC is constant over a broad middle range of capital structures for companies in an industry. If it were otherwise, we would see firms in an industry converging on one optimal structure, because of the competitive advantage accruing to a firm with a lower cost of capital. We do not observe such clustering of capital structures around some optimum value and conclude that the ATWACC must be constant within this range. While there are several theories of capital structure, none has emerged as the definitive explanation of capital structure choice. Nonetheless, one very important conclusion is supported by the research:

*The effect of debt on the cost of equity is material regardless of the "true" shape of the ATWACC curve, i.e., regardless of the true impact of a particular amount of debt on the overall value of the firm.*
2. **AN EXAMPLE OF THE EFFECT OF THE FAILURE TO CONSIDER DIFFERENCES IN CAPITAL STRUCTURE**

This section discusses the potential magnitude of the misestimation of the cost of equity if capital structure differences between sample companies and the regulated entity are not explicitly considered.

Suppose a commission accepted the implied cost of equity of 9.1 percent at a 53 percent equity, 47 percent debt market-value capital structure for the sample companies, but applied it directly to a regulated entity with a 40 percent equity ratio. The result is depicted in Figure 9.

![Figure 9](image)

If the cost of capital expert's sample had actually had a market-value debt-equity ratio of 60-40, its true cost of equity would have been higher. Estimation problems aside, it would have been on the order of 10.5 percent, not 9.1 percent, an error of approximately 140 basis points! Alternatively, a company with the risk this procedure attributes to the regulated entity would have a true cost of equity on the order of 8.0 percent at the sample's market value capital structure, not 9.1 percent.

Moving the 9.1 percent sample cost of equity from the actual capital structure to a 60-40 debt-equity ratio shifts to an entirely different cost of equity curve. It effectively throws away all of the information in the sample cost of equity estimation process and uses a number that might as well be picked at random. *The sample cost of equity has no validity at a radically different capital structure from the one at which it was estimated.*

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21 As discussed above, the 9.1 percent at 53 percent equity was obtained using a standard CAPM estimation method. Which estimation method to rely on for cost of capital estimation in the current economic environment is subject to significant debate, but however the sample estimate is obtained, adjustment for differences in financial leverage is still appropriate.
The equivalent graph for a second sample of gas local distribution companies ("gas LDCs) is shown in Figure 10. Here the change is even more extreme. Since the initial sample cost of equity is lower, at 8.5 percent at 43 percent debt, the new cost of equity curve implied by the use of this value at the 60-40 debt-equity ratio is even lower than in Figure 9. The true sample cost of equity at the regulatory capital structure of 40 percent equity would be on the order of 10.7 percent. Alternatively, the true cost of equity of the new curve at a capital structure that matches the second sample's would have been on the order of 7.4 percent, not 8.5 percent. Again, the leap from the actual capital structure to a radically different one simply robs the sample cost of equity of any meaning. The use of that particular cost of equity value for the regulated entity is completely independent of, and is in no way supported by, the current risk and cost of capital evidence for the sample of rate-regulated companies.

![Figure 10](image)

These two figures illustrate the magnitude of the potential mismatch between the market value information used to the estimate the cost of capital and the cost of equity for the regulated company when differences in capital structure (financial leverage) between the sample companies and the regulated entity are not considered.
V. "YOU CAN'T PUSH ON A ROPE"

This section discusses what is needed to induce investment by corporations in a market economy. Investment by ordinary (i.e., non-financial) corporations is the process of turning a fungible and very liquid asset \( C \) money \( C \) into other assets that have at least as much value, but which are much less fungible and liquid. Examples of such other assets include electric generation and transmission facilities, water treatment plants, automobile factories, and research and development programs that companies hope will produce valuable patents.

Corporations get money to invest by inducing investors to provide it. The inducement comes in the form of an expected return on the investors’ money. The level of return investors require depends on the risk involved, which varies from industry to industry because some of the assets in which corporations invest are riskier than others.

That is, the expected rate of return investors can get if they keep their money in the bank or money-market funds is predictable and carries little or no risk, but the return is also low. The expected rate of return on the assets corporations build or buy with investors' money is less predictable and carries more risk, and sometimes much more. The expected return is also higher, because investors require a higher expected rate of return to bear more risk. To attract capital, corporations must identify investments with an expected rate of return at least equal to that available to investors on alternative investments of equivalent risk.

In several opinions, the U.S. Supreme Court has established the legal standards for allowed rates of return for rate-regulated companies which appear to be in line with these economic principles. For example,

A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public . . . equal to that generally being made . . . on investments in other business undertakings which are attended by corresponding risks and uncertainties. Y The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.\(^{22}\)

and

From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock. [Citation omitted.] By that standard, the return to the equity owner should be commensurate with return on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure

\(^{22}\) Bluefield Waterworks & Improvement Co. v. Public Service Commission, 262 U.S. 668 (1923) at 692-693.
confidence in the financial integrity of the enterprise, so as to maintain its credit
and to attract capital.23

These passages suggest a two-part standard. First, the expected rate of return for investors in a rate-regulated
company should equal that available in other investments of equivalent risk. Second, the return should be
adequate to maintain the financial integrity of the company. Both parts of this standard make good economic
sense, since you can't force investors to put their money into a venture. The very fact that such legal
standards exist makes good economic sense, too.

The latter is true because there is presently an active corporate finance literature that documents the impact
of international differences in enforceable legal rights on the health of a nation's financial markets and the
level of investment. Two quotations from that literature summarize some of the relevant findings:

Recent research reveals that a number of important differences in financial
systems among countries are shaped by the extent of legal protection afforded
outside investors from expropriation by the controlling shareholders or managers.
The findings show that better legal protection of outside shareholders is
associated with: (1) more valuable stock markets... ; (2) a higher number of listed
firms... ; (3) larger listed firms in terms of their sales or assets... ; (4) higher
valuation of listed firms relative to their assets ... ; (5) greater dividend payouts...
; (6) lower concentration of ownership and control... ; (7) lower private benefits
of control... ; and (8) higher correlation between investment opportunities and
actual investments.... [Omitted citations indicated by ellipses.]24

Also,

Recent research suggests that the extent of legal protection of investors in a
country is an important determinant of the development of its financial markets.
Where laws are protective of outside investors and well enforced, investors are
willing to finance firms, and financial markets are both broader and more
valuable. In contrast, where laws are unprotective of investors, the development
of financial markets is stunted. Moreover, systematic differences among
countries in the structure of laws and their enforcement, such as the historical
origin of their laws, account for the differences in financial development... .
[Omitted citations indicated by ellipses.]25

This literature focuses on the possibility of expropriation by a country's citizens of minority investments
made by outsiders, typically foreigners. The issue the Supreme Court addresses is the possibility of
uncompensated takings by acts of government. But the key question is whether the investment is or is not at
risk of being taken, not who the taker is. Investors are understandably reluctant to commit funds when such
takings are possible, leading to less investment and to more costly terms for the investments that are made.

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To understand what is meant by "takings" in the context of a regulatory proceeding, it is useful to consider a bit of background on how an asset's risk may be allocated among different groups of customers. Investments in industry-specific corporate assets can be hostages to fortune. To sink fungible money into a non-fungible asset with few or no alternative uses, particularly one with a long life, is to accept a great deal of intrinsic risk. Companies sometimes choose to bear all of this risk and sometimes try to lay some or all of it off on other parties.

An example is a commercial building that might be used for office space or as a hotel. (Some buildings have both uses at the same time.) Commercial office space normally is rented out under long-term leases. The owner of the building gets a secure payment from the office space lessee, who thereby removes the owner's risk that the office space might lease at a much different rate in a few years. Hotel space, in contrast, rents night to night. The owner bears the risk of bad times, when more rooms will be empty and those rooms that are rented command lower rates or deeper discounts. The owner hopes to more than make up for such losses in good times, when more rooms are occupied and daily rates are higher.

The owner of a building with both office space and hotel space thus lays off some of his or her risk on office space lessees, but keeps the risk for the hotel space. The rents charged to office space lessees are lower than they would otherwise be precisely because the lessees are bearing this risk. Put differently, the cost of capital for office space is lower than the cost of capital for hotel space, and in a competitive market, the average rates for office and hotel space would reflect this difference.

This is an issue for rate-regulated firms because rate regulation often involves companies with long-lived assets with little or no alternative uses, and it therefore involves a great deal of intrinsic risk. The institutions of rate regulation pass much of this risk through to customers, in exchange for lower prices than they would otherwise have to pay. Investors' risk-bearing under rate regulation normally lies somewhere between the office-space and hotel-space extremes. Regulation denies regulated companies the right make extra-high profits by charging premium prices in good times, and in exchange is supposed to protect the company from having to suffer from extra-low prices in bad times. It also is supposed to assure the investor a fair opportunity to recover all of the money sunk into the company's assets, through depreciation or amortization charges. Yet the company normally retains some risks, too. An example is gains or losses due to variations of sales from forecasted levels, which typically fall on the company between rate hearings, at which time new forecasts can be made.

Rate-regulated companies invest under the expectation that they will earn a return equal to the cost of their capital on average, i.e., that investors will have a fair opportunity to earn exactly the rate of return they could get on alternative investments of equivalent risk. The cost of capital for electric utilities is lower than in most industries precisely because of the constraints imposed by rate regulation. Nonetheless, it is higher than office space lessees command, because rate-regulated companies bear more risk than a building owner does from an office lease.

With that background, the economic (not legal) interpretation of what is meant by "takings" follows. Economically a "taking" of regulatory property, in the sense used above, would occur when the terms of regulation were changed so as systematically to deny to investors a fair opportunity to earn the cost of capital after the investors have sunk their money in non-fungible rate-regulated assets.
If it were known in advance that regulators would mark regulated rates down to unremunerative levels right after major investments had been made, for example, investors would invest less than if they believed the returns would be adequate; possibly they would not invest at all. If the policy of unremunerative returns were known in advance, the company's service quality would be lower, and service would be less available and/or more expensive than it would otherwise have to be. Therefore, a change to the terms of regulation to deny a fair opportunity to earn the cost of capital after the fact would get higher service levels without paying for them, and that would constitute a taking from an economic perspective. Whether legal or not, such an act would achieve a short-run benefit for today's customers at a material long-run cost to future customers. The research cited above suggests the long-run cost could be material for the economy of the jurisdiction committing the act, too. Uncertainty of this type may lead to under investment in the electric utility infrastructure of the country.

It is sometimes argued that a commission's need to balance customer and investor interests means that the rate of return on equity should be lowered, especially if overall rates are high due to new investments, but this would violate the standards discussed above if the result is an expected rate of return on equity that is below the cost of capital. The cost of capital is as much a real cost as workers' wages. From an economic perspective, cutting the return on equity because new investment makes costs high is no different from cutting the wages of a utility's workers because costs are high. Workers who were satisfied with the wage before the cut would look for better opportunities after the cut, and some would find such opportunities and quit. The deeper the cut, the larger the proportion of workers who would quit. Investors would have an even easier time finding better opportunities, because the stock market is full of investments that offer an expected rate of return below the cost of capital (which varies with the risks of the particular stock). With an allowed rate of return below the cost of capital, managers who act in their shareholders' interests would try to avoid putting any more capital into the now unremunerative line of business, with material long-run consequences. That would not be in the best interest of customers, any more than would a utility's being unable to operate or to maintain its service quality because it could not attract workers at the wages it was allowed to offer.

Another argument sometimes offered is that if the gain is now and the cost is in the long-run, why worry about it? Is not that a problem for the future? The answer is that it is always possible for one generation to live well and leave future generations to pick up the tab, and economists have no particular claim to expertise with the ethical questions generated by such decisions. However, we can try to help make sure the questions are resolved with a complete understanding of the tradeoffs involved.

Rate-regulated companies, like the institutions of regulation themselves, generally have a great deal of inertia. They are like oil supertankers, which take a great deal of time to turn if trouble looms, but which then take at least as much time to get back on the original course.

Regulated companies' managers tend to want to provide service when it's requested, trusting to the regulatory process to perform acceptably for their investors on average. Therefore, they may not react immediately to the full extent possible if the regulatory process stops doing so. They certainly react less quickly than competitive firms to signals that a previously remunerative market no longer is generating an adequate

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26 From an economic perspective, there is little to distinguish between changing the terms on which capital was invested after the fact and notifying the laborers finishing up on a construction project that they weren't going to receive their final paycheck, or that they would get it but at a much lower wage. The cost of capital is as much a real cost as wages.
return. And even after managers do react and slow or stop new investment, the long-lived nature of regulatory assets can mean existing services take a long time to decay. Therefore, the adverse impacts of a regulatory policy that systematically denies investors a fair opportunity to earn the cost of capital are likely to take awhile to become material, which can lead to the mistaken impression that they will not do so.

Once the adverse impacts are manifest, however, they cannot be overcome in a hurry, any more than a supertanker can immediately resume its previous course. Not only would remedial investment take time, but also it would take longer to get started and/or be more expensive. Moreover, investors, once burned, will be loath to trust that the regulatory jurisdiction in question won't repeat the same pattern if regulators subsequently ask for quick investments to shore up a system that the previous policy let decay, or to extend service to new customers. The safest way for investors to avoid inadequate returns on future major investments in such a jurisdiction is to keep the system capital-starved. For example, the company might not invest unless regulators were willing to negotiate \textit{ex ante} terms that assured a fair return on incremental investment, at least. Such negotiations at least take time and cost extra money. They also lead to a higher rate of return and/or to a shift of more risk to customers than could have been achieved by a policy of allowing the company a fair opportunity to earn its cost of capital all along.

Even though rate-regulated companies an obligation to invest to maintain service, there will be incentives for investors to slow the rate of investment if they become convinced that the return will not be remunerative. It is certain that if a rate-regulated company becomes convinced that its returns in a particular jurisdiction will systematically be inadequate in the future, the best thing it can do for its shareholders is to devise an optimal exit strategy from that jurisdiction. Moreover, whatever the legal form of that strategy, and whatever the direct costs to both investors and customers of its execution, it will also constitute a very negative signal to all companies considering investing in that jurisdiction in the future.

Additionally, even if the company in question stops short of an exit strategy, those most likely to pay attention to inadequate returns for one rate-regulated company are investors in and managers of other rate-regulated industries in the jurisdiction. They may grow cautious about new investment, also, even if they have not yet been affected directly. Rate-regulated industries tend to provide basic services, so a reluctance to invest in these industries, whether solely in the one directly affected or in all of them, is very likely to spill over to the rest of the jurisdiction's economy.

Therefore, a decision to take systematically from today's investors to give service below cost to today's customers will create material problems for tomorrow's customers and very probably for the state's or the country's economy. The optimal strategy for investors in such a company is to keep it capital-starved, and possibly even to exit the jurisdiction. You can't force investors to throw good money after bad, any more than you can push on a rope. As time passes, that will lead to less reliable (and less extensive) service. Unfortunately, while systems consisting of long-lived assets take a long time to "break," once "broken" they also take a long time to fix. Moreover, tomorrow's investors will not put up new money to fix such systems

on the old terms. Even after such a system is restored, it will cost tomorrow's customers more than it would have without the initial decision to take from today's investors.
VI. "EMPTY PROMISES BUY NOTHING"

This section addresses the difference between the cost of capital and the allowed rate of return, and in particular, shows why setting the allowed return equal to the cost of capital provides inadequate compensation if the regulated entity can not expect to earn the allowed return on average.

The "opportunity cost of capital," or "cost of capital" for short, is defined as the expected rate of return in capital markets on alternative investments of equivalent risk. The cost of capital is the bare minimum rate of return necessary to attract capital and to compensate investors for a given level of risk, since that is what they could earn elsewhere without bearing any more risk. That is, it is the competitive market price for capital exposed to a given level of risk. To treat both investors and customers fairly, regulatory procedures should operate so the company expects to earn the cost of capital on the assets its investors' money has bought.  

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The "allowed rate of return" is a regulatory parameter used to determine the revenue requirement. Typically, the allowed rate of return is set equal to regulators' estimate of the cost of capital. The issue for this section is whether the mere setting of the allowed rate of return equal to the cost of capital actually permits investors to expect to earn the cost of capital, even if all parties were to agree that regulators had estimated the cost of capital perfectly.

An allowed rate of return equal to the cost of capital lets the company expect to earn the cost of capital if and only if the company expects to earn the allowed rate of return. If the jurisdiction's regulatory procedures are designed so the company actually expects to earn less than the allowed rate of return, then it expects to earn less than the cost of capital, too.

In this context, the "expected" rate of return or the return the company "expects" to earn refers to the average value. The term "expected" is from statistics, and denotes the mean of the distribution of possible returns or rates of return.  

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This paper uses "expect" and "expected" only in the statistical sense: . . .the idea of expectation of a random variable is closely connected with the origin of statistics in games of chance. Gamblers were interested in how much they could "expect" to win in the long run in a game, and in how much they should wager in certain games if the game was to be "fair." Thus, expected value originally meant the expected long-run winnings (or losings) over repeated play; this term has been retained in mathematical statistics to mean the long-run average value for any random variable over an indefinite number of samples. This holds whether a large number of samples will actually be conducted or whether the situation is a one-trial affair and we consider hypothetical repetitions of the situation. Over a long series of trials, we can "expect" to observe the expected value. At any single trial, we in general cannot "expect" the expected value; usually the expected value is not even a possible value of the random variable for any single trial. . . .


28 A potential exception to this rule is "incentive regulation." Under incentive regulation, the company may be able to expect to earn more than the cost of capital for a period of time if its managers are able to find innovative ways to cut costs. Customers benefit after this period ends (or sometimes right away, according to a predetermined sharing formula) when costs are lower than they would otherwise have been.

29 This paper uses "expect" and "expected" only in the statistical sense: . . .the idea of expectation of a random variable is closely connected with the origin of statistics in games of chance. Gamblers were interested in how much they could "expect" to win in the long run in a game, and in how much they should wager in certain games if the game was to be "fair." Thus, expected value originally meant the expected long-run winnings (or losings) over repeated play; this term has been retained in mathematical statistics to mean the long-run average value for any random variable over an indefinite number of samples. This holds whether a large number of samples will actually be conducted or whether the situation is a one-trial affair and we consider hypothetical repetitions of the situation. Over a long series of trials, we can "expect" to observe the expected value. At any single trial, we in general cannot "expect" the expected value; usually the expected value is not even a possible value of the random variable for any single trial. . . .
In some regulatory jurisdictions, some regulated companies do not earn their allowed rate of return over several years. The specific reasons for these shortfalls would need to be investigated on a case by case basis, but the fact of such shortfalls raises the possibility that investors will not expect to earn the allowed rate of return under some regulatory arrangements. Fair treatment of both investors and customers means that rate-regulated companies should expect to earn the cost of capital on average. If a company does not expect to earn its allowed rate of return, then setting the allowed rate of return equal merely to the cost of capital shortchanges its investors, because the supposed opportunity to earn the allowed rate of return on average is actually an empty promise. Fair treatment of investors in such a case requires either changes to the regulatory mechanism so the company does expect to earn its allowed rate of return on average, or an allowed rate of return set enough above the cost of capital to make up for the expected shortfall between the cost of capital and the rate of return the company actually expects to earn.
VII. CONCLUSIONS

Setting the cost of capital correctly for regulated entities is critical to insuring the adequacy and reliability of service for ratepayers. If the allowed return is set too low, there is likely to be an adverse affect on investment. In addition, merely setting the allowed return equal to the cost of capital does not provide an adequate return if the regulated entity can not expect to earn the allowed rate of return on average. At the same time, setting the allowed return too high means that the rate payers are charged too much for service. Neither outcome is in the best interests of ratepayers or the industry.

Now that the focus of regulation is returning to setting the allowed rate of return, it is important that the latest developments in financial theory be incorporated into the rate setting process so that the cost of capital can be estimated and set as accurately as possible. One area of development in financial theory is the effect of financial leverage (financial risk) on the cost of equity. Just as increased business risk means an increase in the required rate of return on equity, increased financial risk also means an increase in the required rate of return. An allowed return that does not consider both the level of business risk and the level of financial risk is not likely to be an accurate estimate of the cost of capital for the regulated entity.

Unfortunately, the methods used in a regulatory setting frequently ignore differences in financial risk. This paper has described a method that fortunately is very simple that considers both business and financial risk simultaneously so that the allowed return on equity can be set that is consistent with the regulatory capital structure to which the return in applied. This method is to calculate the overall cost of capital (the ATWACC) for all sources of financing in the firm. Using the assumption of a constant overall cost of capital, the analyst can adjust the return on equity to be consistent with both the information provided by the sample companies and with the regulatory capital structure allowed. As demonstrated in the examples in Section V, failure to consider differences in capital structure between the sample and the regulated entity can lead to errors in the estimated cost of equity of 200 basis points or more. Errors of this magnitude make it critical that financial risk be treated appropriately.