BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

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IN THE MATTER OF THE APPLICATION OF ARIZONA-AMERICAN WATER COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE CURRENT FAIR VALUE OF ITS UTILITY PLANT AND PROPERTY AND FOR INCREASES IN ITS RATES AND CHARGES BASED THEREON FOR UTILITY SERVICE BY ITS AGUA FRIA WATER, HAVASU WATER AND MOHAVE WATER DISTRICTS	DOCKET NO. W-01303A-10-____

DIRECT TESTIMONY
OF
DR. BENTE VILLADSEN
ON BEHALF OF
ARIZONA-AMERICAN WATER COMPANY
November 3, 2010

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EXECUTIVE SUMMARY

Dr. Bente Villadsen, a Principal at *The Brattle Group*, files testimony on the cost of capital for Arizona-American Water Company's Aqua Fria Water, Havasu Water and Mohave Water Districts.

Dr. Villadsen selects two benchmark samples, water utilities and gas local distribution companies (LDC). For the water sample, she primarily relies on a subsample that excluded Southwest Water which recently restated its financials and currently pays no dividends. Using two versions of the Discounted Cash Flow (DCF) method and three versions of the Capital Asset Pricing Model (CAPM), she estimates the sample companies' after-tax weighted-average cost of capital. The after-tax weighted average cost of capital is the measure that companies most commonly use to evaluate investments and the measure recommended in standard financial textbooks. Textbooks, the academic literature as well as businesses weigh debt and equity by the market values in determining the after-tax weighted cost of capital.[1]

Having estimated the samples' after-tax weighted-average cost of capital for the samples, she determines the corresponding cost of equity for Arizona-American Water at its target of approximately 45 percent equity. In undertaking her analysis, Dr. Villadsen notes that the overall cost of capital is constant within a broad middle range of capital structures although the distribution of costs and risks among debt and equity holders is not. Because the overall cost of capital is the same in a broad range of capital structures, there are no impacts on the rates customers pay from a higher or lower percentage of equity, so ratepayers are not affected by the choice of capital structure within a broad range. However, Arizona-American Water's capital structure includes only 45 percent equity, which is lower than the percentage equity among many utilities. Therefore, its financial risk is higher and the return required by investors' increases with the level of risk they carry, but this return is paid on a smaller amount of equity than is typical in the water industry. Therefore, the dollar amount paid by customers is the same as if the Company had a lower return on equity but a higher equity percentage.

Dr. Villadsen discusses the impact of the recent recession and ongoing turmoil in financial markets on utilities' cost of capital and notes that while the yield on government issued bills and bonds is currently very low, the spread between the yield on investment-grade utility bonds and government bonds is currently unusually high. As utilities cannot raise debt (or equity) at the same rates as the government, it is necessary to take the yield on investment grade utility bonds into account in assessing the cost of capital for Arizona-American Water. Specifically, the yields on government bills and bonds have been driven artificially down by monetary policy and a flight to safety, so that the yields on these securities are not reflective of normal economic conditions. Consequently, Dr. Villadsen bases her CAPM models on a normalized risk-free rate which consists of the observed risk-free rate plus an adjustment for the increase in the spread between risk-free rates and investment grade utility bond yields. Further, equity investors lost substantial value in capital markets over the couple of years and stock prices have been extremely volatile. As a result, investors risk aversion has increased and the premium they require to invest in stocks going forward has increased. Therefore, the risk premium associated with equity investments is currently higher than it has been in the recent past. Dr. Villadsen performs several sensitivity analyses on the impact hereof, but the requested return on equity is fully supported by her baseline analysis, which relies on a historical market risk premium. In

[1] For example, the Hamada article relied upon by Commission Staff in past proceedings uses market value capital structures.

other words, her recommended return on equity does not include the current higher risk premium making her recommendation conservative in the current economic environment.

In addition to the cost of capital estimation discussed above, Dr. Villadsen reviewed data on Arizona-American Water's earned return over the past 10 years and data on Arizona-American Water's current credit ratios. Both the inability to earn the allowed return on equity and the credit ratios show that it is vital that Arizona-American Water be allowed an opportunity to earn a reasonable return on equity that would support as the bare minimum an investment grade credit rating on a stand alone basis. Further, Dr. Villadsen reviewed 22 recent decisions by the Arizona Corporation Commission to assess the reasonableness of Arizona-American Water's current request. When compared in terms of the overall return, the cost of equity requested by Arizona-American Water in this proceeding is comparable to that granted to other water and wastewater utilities in Arizona as adjusted using Arizona-American's equity percentage.

Lastly, the industry needs to invest in wastewater collection and treatment. The needed infrastructure investment requires substantial external financing (i.e., new debt and equity) and access to capital requires that investors expect to earn their required return. Failure to provide adequate returns may discourage potential investors. While it may seem counterintuitive to increase the cost of capital at a time when the economy is performing poorly, it is necessary to attract needed capital. The increase in the spread between utility bond yields and government bond yields along with the fact that investors are holding onto their funds, are indicators that the required return has increased. Thus, in order to attract investments, investors need to expect that they can earn a return on their investment that makes it worth the risk and that return is higher than prior to the financial crisis. The fact that Arizona-American Water has been unable to earn its allowed return since 2000 and on a stand alone basis has weak credit ratios makes the attraction of capital especially difficult for Arizona-American Water. These factors indicate that investors expect a higher risk premium for investing in equity than prior to the financial crisis and that Arizona-American Water face additional challenges in raising capital.

Based on the evidence from the samples, Dr. Villadsen finds that Arizona-American Water's request for 11.50% return on equity is reasonable and fully supported by her analysis. The financial turmoil has made the range of a reasonable return on equity wider and especially the water sample shows a wide range from approximately 10½ to 14½%, although the risk positioning results are in a narrower range from 11¼ to 12. The gas LDC sample's results are concentrated in the range of 11 to 12%. Based on the data and the analysis of Arizona-American Water's credit metric and the returns allowed other water utilities, I support the request for an allowed return on equity of 11.50%.

I. INTRODUCTION AND SUMMARY

Q. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A. My name is Bente Villadsen. My business address is The Brattle Group, 44 Brattle Street, Cambridge, MA 02138.

Q. PLEASE DESCRIBE YOUR JOB AND EDUCATIONAL EXPERIENCE.

A. I am a Principal of The Brattle Group, (Brattle), an economic, environmental and management consulting firm with offices in Cambridge, Washington, San Francisco, London, Brussels, and Madrid. My work concentrates on regulatory finance and accounting. I have previously prepared and presented cost-of-capital testimony before the Arizona Corporation Commission (Commission). I hold a B.S. and M.S. from University of Aarhus, Denmark and a Ph.D. from Yale University.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. I have been asked by Arizona-American Water Company (Arizona-American Water or the Company) to estimate the cost of equity for Arizona-American Water's Aqua Fria Water, Havasu Water and Mohave Water Districts. The cost of equity is the return that the Commission should provide the Company an opportunity to earn on the portion of its rate base financed by equity.

To determine the cost of equity for Arizona-American Water, I first estimate the overall cost of capital for two samples (and two subsample) of regulated companies using several versions of the discounted cash flow (DCF) and risk-positioning models. Second, I determine the cost of equity that the estimated overall cost of capital gives rise to at Arizona-American Water's requested capital structure consisting of about 45 percent equity. Third, I evaluate the relative risk of Arizona-American Water and the sample companies to determine the recommended cost of **equity for Arizona-American Water**. In doing so, I compare the characteristics of the comparable companies and those of Arizona-American Water.

In addition, I review how credit rating agencies rate utilities such as Arizona-American Water and discuss the critical importance placed on cash flow by credit rating agencies and creditors. The development of credit ratings and generic financial strength is important because debt investors, as well as equity investors, are concerned about the financial strength of companies and investors have become increasingly concerned about the credit worthiness of companies following the financial crisis. For a regulated entity such as Arizona-American Water, the revenue requirement to a large degree determines the cash flow that will accrue to the utility. A utility's financial strength is linked to cash flow, so a utility is clearly very dependent upon (1) the allowed rate of return and (2) its ability to earn the allowed rate of return. It is important that a utility remains credit worthy and maintains a solid credit rating, because the lack of creditworthiness reduces and possibly eliminates the utility's access to credit markets and hence to financing. Further, a reduction in, for example, a utility's credit rating implies a higher cost of debt and because the cost of debt increases very dramatically as the credit rating drops.

Q. PLEASE SUMMARIZE ANY PARTS OF YOUR BACKGROUND AND EXPERIENCE THAT ARE PARTICULARLY RELEVANT TO YOUR TESTIMONY ON THESE MATTERS.

A. Brattle's specialties include financial economics, regulatory economics, and the utility industry. I have worked extensively on cost of capital matters for electric, natural gas distribution, pipeline, transportation and water utilities in state, federal, and foreign jurisdictions. Additionally, I have significant experience in other areas of rate regulation, credit risk in the utilities industry, energy contracts, and accounting issues. I have filed expert testimony and appeared before regulatory commissions and arbitration tribunals as well as in federal and district court concerning cost of capital, accounting questions, and damage issues. I have previously filed cost of capital testimony before

this Commission. Appendix A contains more information on my professional qualifications.

Q. PLEASE SUMMARIZE YOUR ESTIMATION OF THE COST OF CAPITAL FOR ARIZONA-AMERICAN WATER.

A. To assess the cost of capital for Arizona-American Water, I select two benchmark samples, regulated water utilities and natural gas local distribution companies (LDC). These samples are selected to have risks characteristics comparable to those of Arizona-American Water. I also report results for a subsample of both the water and the gas LDC sample as the subsample companies are less likely to have unique issues that may affect the cost of capital estimates. For each sample, I estimate the sample companies' cost of equity using several versions of the DCF method and of the risk-positioning model. Next, based on the cost-of-equity estimates for each company and its market costs of debt and preferred stock, I calculate each firm's overall cost of capital, i.e., its after-tax weighted-average cost of capital (ATWACC), using the company's market value capital structure. I then calculate the samples' average ATWACC and the cost of equity for a capital structure with approximately 45 percent equity. Thus, I present the cost of equity that is consistent with the samples' market information and Arizona-American Water's regulatory capital structure. (By "regulatory capital structure," I mean the capital structure that Arizona-American Water proposes in its application.) Because of the ongoing financial turmoil, I present results for both a baseline case and for several scenarios that take the increased risk aversion among investors into account.

The results for the gas LDC sample and subsample are concentrated in a relatively narrow range from 11 to 12%, while the ROE estimates for the water sample exhibit substantially larger variation. Specifically, the risk positioning results for the water sample are also in the range of 11 to 12%, but the water subsample indicate a higher

return on equity. The water sample and subsample's DCF estimates range from 10½ to 14½ percent. Therefore, the requested return on equity of 11.5% in the middle of the range and fully supported by the estimation results.

Q. ARE THERE ANY UNIQUE ISSUES IN ESTIMATING THE COST OF CAPITAL AT THIS POINT IN TIME?

A. Yes. While the economic crisis may have lessened and the National Bureau of Economic Research (NBER) has declared the recession over, there is still substantial turmoil in financial markets and investors remain wary of providing capital. I discuss the impact hereof in more detail in Section III below, but in general, the cost of capital is higher for all companies today than it was before the crisis. Therefore, in addition to my standard cost of capital estimates, I also report the results from several benchmarks that take the impact of the financial crisis into account.

Q. ARE THERE ANY SPECIAL CIRCUMSTANCES FOR ARIZONA-AMERICAN WATER THAT NEEDS TO BE CONSIDERED?

A. Yes. As noted in the Direct Testimony of Mr. Townsley, Arizona-American has been unable to earn its allowed rate of return during the last 10 years. In addition, its credit metric on a stand-alone basis shows that the Company on a stand alone basis is generating too little cash flow to meet credit rating agencies' expected metric for an investment grade rating. Both of these facts indicate that it is imperative that Arizona-American be allowed a reasonable return on its equity capital and that there are no regulatory barriers that prevent the Company from being able to earn the allowed return on equity on average. Examples of barriers to earn the allowed rate of return include delayed inclusion of capital expenditures in rate base as is the case under a historic test

year or if Construction Work in Progress (CWIP) is not in rate base.[2] Similarly, any delays in including expenses in the revenue requirement would create barriers to earn the allowed return.

Q. USING YOUR BASELINE RESULTS, PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING ARIZONA-AMERICAN WATER'S COST OF EQUITY.

A. Using the risk positioning models, the baseline cost of equity estimate for both the water sample and the gas LDC sample and subsample is 11 to 12 percent at Arizona-American Water's regulatory capital structure. The risk positioning estimates for the water subsample range from 12 to 12½ percent. The DCF results for the gas LDC sample and subsample are clustered around 11½ percent, while the DCF results for the Water sample and subsample is much wider at 10½ to 14½ percent. Because the risk positioning results and the gas LDC DCF results have a range of 11 to 12 percent and the Water DCF results include that range, a point estimate of 11½ is reasonable for Arizona-American, which is exposed to a greater amount of risk than most of the companies in the comparable samples and subsamples. Arizona-American Water's parent, American Water has a lower debt rating than the comparable companies and on a stand alone basis, Arizona-American Water's credit metric is weak. In addition, the Company operates in a state that has seen a substantial growth in population, which makes the use of a historic test year and the fact that CWIP is not included in rate base a larger issue than in states, where population growth is lower. As discussed below, Arizona-American is significantly under earning its allowed return and has only earned a positive profit in one year since 2001.

[2] Arizona relies on a historic test year and only in specific circumstances is CWIP part of rate base. The regulatory treatment of test year and CWIP vary by state. See, for example, National Association of Water Companies survey, "Construction Work in Progress." (http://www.nawc.org/)

Q. WHY DO YOU NEED TO CONSIDER ARIZONA-AMERICAN WATER'S REGULATORY CAPITAL STRUCTURE?

A. A firm's cost of equity is a function of both its business risk and its financial risk. The more leveraged a company is the higher its financial risk. Investors holding equity in companies with higher risk require a higher rate of return, so as a company adds debt, the cost of equity goes up at an ever increasing rate. The higher cost of equity offsets the lower cost of debt, so that the after-tax weighted-average overall cost of capital remains constant over a broad range of capital structures.

That is, the associated capital structure affects an estimated cost-of-equity estimate just as a life insurance applicant's age affects the required life-insurance premium. It is therefore necessary to calculate the cost of equity the sample companies would have had at Arizona-American Water's regulatory capital structure to report accurately the market evidence on the cost of equity.

Q. HOW IS THE REST OF YOUR TESTIMONY ORGANIZED?

A. The rest of my testimony is organized as follows:

Section II defines the cost of capital and discusses the principles that relate a company's cost of capital and its capital structure

Section III discusses the impact on cost of capital of the current turmoil in financial markets and methods to estimate the relevant risk-free rate and market risk premium under current financial market conditions.

Section IV presents the methods used to estimate the cost of capital for the benchmark samples, and the associated numerical analyses. This section also explains the basis of my conclusions for the benchmark samples' returns on equity and overall costs of capital.

Section V explains why credit ratings matter and also discusses Arizona-American Water's earned return and the impact of under earning on credit metrics.

Section VI summarizes the analysis and discusses the recommendation for Arizona-American Water.

Appendix A lists my qualifications.

Appendix B discusses in detail the selection procedure for each sample, and the methods used to derive the necessary capital structure market value information.

Appendix C details the risk-positioning method including the numerical analyses.

Appendix D details the DCF method, including the numerical analyses.

Appendix E discusses the impact of leverage on the cost of capital in more detail.

I repeat portions of my testimony in the appendices in order to give the reader the context of the issues before I present additional technical detail and further discussion.

II. THE COST OF CAPITAL AND RISK

A. The Cost of Capital and Risk

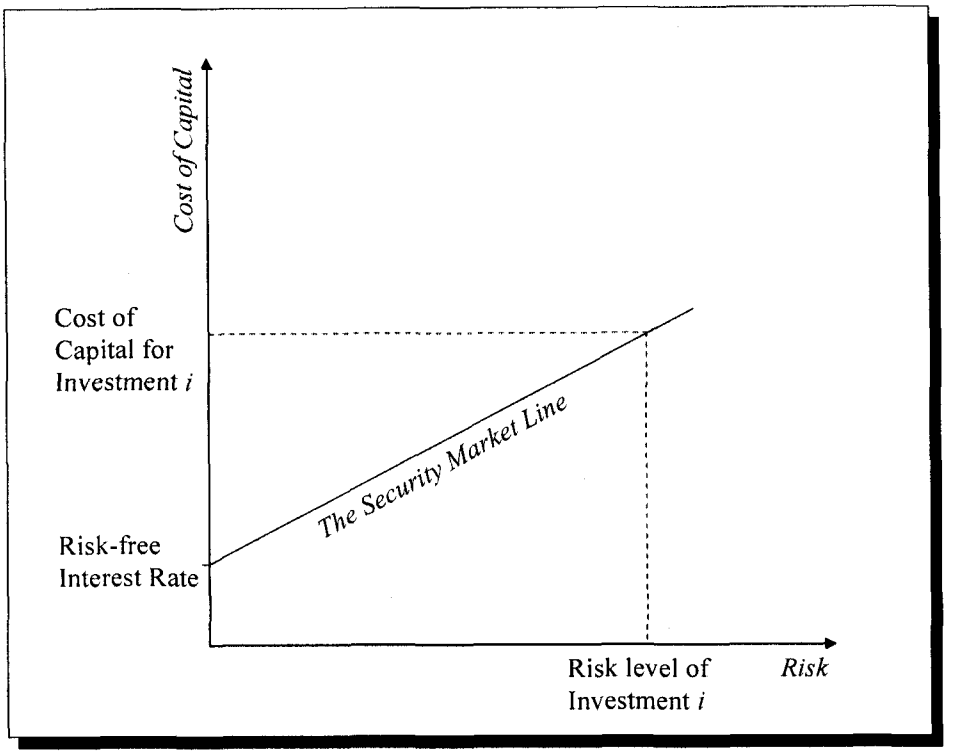
Q. PLEASE FORMALLY DEFINE THE "COST OF CAPITAL."

A. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[3]

[3] "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected" in this testimony, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

The definition of the cost of capital recognizes a tradeoff between risk and return that is known as the "security market risk-return line," or "security market line" for short. This line is depicted in Figure 1. Figure 1 shows that the higher the risk, the higher the cost of capital. The risk depicted on the horizontal axis in Figure 1 is often measured by the security's beta, which measures the security's systematic risk in comparison to the market as a whole. The market as a whole has a beta of 1, so betas below one indicate a security with less systematic risk than the market whiles a beta above 1 indicate a security with higher systematic risk than the market. A version of Figure 1 applies for all investments. However, for different types of securities, the location of the line may depend on corporate and personal tax rates.

Figure 1: The Security Market Line



Q. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility investment.[4] This practice is normally viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Waterworks & Improvement Co. v. Public Service Commission*, 262 U.S. 678 (1923), and *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944).

From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital makes customers overpay for service. Regulatory authorities normally try to prevent such outcomes, unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to investors but, importantly, to customers as well. In the long run, such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises characterized by commensurate risks and uncertainties.

More important for customers, however, are the economic issues an inadequate return raises for them. In the short run, deviations of the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"-- investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, even in the short run, such action may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed or because the company is forced to file more frequent rate cases. In the long run, inadequate returns are likely to cost customers – and society generally – far more than

[4] An early paper that links the cost of capital as defined by financial economics with the correct expected rate of return for utilities is Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science*, 3:58-97 (Spring 1972).

may be gained in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. The costs of an undercapitalized industry can be far greater than the short-run gains from shortfalls in the cost of capital. Moreover, in capital-intensive industries (such as the water industry),[5] systems that take a long time to decay cannot be fixed overnight. Thus, it is in the customers' interest not only to make sure that the return investors expect does not exceed the cost of capital, but also to make sure that it does not fall short of the cost of capital, either.

Of course, the cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors expect to earn more or less than the cost of capital even if the allowed rate of return equals the cost of capital exactly. However, a commission that sets rates so investors expect to earn the cost of capital on average treats both customers and investors fairly, which is in the long-run interests of both groups.

While it may seem counter-intuitive that the cost of capital has increased in a market where many companies and individuals have seen their income decline, it is important to keep two facts in mind. First, the cost of capital is an *expected* rate of return and thus a forward looking measure as opposed to a measure of the recent past. Therefore, low realized returns in, for example, 2008 do not necessarily reflect the *expected* rate of return. As market volatility and investors' risk aversion has increased, investors are likely to require a higher return for providing capital. Second, it the expected rate of return that is available in capital markets on alternative investments of equivalent risk, so a key question becomes what the return on alternative investments is. The yields on

[5] Water utilities are very capital intensive and have over the last five years earned only about $0.33 for each $1 of property, plant of equipment. In comparison, railroads earn approximately $0.45, gas utilities $1.35, and the Dow Jones companies $4.56 for each $1 invested in property, plant and equipment.

investment grade utility bonds, which are relatively low risk, have increased, so utility stock would expect a higher rate of return, too. Therefore, the cost of equity in today's financial markets is higher than it was before the financial crisis.

B. Business Risk and Financial Risk: Capital Structure and the Cost of Equity

Q. WHAT IS THE DIFFERENCE BETWEEN BUSINESS RISK AND FINANCIAL RISK?

A. Business risk is the risk of a company from its line of business if it used no debt financing. When a firm uses debt to finance its assets, the business risk of the assets is shared between the debt holders and the equity holders, but the equity holders bear more of the risk because debt holders have a prior claim on the company's cash flows. Equity holders are residual claimants, which simply mean that equity holders get paid last. In other words, the use of debt imposes financial risk on equity holders. The goal of selecting a sample is to choose companies whose business risk is judged to be comparable to the regulated company in the proceeding. As a result, differences in financial risk must be dealt explicitly.

Q. PLEASE EXPLAIN WHY IT IS NECESSARY TO REPORT THE COST OF EQUITY ADJUSTED FOR CAPITAL STRUCTURE.

A. Rate regulation in North America has traditionally focuses on the components of the rates.[6] In other words, the focus of cost-of-capital estimation is usually on determining the "right" cost of equity, and to a lesser degree on setting the allowed capital structure. While the overall cost of capital depends primarily on the company's line of business, the distribution of the cost of capital among debt and equity depends on their share in total

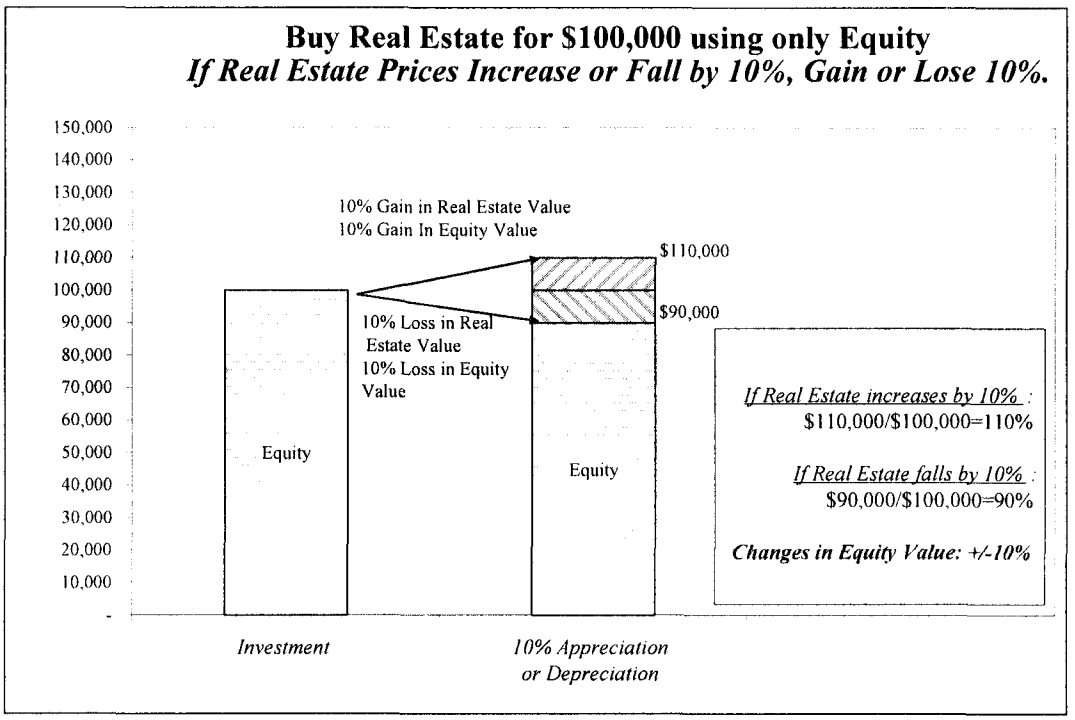
[6] An exception is the recent decision by the National Energy Board of Canada which in its RH-1-2008 decision, issued March 2009, determined the after-tax weighted average cost of capital rather than a return on equity and a capital structure.

revenues. Debt holders' claim is usually a fixed amount (except in situations of default) while equity holders are residual claimants, meaning that equity holders get paid last. In other words, the use of debt imposes financial risk on the equity holders. Because a company's financial risk depends on its capital structure, the risk shareholders carry increases with the leverage of the company. As shareholders expect to be compensated for increased risk, the required rate of return increases with the company's leverage. The increased risk is caused by the fact that debt has a senior claim on a specified portion of earnings and in bankruptcy on assets. As common equity is the most junior security, it gets what's left after everyone else has been paid. In other words, common equity holders carry all residual risk. However, as explained in more detail in Appendix E, the overall cost of capital is constant within a broad middle range of capital structures, although the distribution of costs and risks among debt and equity holders is not.

Q. PLEASE PROVIDE AN EXAMPLE ON HOW DEBT ADDS RISK TO EQUITY.

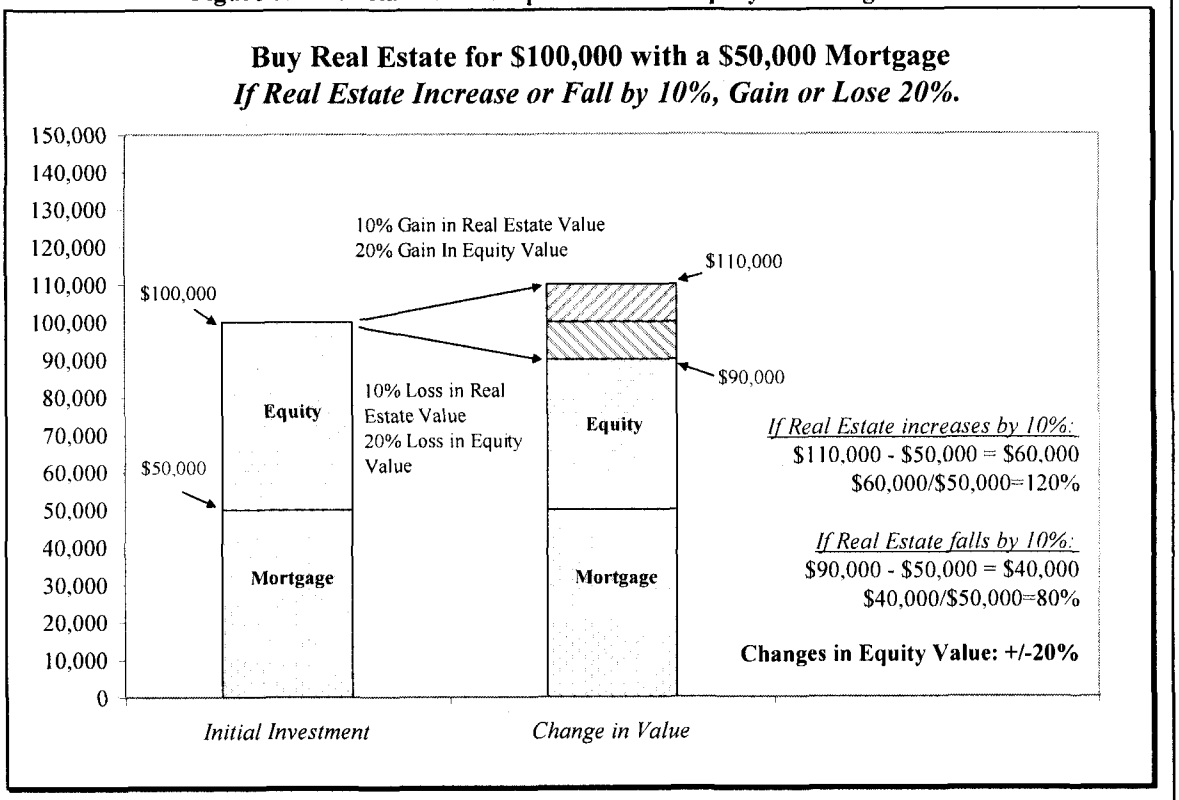
A. As a simple example, think of an investor who takes money out of his savings account and invests $100,000 in real estate. The future value of the real estate is uncertain. If the real estate market booms, he wins. If the real estate market goes down, he loses. Figure 2 below illustrates this.

Figure 2. Financial risk example – equity financing



In the scenario above, the investor financed his real estate purchase through 100 percent equity. Suppose instead that the investor had financed 50 percent of his real estate investment with a mortgage of $50,000. The mortgage lender does not expect to share in any benefits from increases in real estate values. Neither does the mortgage lender expect to share in any losses from falling real estate values. As a result, the investor carries the entire risk of fluctuating real estate prices. Figure 3 illustrates this effect.

Figure 3. Financial risk example - debt and equity financing



In Figure 3, where the investor financed his purchase through 50 percent equity and 50 percent debt, the variability in the investor's equity return is two times greater than that of Figure 2. The entire fluctuation of 10 percent from rising or falling real estate prices falls on the investor's $50,000 equity investment. The lesson from the example is obvious: debt adds risk to equity.

C. Implications for Analysis

Q. PLEASE EXPLAIN THE IMPLICATIONS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY FOR RATE REGULATION.

A. The risk equity holders carry, and therefore the cost of equity, depends on the capital structure. As illustrated in the example above, as leverage increases, the market risk increases and hence the required return on equity increases.

Q. TO ASSESS THE MAGNITUDE OF FINANCIAL RISK FOR A RATE REGULATED COMPANY, SHOULD YOU USE THE MARKET-VALUE OR THE BOOK-VALUE CAPITAL STRUCTURE?

A. The market-value capital structure is the relevant quantity for analyzing the cost-of-equity evidence, which is based on market information.[7]

Q. PLEASE PROVIDE AN EXAMPLE THAT ILLUSTRATES WHY MARKET VALUES ARE RELEVANT.

A. Suppose in the previous example that the investor has invested in real estate 10 years ago. Further assume that depreciation has reduced the book value of the real estate from $100,000 to $75,000 and assume the investor has paid off 40 percent of his $50,000 mortgage. Thus, the investor has a remaining mortgage of $30,000 (= 60% × $50,000). The book value of the investor's equity is therefore $45,000 (= $75,000 - $30,000).

What happens now if real estate prices rise or fall 20 percent? To answer that question, we need to know how real estate prices have developed over the past 10 years. If the market value of the real estate now is $200,000, then a 20-percent decrease in the price of real estate ($40,000) is almost equal to the investor's book value equity. However, his market value equity (or net worth) is equal to the value of the real estate minus what he owes on the mortgage. If we assume that the market value of the mortgage equals the unpaid balance ($30,000), then the investor's net worth is calculated as follows:

[7] The need to use market-value capital structures to analyze the effect of debt on the cost of equity has been recognized in the financial literature for a long time. For example, the initial reconciliation of the Modigliani-Miller theories of capital structure with the Capital Asset Pricing Model, in Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969) works with market-value capital structures. For a more recent presentation of the concept, see, for example, Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, New York: McGraw-Hill/Irwin 9th ed. (2008) (Brealey, Myers, and Allen (2008)) pp. 530-533. 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 determinants of the impact of debt on the cost of equity.

Net Worth	=	Market Value of Real Estate	-	Remaining Mortgage
	=	$200,000	-	$30,000
	=	$170,000		

Therefore, the rate of return on equity due to a 20 percent decline in real estate prices is calculated as follows:

Table 1. Calculating the Rate of Return on Equity

Decline in Real Estate Value	$40,000
Market-Value Equity	$170,000
Rate of Return on Equity	- $40,000/$170,000 = -23.5%

Q. PLEASE EXPLAIN THE IMPLICATIONS FOR RATE REGULATION AND YOUR TESTIMONY.

A. Because the market risk, and therefore the cost of equity, depends on the market-value capital structures, one must base the estimation of the sample companies' cost of capital on market value capital structures. An approach that estimates the cost of equity for each of the sample firms without explicit consideration of the market value capital structure (i.e. the financial risk) underlying those costs risks material errors. The cost-of-equity estimates of the sample companies at their actual market-value capital structures are not necessarily reflected in the regulatory capital structure. Therefore, using book values could lead to an incorrect rate of return. I avoid this problem by calculating each sample company's ATWACC using its market value capital structure. I then use the sample companies' average overall cost of capital to determine the corresponding return on equity at Arizona-American Water's regulatory capital structure. This procedure ensures that the capital structure and the estimated cost of equity are consistent.

In my analyses, I estimate the cost of equity for each of the sample firms using traditional estimation methods (such as the DCF and Capital Asset Pricing Model (CAPM)). For each estimation method, I use each sample company's estimated cost of equity, market cost of debt and market-value capital structure to estimate along with Arizona-American Water's marginal tax rate to estimate each sample company's overall cost of capital. I then calculate the samples' average overall cost of capital for each estimation method. Finally, I determine the cost of equity that is associated with the estimated ATWACC at Arizona-American Water's regulated capital structure. Thus, the samples' overall cost-of-capital and that of Arizona-American Water is the same.

Q. IS THE USE OF MARKET VALUES TO CALCULATE THE IMPACT OF CAPITAL STRUCTURE ON THE RISK OF EQUITY INCOMPATIBLE WITH USE OF A BOOK-VALUE RATE BASE FOR A REGULATED COMPANY?

A. No. Investors buy stock at market prices and expect a reasonable return on their investment. Market-based cost-of-equity estimation methods, such as DCF or CAPM which are frequently used in rate regulation, recognize this and rely on market data. That is, the cost of capital is the fair rate of return on regulatory assets for both investors and customers. Most regulatory jurisdictions in the U.S. 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.

The issue here is "what level of risk is reflected in that cost-of-equity estimate?" That risk level depends on the sample company's market-value capital structure, not its book-value capital structure. *That risk level would be different if the sample company's market-value capital structure exactly equaled its book-value capital structure, so the estimated cost of equity would be different, too.*

Q. PLEASE SUM UP THE IMPLICATIONS OF THIS SECTION.

A. The market risk, and therefore the cost of equity depend on the market-value capital structure of the company or asset in question. It therefore is impossible to validly compare the measured 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 (e.g., with home mortgages) and basic financial principles.

Q. HOW SHOULD A COST-OF-CAPITAL ANALYST IMPLEMENT THIS PRINCIPLE?

A. As discussed further in Appendix E, there has been a great deal of financial research on the effects of capital structure on the value of the firm. One of the key conclusions that result from the research is that no narrowly defined optimal capital structure exists within industries, although the typical range of capital structures does vary among industries. Instead, there is a relatively wide range of capital structures within any industry in which fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to its overall after-tax cost of capital.

Accordingly, it is appropriate to treat the market-value weighted average of the cost of equity and the after-tax current cost of debt, or the "ATWACC" for short, as constant. The economically appropriate cost of equity for a regulated firm is the quantity that, when applied to the regulatory capital structure, produces the same ATWACC, as was derived from the sample companies. That value is the cost of equity that the sample would have, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q. HOW DO YOU CALCULATE THE COST OF EQUITY CONSISTENT WITH THE MARKET-DETERMINED ESTIMATE OF THE SAMPLE'S AVERAGE COST OF CAPITAL?

A. For simplicity assume that all sample companies have only common stock and debt. Then the ATWACC is calculated as:

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E$$

where r_D is the market cost of debt, r_E is the market cost of equity, T_C is the marginal corporate income tax rate, D is the percent debt in the capital structure, and E is the percent equity in capital structure. The cost of equity consistent with the overall cost-of-capital estimate (ATWACC), the market cost of debt and equity, the marginal corporate income tax rate and the amount of debt and equity in the capital structure can be determined by solving equation (1) for r_E.

Q. WHY DOESN'T ARIZONA-AMERICAN WATER SIMPLY INCREASE ITS EQUITY RATIO SO THAT NO ADJUSTMENT IS NEEDED?

A. First, as long as a utility operates within a broad middle range of capital structure the total capital costs are the same, so it is not clear why it would affect rates. Second, as discussed in the Direct Testimony of Mr. Paul G. Townsley (Townsley Testimony), the parent of Arizona-American Water, American Water Works, has not infused equity capital in the Company in 2009 or 2010, and has no plans on providing additional equity unless the financial performance of the Company improves.[8] Therefore, it would be extremely difficult if not impossible for Arizona-American Water to increase its equity ratio without an improvement in the earned return.

[8] Direct Testimony of Paul Townsley.

Q. CAN YOU PROVIDE AN EXAMPLE OF HOW THIS FORMULA IS USED TO DETERMINE THE COST OF EQUITY?

A. Yes. Consider a company with a 40 percent marginal corporate income tax rate and a cost of debt equal to 6 percent. For simplicity, I assume there is no difference in the company's embedded cost of debt and the cost at which it currently can issue additional debt. Further, suppose that the ATWACC estimate based on a sample of companies with comparable business risk is 7.5 percent. If the company's capital structure has 50 percent debt and 50 percent equity, equation (1) above yields a cost-of-equity estimate of 11.4 percent. If the equity ratio is lower, for example 45 percent, the cost of equity would instead be 12.3 percent. Conversely, a higher equity ratio such as 55 percent would imply a lower cost-of-equity estimate of 10.7 percent. Table 2 below summarizes these calculations as well as the dollar amount customers have to pay for financing costs.

Table 2. Example of the effect of capital structure on the estimated cost of equity.

Marginal tax rate	40%		
Cost of debt	6%		
Estimated ATWACC	7.50%		
Rate Base	$ 1,000,000		
Regulatory Equity Ratio	45%	50%	55%
Regulatory Debt Ratio	55%	50%	45%
Estimated ATWACC	7.50%	7.50%	7.50%
Cost-of-equity	12.3%	11.4%	10.7%
After Tax Cost of Financing[1)]	$ 75,000	$ 75,000	$ 75,000
Before Tax Cost of Financing[2)]	$ 125,000	$ 125,000	$ 125,000

[1)] Estimated ATWACC × Rate Base.
[2)] Estimated ATWACC × Rate Base / (1 - Tax Rate).

The important point of this example is that the overall cost of capital does not depend on the company's capital structure, as long as the capital structure is in a wide middle range of values. Therefore, the cost to customers does not depend on the capital structure either. A higher equity ratio simply means that a higher percentage return is paid to

equity investors, but the fraction of the rate base to which this higher return applies is lower. The equity investors are compensated appropriately for the higher risk, but that has no effect on the overall cost borne by customers. As long as equity investors are correctly compensated for the risk of their investment, the only effect that a higher equity ratio has is on how the return is divided between debt holders and equity holders, and not on how much customers end up paying.

Q. BUT IS IT NOT THE CASE THAT IF THE ALLOWED RATE OF RETURN ON EQUITY IS LOWER, THEN ALL ELSE EQUAL RATEPAYERS PAY LESS?

A. Yes, for a given equity percentage. However, it comes at a cost: if the rate of return on equity for a capital structure with 55 percent equity were applied to a company whose equity ratio is 45 percent, the company's equity investors would not be compensated for the financial risk of their investment. In particular, in this situation the expected return on equity would be set too low. Such a result would impair the company's ability to attract investors, since they can expect higher returns elsewhere for the same risk level. This may well have negative consequences for the utility's ability to sustain an appropriate level of investment. Ultimately, this translates into a lower quality of the services that the utility can provide to its customers. Alternatively, the company could reduce its equity percentage with possibly negative effects on the cost of debt or other credit factors.

Q. ARE YOU AWARE THAT COMMISSION STAFF PREFERS A SPECIFIC METHDOLOGY AND THAT STAFF IN THE PAST HAS VIEWED THE ATWACC METHDOLOGY APPLIED TO MARKET VALUES AS NON-STANDARD?

A. Yes. In past proceedings, Commission Staff has typically relied on two versions of the DCF methodology and two versions of the risk-positioning methodology. In addition,

Staff has in the past taken differences between the sample's and Arizona-American Water's book-value capital structure into account. Thus, Commission Staff has in the past acknowledged that differences in capital structure needs to be considered as companies with less equity face higher financial risk. Specifically, Staff has in the past relied upon the so-called Hamada methodology to compensate Arizona-American Water for having higher financial risk that the sample companies.[9] However, the Hamada article that derives the Hamada methodology clearly uses market values[10] as do newer expositions of the results.[11]

III. CURRENT FACTORS TO CONSIDER WHEN SETTING THE COST OF CAPITAL

Q. WHAT DO YOU DISCUSS IN THIS SECTION?

A. This section addresses the effect of the recent recession and ongoing financial turmoil on the cost of capital.

Q. HOW DOES THE FINANCIAL TURMOIL IMPACT THE COST OF CAPITAL?

A. Although the turmoil in the financial markets has lessened, economic conditions are not back to their pre-crisis status. For example, although the spread between utility bond yields and government bonds yields (yield spread) narrowed in recent months, the spread remains larger than before the crisis and especially so for lower-rated bonds, including utility bonds. Capital markets remain more volatile than prior to the crisis, and macroeconomic factors such as unemployment and mortgage foreclosures are very high by historic standards. Some investors fear that the current economic recovery may not

[9] See, for example, Direct Testimony of Juan C. Manrique in Docket No. W-0130A-09-0343, p. 43.

[10] Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969).

[11] It is also noteworthy that other jurisdictions such as the Australian Energy Regulator and the New Zealand Commerce Commission rely on market value capital structures to determine the overall cost of capital.

continue and that we may enter a "double dip" recession. At the same time, the deficits at all levels of government are at high and unsustainable levels, with the potential for rampant inflation inherent in the deficit spending by the U.S. government and by the liquidity injected into the capital markets by the Federal Reserve (Fed).

Q. HOW HAS THE YIELD SPREAD BETWEEN GOVERNMENT AND UTILITY BONDS CHANGED SINCE THE START OF THE CREDIT CRISIS?

A. Although the yield on utility bonds declined and the spread between utility bond yields and government bond yields has narrowed from the height of the financial crisis, the yield spread has recently begun to increase again in response to the ongoing economic uncertainty. The yield on utility bonds has shown an increased spread to government bond yields during much of the past year than prior to the credit crisis. Figure 4 illustrates an important point: the yield spread increases dramatically during times of financial distress, which is one reason that the credit ratings of regulated companies should not be allowed to decline to non-investment grade levels. Further, Figure 4 illustrates that the yield spread remain higher than prior to the financial crisis of 2008-09. A supportive regulatory environment coupled with an appropriate allowed ROE are important components to insure that the utility's credit rating remains investment grade.

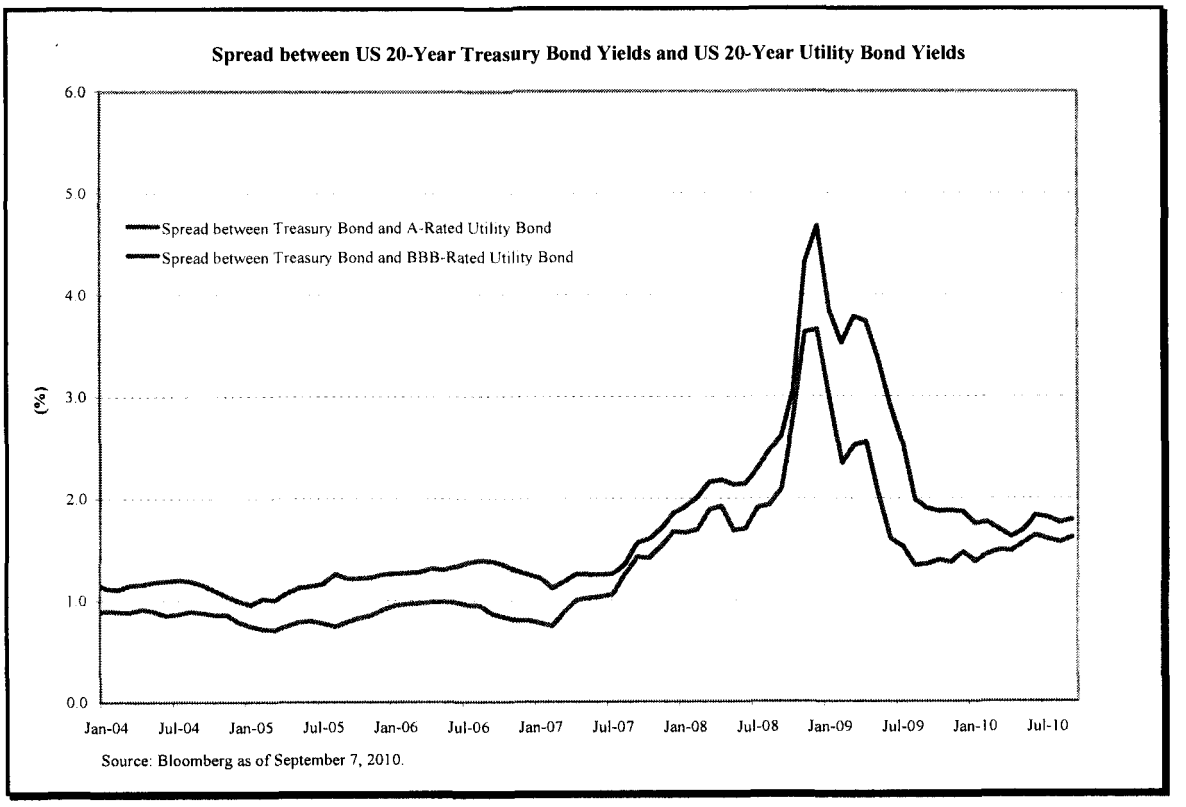


Figure 4

The current spread between the yield on utility bonds and 20-year government is unusually high as illustrated in Table 3 below. The spread between 20-year A-rated utility bond yield and the 20-year government bond yield is currently 66 bps above its normal level, while the widening for BBB-rated utility bonds is a bit lower.

Table 3

Spreads between US Utility Bond (20 year maturity) and US Treasury Bond (20 year maturity)

Periods	Bloombergs Composite A-Rated Utility and Treasury	Bloombergs Composite BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.95	1.25	[1]
Period 2 - Average Aug-2008 - 2010	1.94	2.54	[2]
Period 3 - Average Aug 2010	1.57	1.76	[3]
Period 4 - Average 15-Day (Aug. 31 - Sept. 21, 2010)	1.61	1.79	[4]
Spread Increase between Period 2 and Period 1	0.99	1.29	[5] = [2] - [1].
Spread Increase between Period 3 and Period 1	0.62	0.51	[6] = [3] - [1].
Spread Increase between Period 4 and Period 1	0.66	0.54	[7] = [4] - [1].

Source:
Spreads for the periods are calculated from Bloomberg's yield data.
Data were retrieved from Bloomberg as of October 15, 2010, calculations are through September 21, 2010.

Q. WHAT IS THE IMPLICATION OF HIGHER THAN NORMAL YIELD SPREADS?

A. A higher than normal yield spread is one indication of the higher cost of capital. As investors consider the risk-return tradeoff illustrated in Figure 1, they select investments based on the desired level of risk. Currently, the expected return on utility debt is elevated (relative to government debt). More risky equity is therefore also more costly relative to government debt. As a result, the cost of equity is currently elevated compared to its pre-crisis level. I discuss how to take this fact into account below.

Q. ARE THE HIGHER THAN NORMAL YIELD SPREADS AN INDICATION OF INVESTORS' "FLIGHT TO SAFETY"?

A. Yes. When investors become concerned about the economy, they frequently seek to reduce their exposure to investment risk. U.S. Government debt is generally considered to be the least risky available investment – in effect it is considered to be risk-free – so U.S. Government debt is in high demand during times of economic uncertainty.

Q. DO REGULATED COMPANIES BENEFIT FROM THE FLIGHT TO SAFETY?

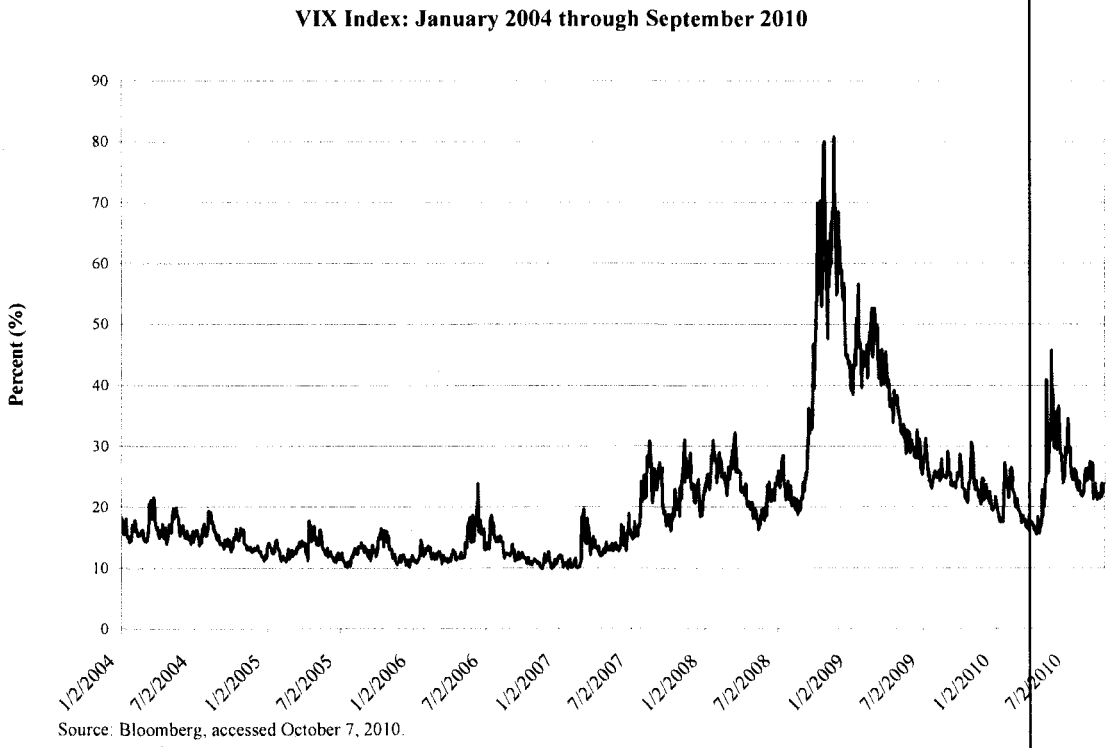
A. To a degree. However, the required return on all risky investments, including utilities, increases during a time of flight to safety. Stock prices of regulated companies fell along with the market, although not as much in percentage terms as the market, but that is to be expected because regulated companies are of lower risk. The prices of regulated companies have recovered along with the market, but not as quickly or as much in percentage terms as the market, again as expected by the relative risk of regulated companies compared to the market.[12]

Q. WHAT EVIDENCE DO YOU HAVE THAT FINANCIAL MARKETS ARE VOLATILE?

A. Although the day-to-day volatility has decreased from the height of the financial crisis, it remains high by historical standards. As displayed in Figure 5 below, the VIX index is higher its historical level.[13] The VIX index is an indicator of volatility in the market, and a high value indicates substantial uncertainty among investors. The relatively high level of VIX is one important measure demonstrating that financial markets remain more volatile than in the recent past.

[12] For example, while the Dow Jones Industrial Index and the S&P 500 have gained more than 60% since their low in March 2009, the Dow Jones Utility Index has only increased approximately 35%.

[13] Trading in futures on the VIX index started in 2004. (http://www.cboe.com/micro/vix/introduction.aspx)



Source: Bloomberg, accessed October 7, 2010.

Figure 5

Q1.

As can be seen from Figure 5, the VIX index and thus market volatility remains above the pre-crisis level.

Q. WHY IS IT IMPORTANT TO CONSIDER THE STOCK MARKET'S VOLATILITY?

A. Academic research finds that investors expect a higher risk premium during more volatile periods. The higher the risk premium, the higher is the required return on equity. For example, French, Schwert, and Stambaugh (1987) find a positive relationship between the expected market risk premium (MRP) and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides

indirect evidence of a positive relation between expected risk premiums and volatility.[14]

One significant implication of this finding is that even if investors' risk aversion had not changed, the MRP would increase simply because market volatility is up.

Q. WHAT DO YOU MEAN BY THE TERM "RISK AVERSION"?

A. Risk aversion is the recognition that investors dislike risk, which means that for any given level of risk, investors must expect to earn a higher return than before to be induced to invest. An increase in risk aversion means that investors require an even greater return for a given level of risk.

Q. ARE THERE ANY FACTS THAT INDICATE THAT INVESTORS' ATTITUDE TOWARDS RISK HAS CHANGED?

A. Yes. Many investors were burned and lost substantial wealth during the 2008-09 financial crisis and it likely will take a while for the confidence in financial markets to be restored. According to a recent Mercer report, pension plans shifted approximately $40 billion to bonds from other asset classes in 2009.[15] This indicates that they remain cautious about other investments, including stocks. If investors have changed their attitude towards risk, then the required reward for investing in the stock market, i.e., the MRP, must have gone up and is likely to stay at a higher-than-normal level for the foreseeable future. An increase in the MRP is corroborated by Professor Damodaran, who assessed the increase to the MRP to be on the order of two percent.[16] This view is

[14] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, pp 3.

[15] Aspen Publishers news release, "Pension Plan Sponsors Repositions to Bonds, Mercer Reports," May 13, 2010.

[16] Professor Aswath Damodaran, "September 12 to October 16, Five weeks from Hell? And the lessons we have learned ...," power point presentation, New York University.
(www.stern.nyu.edu/~adamodar/pdfiles/country/crisis08.pdf)

supported by a recent article suggesting that the equity risk premium is at an all time high in the United States.[17] An increase in the MRP results in an increase in the cost of capital for all risky investments including regulated utilities.

Q. IF THE INCREASE IN THE COST OF CAPITAL IS LIKELY TO BE TEMPORARY, SHOULD THE COMMISSION STILL TAKE THE INCREASED COST OF CAPITAL INTO CONSIDERATION WHEN SETTING THE ALLOWED RETURN FOR THE COMPANY?

A. Yes. I recommend that the Commission recognize the increased cost of capital. Although I believe that some of the increase in yield spread and in the MRP is likely to be temporary, it is very difficult to predict when the capital markets will return to normal conditions, so it is difficult to predict when the market cost of risk will return to normal levels. Even when market conditions are more normal than during the height of the financial crisis, investors' risk aversion may remain higher well into the recovery period until their confidence fully returns. The federal government seems to recognize investors' fears, and is in the process of overhauling the financial regulatory environment in order to restrict the behavior by financial institutions that led to the current crisis.[18] While the success or failure of those actions are unlikely to be observed in the short- to medium-term, in the long run these measures may help alleviate investors concerns. However, it could easily be years before investors regain the confidence prevailing prior to the current crisis. In fact, there may be a "permanent" adjustment in risk tolerance now that investors realize that severe economic conditions are still possible even with the increased tools to manage the economy available to government.

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[17] *The Economist*, "A Bull Market in Pessimism," August 21st to 27th, 2010, pp. 59-60.

[18] The so-called Dodd-Frank Act was passed in July 2010. For a summary, see "Brief Summary of the Dodd-Frank Wall Street Reform and Consumer Protection Act" by the Senate's Banking Committee. Available at http://banking.senate.gov/public/_files/070110_Dodd_Frank_Wall_Street_Reform_comprehensive_summary_Final.pdf)

Q. ARE THERE OTHER ISSUES THAT MAY AFFECT THE COST OF CAPITAL IN THE LONGER TERM?

A. Yes, the federal budget deficit is the highest on record with the 2009 fiscal year deficit at $1.4 trillion, more than triple that of 2008 and well above the average for the last ten years. Further, the Congressional Budget Office (CBO) recently announced that the 2010 deficit was the second largest on record at $1.3 trillion corresponding to 8.9% of the GDP.[19] The CBO estimates that the budget deficit will remain high over the foreseeable future.[20] It will be difficult to sustain such a high deficit, so it is likely that the magnitude of the federal deficit will affect the inflation and hence the cost of capital going forward. Also, the Fed now holds approximately one trillion dollars in mortgage-backed securities and continues to have substantial holdings related to Bear Stearns, AIG, and other institutions.[21] It is unclear how the unwinding of these positions will affect financial markets, which creates additional uncertainty and market volatility.

Q. CAN YOU SUMMARIZE HOW THE ECONOMIC DEVELOPMENTS DISCUSSED ABOVE HAVE AFFECTED THE RETURN ON EQUITY AND DEBT THAT INVESTORS REQUIRE?

A. Investors have been dramatically affected by the credit crisis, and companies such as Arizona-American rely on these investors to support efficient business operations. As noted previously, many have lost their jobs, their homes and/or their savings. Many cannot retire as early as hoped or planned. As a result investors' risk aversion has increased. Figure 5 above shows that volatility has increased over its historical level and day-to-day volatility remains high as investors react to financial news. Although the bottom of the economic downturn may have been reached, the speed and duration of

[19] http://cboblog.cbo.gov/?p=1457.

[20] Congressional Budget Office: http://www.cbo.gov/

[21] Federal Reserve Statistical Release, March 25, 2010 (http://www.federalreserve.gov/releases/h41/).

economic recovery are highly uncertain as are the effects of the federal budget deficit and the Fed's unwinding of its involvement in providing credit. Uncertainty in the capital markets remains high due in part to the ongoing concern over sovereign debt in Europe. Therefore, the required level of return is higher today than it was prior to the crisis for all risky investments.

Q. HOW DO YOU TAKE THE CURRENT ECONOMIC CONDITIONS INTO ACCOUNT WHEN ESTIMATING THE COST OF EQUITY?

A. Because the risk-free rate currently is unusually low and the spread between the yield on utility bonds and government bonds is high, I recognize the phenomena by adding a "yield spread adjustment" to the current long-term risk-free rate. This has the effect of increasing the intercept of the Security Market Line displayed in Figure 1 above. The normalization of the risk-free rate is consistent with forecasts on the government bond yield, where, the Federal Reserve Bank of Philadelphia recently releases a survey, which expects the yield on the 10-year government bond to increase by 60-130 basis points over the next 1-2 years.[22] In addition, I present result for several estimates of the MRP, which has increased due to investors' added risk aversion. In addition to my baseline results, which rely on an MRP of 6.5%, I also estimate the risk positioning models using and MRP of 7.0% and 7.5%.[23] These sensitivity analyses show that the cost of equity for Arizona-American Water likely has increased by 25 to 75 basis points as a result of the financial crisis. However, my recommended range and point estimate is fully supported by the baseline results that do not increase the MRP over its historical estimate.

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[22] Federal Reserve Bank of Philadelphia, "Survey of Professional Forecasters: Third Quarter 2010," August 13, 2010 comparing the data provided for Q3, 2010 with the forecast for 2011 and 2012.

[23] Because it is plausible that the government bond beta against the equity market is different from zero, I adjust the risk-free rate downward in the sensitivity analyses where the MRP is increased. The details of this relationship is explained in Appendix C.

Q. HOW HAVE THE FINANCIAL CONDITIONS DISCUSSED ABOVE AFFECTED THE WATER INDUSTRY?

A. There is a substantial need for ongoing investment in water industry infrastructure. The EPA has recently updated the spending needs in the water industry from $275 billion to $334.8 billion over the next 20 years.[24] These expenditures are driven by the need for upgrades to the distribution and transmission system as well as by the need to develop new water resources Thus, infrastructure investment in the water industry will require substantial external financing (i.e., new debt and equity). Access to capital requires that investors expect to earn their required return. Failure to provide adequate returns may discourage potential investors.

Q. IS THIS DISCUSSION RELEVANT TO ARIZONA-AMERICAN WATER?

A. Yes. As discussed in the Townsley Testimony, Arizona-American Water's has not had any recent infusions of equity capital and its access to equity capital may be limited. While it is always true that investors expect a reasonable return on their investment, the financial crisis has crystallized the need to earn a reasonable return to maintain or gain access to equity capital.

IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES

Q. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A. As noted in *Section I*, I estimate the cost of capital using two samples of comparable risk companies. This section first covers preliminary matters such as sample selection, market-value capital structure determination, and the sample companies' costs of debt. It then covers estimation of the cost of equity for the sample companies and the resulting estimates of the sample's overall after-tax cost of capital.

[24] Rudden Energy Strategies Report, May 26, 2009 p. 6.

A. Preliminary Decisions

Q. WHAT PRELIMINARY DECISIONS ARE NEEDED TO IMPLEMENT THE ABOVE PRINCIPLES?

A. I must select the benchmark samples, calculate the sample companies' market-value capital structures, and determine the sample companies' market costs of debt and preferred equity.

1. The Samples: Water Utilities and Gas Local Distribution Companies

Q. WHY DO YOU USE TWO SAMPLES?

A. The overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis.

Estimating the cost of capital for Arizona-American Water's regulated assets is the subject of this proceeding. The ideal sample would be a number of companies that are publicly traded "pure plays" in the water production, storage, treatment, transmission, distribution and wastewater lines of business.[25] "Pure play" is an investment term referring to companies with operations only in one line of business. Publicly traded firms, firms whose shares are freely traded on stock exchanges, are ideal because the best way to infer the cost of capital is to examine evidence from capital markets on companies in the given line of business.

Therefore, for this case, a sample of companies whose operations are concentrated solely in the regulated portion of the water industry would be ideal. Unfortunately, the available

[25] Most of the water utilities in *Value Line* have operations in the water as well as wastewater business.

sample of "water" utility companies in the U.S. is relatively small and has data deficiencies.

To select my sample of comparable water and gas LDC companies, I start with those companies that are listed as a water utility or natural gas utility in *Value Line*.[26] Usually, I would apply several selection criteria to delete companies with unusual circumstances that may bias the cost-of-capital estimation and companies whose risk characteristics differ from those of the filing entity. However, the application of such criteria would eliminate almost all the water utilities listed in *Value Line*. Therefore, I do not apply selection criteria to the water utility sample although I do apply my standard criteria to the gas LDC sample. Specifically, if I eliminate all water utilities with annual revenues below $300 million, less than 50 percent regulated revenues, lack of growth rates (from Bloomberg or *Value Line*), lack of a bond rating or lack of other data, I would be left with at most three companies (American States Water, Aqua America and California Water Services). A three-company sample is simply too small to provide reliable results. Therefore, I keep all water utilities with data in my water utility sample, but I do report results for a subsample of companies that are more stable. Specifically, this sample excludes Southwest Water, because Southwest Water currently does not pay dividends and recently restated its financials. The subsample for the risk positioning method also excludes American Water Works, because data on stock prices are available for less than five years. It is noteworthy that Value Line "recommends that investors wait on the sidelines, give AWK some time to develop a track record and certain performance indicators."[27] Similarly, Value Line cites the short trading history of American Water as the reason for not provide all of *Value Line's* standard measures (e.g., timeliness). The

[26] To select the samples I include both the Standard, the Small and Mid-Cap Editions of *Value Line Investment Survey* and *Value Line Investment Survey - Plus Edition.*

[27] Value Line Investment Survey, "American Water," July 23, 2010.

short history also shows up in the beta estimation I perform where American Water's beta larger statistical uncertainty that estimates for the other large water utilities. This feature is likely a consequence of the lack of sufficient data for the statistical analysis.[28] Finally, some of the water utilities do not have growth forecasts, so I exclude them from the DCF analysis.

Q. WHAT DO YOU DO TO OVERCOME THE WEAKNESSES OF THE WATER UTILITY SAMPLE?

A. To overcome the weaknesses of the water sample, I select a second sample of regulated utilities: gas local distribution companies. Gas LDCs, like water utilities, are regulated by state regulatory bodies, have large distribution investments, and serve a mix of residential, industrial, and commercial customers.

One reason for using the gas LDC sample is to generate a sample of regulated companies whose primary source of revenues is in the regulated portion of the natural gas industry to provide a second set of results for the cost of capital in a heavily regulated distribution industry. Therefore, I start with *Value Line*'s universe of natural gas utilities, and eliminate those companies whose percentage of assets attributed to regulated activities is less than 50 percent. In addition, I only include companies with an investment grade bond rating, no recent sizable mergers or acquisitions, no recent dividend cuts, and no other activity that could cause the estimation parameters to be biased. Additionally, I require the companies to have necessary data available. The final sample includes eleven companies. From this sample, I create a subsample of companies that are closer to being pure plays in the regulated gas distribution industry. Additional details of the sample

[28] Statistically, the t-statistic for American Water is lower than that of all but Pennichuck Corp. and York Water, which have a market capitalization of approximately $150 and $275 million, respectively. In comparison, American Water's market capitalization is approximately $9.8 billion (Table No. BV-3, Panels D, I, and J)

selection process for each sample and subsample are described below as well as in Appendix B.

Q. IF THE BUSINESS RISK OF THE GAS LDC SAMPLE DIFFERS FROM THE WATER SAMPLE, CAN YOU STILL RELY ON THE COST OF EQUITY ESTIMATED FOR THE GAS LDC SAMPLE?

A. Yes. If the business and financial risk of the two samples differ, then a cost-of-capital analyst can still make use of the information from the more reliable sample to evaluate the reliability of the estimates from the water sample. The inference would be based on information about the relative risk of the two industries. In this instance the business operations of water and gas LDC companies are similar, but the water companies tend to have a higher percentage of their assets and revenue subject to regulation.

Q. PLEASE ELABORATE ON THE WAY TWO SAMPLES WITH DIFFERENT BUSINESS AND FINANCIAL RISKS CAN BE COMPARED.

A. As mentioned above, the overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis. According to financial economics, the overall risk of a diversified company equals the market value weighted-average of the risks of its components.

Calculating the overall after-tax weighted average cost of capital for each sample company as described above allows the analyst to estimate the average overall cost of capital for the sample. The ATWACC captures both the business risk and the financial risk of the sample companies in one number. This allows comparison of the cost of capital between two samples on a much more informed basis. If the alternative (more reliable) sample is judged to have slightly different risk than the water sample, but the

results show wide differences in the ATWACC estimates, the analyst should carefully consider the validity of the water sample estimates, whether they are materially higher or lower than the alternative sample's estimates. Of course, the alternative sample could be the source of the error, but that is less likely because the alternative sample has been selected precisely because of its expected reliability.

Q. PLEASE COMPARE THE CHARACTERISTICS OF THE WATER UTILITY SAMPLE AND THE GAS LDC SAMPLE.

A. The two samples differ primarily in that they operate in two different (regulated) industries, but they are relatively similar in terms of the percentage of revenues from regulated operations and the customers they serve. On average, both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. In addition, both industries are characterized by large capital investment and both are operating a large distribution system. Because of their larger size and better data availability, the Gas LDC sample has fewer estimation issues than the water sample. Please refer to Appendix B for additional details on the two samples.

2. Market-Value Capital Structure

Q. WHAT CAPITAL STRUCTURE INFORMATION DO YOU REQUIRE?

A. For reasons discussed below and in Appendix E, explicit evaluation of the market-value capital structures of the sample companies is vital for a correct interpretation of the market evidence on the return on equity. This requires estimates of the market values of common equity, preferred equity and debt, and the current market costs of preferred equity and debt.

Q. PLEASE DESCRIBE HOW YOU CALCULATE THE MARKET VALUES OF COMMON EQUITY, PREFERRED EQUITY AND DEBT.

A. I estimate the capital structure for each sample company by estimating the market values of common equity, preferred equity and debt from the most recent publicly available data. The details are in Appendix B.

Briefly, the market value of common equity is the price per share times the number of shares outstanding. For the risk-positioning approach, I use the last 15 trading days of each year to calculate the market value of equity for the year. I then calculate the average capital structure over the corresponding five-year period used to estimate the "beta" risk measures for the sample companies. This procedure matches the estimated beta to the degree of financial risk present during its estimation period. In the DCF analyses, I use the average stock price over 15 trading days ending on the release date of the BEst growth rate forecasts utilized.[29] I use 15 trading days to balance the need for a current stock price and avoiding that any one day unduly influences the results.

The market value of debt is estimated at its book value adjusted by the difference between the "estimated fair (market) value" and the "carrying cost" of long-term debt reported in each company's 10-K. The market value of preferred stock for the samples is set equal to its book value.[30,31]

3. Market Costs of Debt and Preferred Equity

Q. HOW DO YOU ESTIMATE THE CURRENT MARKET COST OF DEBT?

[29] Best is Bloomberg's name for its earnings growth rate information. BEst growth rate forecasts are as of September 15, 2010 for the Gas LDC sample and as of September 30, 2010 for the Water sample.

[30] This is unlikely to affect the results as the average percentage of preferred is close to zero for both the water and gas LDC sample.

[31] Commission Staff has in the past used the book value capital structure as of a specific recent date as well as the stock price on a recent date. As financial risk is determined in financial markets, I rely on the market value capital structure. Further, to match the horizon over which the systematic risk is determined and the capital structure I use an average over the last five years. The reliance of a 1-day versus a 15-day stock price in the DCF model is unlikely to materially impact the results unless the 1-day price is influenced by unusual events on that specific day.

A. The market cost of debt for each company is set equal to the fifteen-day average yield on an index of public utility bonds that have the same credit rating, as reported by Bloomberg. The DCF analyses use the current credit rating whereas the risk-positioning analyses use the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate each company's beta. Bond rating information was obtained from Bloomberg which reports Standard & Poor's bond ratings. I calculate the after-tax cost of debt using Arizona-American's estimated marginal income tax rate of 38.6 percent.

Q. HOW DO YOU ESTIMATE THE MARKET COST OF PREFERRED EQUITY?

A. For all sample companies, the preferred rating was assumed equal to the company's bond rating. The cost of a company's preferred equity was set equal to the yield on an index of preferred utility stock with the same rating. The data were obtained from the Mergent Bond Record.[32]

B. Cost-of-Equity Estimation Methods

Q. HOW DO YOU ESTIMATE THE COST OF EQUITY FOR YOUR SAMPLE COMPANIES?

A. Recall that the cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. This definition leads me to address three key points in my estimation procedures. First, the cost of capital is an expected rate of return – it cannot be directly observed, but must be inferred from available evidence. Second, the cost of capital is determined in capital markets (such as the New York Stock

[32] Published monthly, Mergent's Bond Record offers a comprehensive review of over 68,000 bond issues including coverage of corporate, government, municipal, industrial development/environmental control revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

Exchange). Therefore, capital market data provide the best evidence from which to draw inferences. Third, the cost of capital depends on the return offered by alternative investments of equivalent risk. Consequently, measures of risk that matter in capital markets are part of the evidence that I need to examine. The overall cost of capital that I estimate for the samples is the primary evidence I rely on to determine Arizona-American Water's overall cost of capital.

Q. HOW DOES THE ABOVE DEFINITION HELP YOU ESTIMATE THE COST OF CAPITAL?

A. The definition of the cost of capital recognizes a tradeoff between risk and expected return; this is the security market line plotted above in Figure 1 above. Cost-of-capital estimation methods usually take one of two approaches: (1) they establish the location of the security market line and estimate the relative risk of the security, which jointly determine the cost of capital, or (2) they try to identify a comparable-risk sample of companies and estimate the cost of capital directly. Looking at Figure 1, the first approach focuses directly on the vertical axis, while the second focuses both on the security's position on the horizontal axis and on the position of the security market line.

The first type of approach is more direct, but ignores the wealth of information available on securities not thought to be of precisely comparable risk. The "discounted cash flow" or "DCF" model is an example. The second type of approach, sometimes known as "equity risk premium approach," requires an extra step – positioning the security market line. Using the second approach allows me to use information from all traded securities rather than just those included in my sample. The capital asset pricing model (CAPM) is an example. While both approaches can work equally well if conditions are right, one may be preferable to the other under certain circumstances. In particular, approaches that rely on the entire security market line are less sensitive to deviations from the

assumptions that underlie the model, all else equal. In this case, I examine both DCF and risk-positioning approach evidence for the water utility and gas LDC sample.

1. The Risk-Positioning Approach

Q. PLEASE EXPLAIN THE RISK-POSITIONING METHOD.

A. The risk-positioning method estimates the cost of equity as the sum of a current interest rate and a risk premium. It is therefore sometimes also known as the "risk premium" approach. This approach may sometimes be applied more or less formally. As an example of an informal application, an analyst may estimate the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at a specific time, and then apply that spread to current interest rates to get a current estimate of the cost of capital.

More formal applications of the risk-positioning approach take full advantage of the security market line depicted in Figure 1: they use information on a large number of traded securities to identify the security market line and derive the cost of capital for the individual security based on that security's relative risk. This reliance on the entire security market line makes the method less vulnerable to the kinds of problems that arise from using one stock at a time (such as the DCF method). The risk-positioning approach is widely used and underlies much of the current research published in academic journals on the nature, determinants and magnitude of the cost of capital. The most commonly used version of the formal risk-positioning models is the Capital Asset Pricing Model (CAPM). The equation for the CAPM is:

$$k_s = r_f + \beta_s \times MRP$$

where k is the cost of capital, r_f is the risk-free interest rate, MRP is the market risk premium, and β is the measure of relative risk.

Section I of Appendix C to this testimony provides more detail on the principles that underlie the risk-positioning approach. Section II of Appendix C provides the details of the risk-positioning approach empirical estimates I obtain.

Q. HOW ARE THE "MORE FORMAL" APPLICATIONS OF THE RISK-POSITIONING APPROACH IMPLEMENTED?

A. The first step is to specify the current values of the benchmarks that determine the security market line. The second is to determine the security's, or investment's, relative risk. The third is to specify exactly how the benchmarks combine to produce the security market line, so the company's cost of capital can be calculated based on its relative risk.

a) Security Market Line Benchmarks

Q. WHAT BENCHMARKS ARE USED TO DETERMINE THE LOCATION OF THE SECURITY MARKET LINE?

A. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" (MRP), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the risk-positioning approach, the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

Q. WHAT BENCHMARK DO YOU USE FOR THE MRP?

A. For this proceeding I estimate only a long-term version of the risk-positioning model. This version of the risk-positioning model measures the market risk premium as the risk premium of average-risk common stocks over long-term Government bonds. I do not present result on a short-term version in this proceeding because monetary policy has

driven the short-term risk-free rate close to zero. I also report several sensitivity analyses that take into account the increase in the MRP as discussed above in *Section III.*

Q. HOW DO YOU ESTIMATE THE BASELINE MRP?

A. Appendix C summarizes academic and empirical research on the MRP. However, as discussed in the appendix, there is currently little consensus on the "best practice" for estimating the MRP even pre-crisis. (Note: this is not the same as saying that all practices are equally good). For example, the leading graduate textbook in corporate finance expresses the view that a range between 5 to 8 percent is reasonable for the U.S.[33] Morningstar data from 1926 to 2009, the longest period reported, show an MRP average premium of stocks of 8.1 percent over Treasury bills and 6.7 percent over long-term Government bonds. The publication reports a premium of stocks over bonds of 6.5 percent for the period 1947 to 2009.[34] At the same time, *Credit Suisse's Global Investment Return Yearbook 2010* estimate the arithmetic market risk premium for the U.S. over the 1900 to 2009 period at 6.3 percent over bonds.[35] In a regulatory setting, the Surface Transportation Board (STB) recently decided to rely on the CAPM when determining the cost of capital for major railroads in the U.S. As part of its methodology, the STB decided to rely on the long-term market risk premium reported by Morningstar/Ibbotson in its implementation of the CAPM.[36]

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[33] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 9th edition, 2008, pp. 173-180.

[34] Morningstar, *Ibbotson SBBI Valuation Yearbook 2010*, Appendix A, Tables A-1 and A-3.

[35] Credit Suisse (with E. Dimson, P. Marsh, and M. Staunton), "*Global Investment Returns Yearbook 2010*," Table 10.

[36] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect.

Considering all the evidence, I conclude that S&P 500 stocks of average risk commanded 6.5 percent over the long-term Government rate prior to the financial crisis. This estimate is a conservative estimate of the historical average risk-premium in that it is lower than the figure reported over the longest period available and includes the unusual 2008 year. As discussed in *Section III* above, this figure has increased with the current market turmoil, so that the baseline of 6.5 percent likely underestimates the current MRP. However, I choose to use it as a benchmark to be conservative. I do, however, report sensitivity analyses that reflect an increase in the MRP I refer to models that use the 6.5 percent MRP as the baseline. The estimation of the MRP is discussed in greater detail in Appendix C.

Q. HOW DO YOU DETERMINE THE RISK-FREE RATE YOU USE?

A. First, I calculate the yield on long-term Government bonds over a recent 15-day period. Second, I determine the increase in the spread between the yield on A-rated utility bonds and long-term (20-year) Government bonds.[37] As of September 22, 2010 this spread stood at 161 basis points (using Bloomberg's calculated yields) and were 66 basis points above the average for the period 1991 to 2007.[38] I conservatively choose to add 50 basis points to the current long-term risk-free rate and note that this is conservative compared to the increase expected in the Federal Reserve Bank of Philadelphia study cited above.

[37] I use the yield on A-rated utility bonds as they are less likely to include a default premium than are lower rated utility bonds.

[38] See Table 3 above and Workpaper #2 to Table No. BV-9, Panel B.

b) Relative Risk

WHAT MEASURE OF RELATIVE RISK DO YOU USE?

A. I examine the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates.

The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification. This concept is explored further in Appendix C.

Q. WHAT DOES A PARTICULAR VALUE OF BETA MEAN?

A. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market. A stock with a beta of 2.0 tends to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 understate the swings in the market. A stock with a beta of 0.5 tends to rise 5 percent when the market rises 10 percent.

Q. HOW DO YOU ESTIMATE BETA?

A. I use beta estimates from Bloomberg in this testimony. In the past, I have relied on *Value Line* estimates, but because I have been unable to replicate *Value Line's* estimates for the gas LDC companies, I choose to rely on Bloomberg estimates instead.[39] Bloomberg betas are very close to those I obtain using standard estimation methods and also have the advantage of being recent as of the calculation date, while *Value Line* betas can be up to 3 month old.

[39] *Value Line* and Bloomberg estimates for the water sample are comparable and similar to what I estimate using standard techniques. However, for consistency, I choose to rely on the same source for both samples.

c) Cost of Equity Capital Calculation

Q. HOW DO YOU COMBINE THE PRECEDING STEPS TO ESTIMATE THE COST OF EQUITY?

A. The most widely used approach to combine a risk measure with the benchmark market risk premium on common stocks to find a risk premium for a particular firm or industry is the Capital Asset Pricing Model. However, the CAPM is only one risk-positioning technique.

In addition to the CAPM, I rely on an empirical variety of the model. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to account for this finding.

This finding can be used directly to estimate the cost of capital, using beta to measure relative risk, without simultaneously relying on the CAPM. Here I examine results from both the CAPM and a version of the security market line based on the empirical finding that risk premia are related to beta, but are not as sensitive to beta as the CAPM predicts, to convert the betas into a risk premium. I refer to this latter model as the "ECAPM," where ECAPM stands for Empirical Capital Asset Pricing Model. The formula for the ECAPM is

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha)$$

where as before k is the cost of capital, r_f is the risk-free interest rate, MRP is the market risk premium, β is the measure of relative risk, and α is the empirical adjustment factor.

Research supports values for α ranging from one to seven percent when using a short-term interest rate. I use benchmark values of α of 0.5 percent for the long-term risk-free

rate as it is in the lower range of what empirical evidence support. I also conduct sensitivity tests for different values of α. For the long-term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Appendix C for a more detailed discussion of the ECAPM model and Table C-1 for a summary of the empirical evidence on the size of the required adjustment.

Q. WHY IS IT APPROPRIATE TO USE THE ECAPM MODEL?

A. Empirical tests of the CAPM have repeatedly shown that an investment's return is related to systematic risk, but that the increase in return for an increase in risk is less than is predicted. The empirical tests have also shown that the theoretical intercept, as measured by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical data support the ECAPM. The ECAPM recognizes the consistent empirical observation that the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The ECAPM corrects the predictions of the CAPM to more closely match the results of the empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of capital that is likely to be less accurate than is possible.

Q. IS THE USE OF THE ECAPM EQUIVALENT TO ADJUSTING THE ESTIMATED BETAS FOR THE SAMPLE COMPANIES?

A. No. Fundamentally, this is not an adjustment (increase) in beta. This can easily be seen by the fact that the expected return on high beta stocks is lower with the ECAPM than when estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the risk-return tradeoff is flatter than predicted and the intercept higher based upon repeated empirical tests of the model.[40] Even if the beta of the sample companies were

[40] Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment, which adjusts betas 1/3 toward one. This type of adjustment is intended to compensate for

estimated accurately, the CAPM would still underestimate the required return for low beta stocks. Even if the ECAPM were used, the costs of equity would be underestimated if the betas were underestimated.

2. Discounted Cash Flow Method

Q. PLEASE DESCRIBE THE DISCOUNTED CASH FLOW APPROACH.

A. The DCF model takes the first approach to cost-of-capital estimation, i.e., to attempt to estimate the cost of capital in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive over the life of the company. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t (i.e., subscript period 1, 2, 3 or T in the equation); "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (i.e., unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

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sampling errors in the beta estimation, not for the empirical fact that CAPM tends to overestimate the sensitivity of the cost of capital to beta. See Appendix C for a more detailed explanation.

$$P = \frac{D_1}{(k-g)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation (5) is a simplified version of Equation (4) that can be solved to yield the well known "DCF formula" for the cost of capital:

$$k = \frac{D_1}{P} + g$$
$$= \frac{D_0 \times (1+g)}{P} + g$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (6) says that if Equation (5) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong, unrealistic, assumptions.

Q. CAN YOU ILLUSTRATE THE DCF MODEL?

A. Yes. For simplicity, I will illustrate the method using annual data although most companies pay dividends quarterly, so that a quarterly model is more appropriate. If, on an annual basis, a company paid $2 in dividends, D_0, has a current stock price, P, of $30 and an estimated growth rate, g, of 5 percent per year, then the calculations in equations (5) and (6) above are as follows

Dividends next period:	$D_1 = D_0 \times (1 + g) = \$2.00 \times (1 + 5\%) = \$2.10$
Dividend Yield:	$D_1 / P = \$2.10 / \$30 = 7.0\%$
Cost of equity:	$k = D_1 / P + g = 7.0\% + 5\% = 12\%.$

Q. ARE THERE OTHER VERSIONS OF THE DCF MODELS BESIDES THE "SIMPLE" ONE?

A. Yes. There are many variations on the DCF models that may rely on less strong (more realistic) assumptions in that they allow growth rates to vary over time. I consider a variant of the DCF model that uses the companies' individual growth rates during the first five years, converges to a perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF method. The DCF models are described in detail in Section I of Appendix D. (Section II of Appendix D provides the details of my empirical DCF analysis.)

Q. WHAT ARE THE MERITS OF THE DCF APPROACH?

A. The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems. (See Appendix D for details.)

Q. WHAT IS THE MOST DIFFICULT PART OF IMPLEMENTATING THE DCF APPROACH?

A. Finding the right growth rate(s) is the usual "hard part" of a DCF application. The original approach to estimation of the growth rate, *g*, relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates *g* as the average book rate of return times the

fraction of earnings retained within the firm. But it is highly unlikely that these historical averages over periods with widely varying rates of inflation and costs of capital will equal current growth rate expectations. This is particularly true for the water sample as many companies in the industry are growing fast, engaged in mergers, acquisitions or other restructuring activities.

Moreover, the constant growth rate DCF model requires that dividends and earnings grow at the same rate for companies that on average earn their cost of capital.[41] It is inconsistent with the theory on which the model is based to have different growth rates in earnings and dividends over the period when growth is assumed to be constant. If the growth in dividends and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to estimate a multistage DCF model. In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period. A difference between forecasted dividend and earnings rates therefore is a signal that the facts do not fit the assumptions of the simple DCF model.

Q. HOW DO YOU ESTIMATE THE GROWTH RATES YOU USE IN YOUR DCF ANALYSIS?

A. I use earnings growth rate forecasts from Bloomberg and *Value Line*. Analysts' forecasts are superior to using single variables in time series forecasts based upon historical data as

[41] Why must the two growth rates be equal in a steady-growth DCF model? Think of earnings as divided between reinvestment, which funds future growth, and dividends. If dividends grow faster than earnings, there is less investment and slower growth each year. Sooner or later dividends will equal earnings. At that point, growth is zero because nothing is being reinvested (dividends are constant). If dividends grow slower than earnings, each year a bigger fraction of earnings are reinvested. That makes for ever faster growth. Both scenarios contradict the steady-growth assumption. So if you observe a company with different expectations for dividend and earnings growth, you know the company's stock price and its dividend growth forecast are inconsistent with the assumptions of the steady-growth DCF model.

has been documented and confirmed extensively in academic research. Please see Section I in Appendix D for a detailed discussion on this issue.

Q. ARE YOU AWARE THAT SOME REGULATORY COMMISSIONS RELY ON BOTH HISTORICAL AND FORECAST GROWTH RATES IN THEIR IMPLEMENTATION OF THE DCF MODEL?

A. Yes, but I do not believe that is the best way to estimate the growth rate for use in the DCF model for the following reasons. First, as mentioned above, the model requires that dividends and earnings grow at the same rate at some point in the future in order to apply the model. The data on historical growth rates do not confirm this condition. Second, analysts have access to historical information and include that information in their forecast of earnings growth rates. In other words, using historical data provides no additional information than that captured in analyst forecasts. Data providers such as *Value Line* provide information on the going forward payout ratio as well as on other key financial parameters.

Q. ARE YOU AWARE OF EVIDENCE THAT ANALYSTS'FORECAST OF EARNINGS GROWTH HAVE HISTORICALLY OVERESTIMATED EARNINGS AND DIVIDEND GROWTH?

A. Yes. Although analyst forecasts have historically been too optimistic, this problem is less acute for regulated companies.[42] Further, according to a recent joint report by NASD and the NYSE,

> ... the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and promoting transparency of other potential conflicts of interest. Evidence

[42] See, for example, L.K.C. Chan, J. Karceski, and J. Lakonishok (2003), "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2), pp. 643-684.

> also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[43]

In addition, the use of a two-stage DCF model, which substitutes the forecast growth of GDP, mitigates analyst optimism by substituting the GDP growth rate for the potentially optimistic (or pessimistic) earnings forecasts of analysts.

Q. HOW WELL ARE THE CONSTANT-GROWTH RATE CONDITIONS NECESSARY FOR THE RELIABLE APPLICATION OF THE DCF LIKELY TO BE MET FOR THE SAMPLE COMPANIES AT PRESENT?

A. The requisite conditions for the sample companies are not fully met at this time, particularly for the water sample, which include several companies that have limited data available and where acquisitions have been frequent. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (i.e., the growth rate after the water industry settles into a steady state, which may be beyond the next five years for this industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable – so there is little doubt as to the growth rate investors expect – DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

Of the ten companies in the water sample, five do not have *BEst* growth rates and one *Value Line* estimate is not meaningful, as it is based on a very low 2010 earnings estimate resulting in a growth rate above 90%, which is not plausible. As a result only five companies have growth rates from both *BEst* and *Value Line*. These five companies constitute the DCF water subsample. The long-term growth rates for the water

[43] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

companies range from 1.1% to 14.3% (See Table No. BV-5). A problem for the water DCF is that only three of the sample companies have more than 2 analysts following them. The growth rates for gas LDC sample vary much less from 3.0 to 7.5 percent, and are more consistent with the GDP growth forecast of 4.8 percent. Of the 11 companies in the gas LDC sample, one has currently no *BEst* forecast and one has only two analysts providing a forecast (one *Value Line* and one BEst). The two-stage DCF model adjusts for any overly optimistic (or pessimistic) growth rate forecasts by adjusting the 5-year growth rate forecasts of the analysts toward the long-term GDP growth rate in the years after year 5. See Appendix D, *Section I* for a discussion of the two-stage model.

The DCF growth rates, whether estimated from historical data or from analyst forecasts, have likely been affected by several factors: many mergers and acquisitions in the water industry in recent years, significant growth in many parts of the country, and a trend towards consolidation. The industry appears to be moving towards a larger degree of consolidation – at least among the privately held water utilities. The consolidation of the industry may well increase as the industry needs significant infrastructure investments and the capital expenditures exceed funds available internally to the companies.[44] The American Society of Civil Engineers estimated in 2009 that "drinking water systems face an annual shortfall of at least $11 billion in funding needed to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations"[45] with a total investment need for drinking water and wastewater investments of $255 billion over the next five years.[46] Drinking water is mentioned as the second most important infrastructure concern for Arizona and the required

[44] See, for example, *Value Line*, Water Utility Industry, July 23, 2010.

[45] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2009, p. 1.

[46] *Ibid.*, Executive Summary p. 7. According to the document, the investment shortfall is about $108.6 billion for the water industry over the next five years.

investments is estimated at $9.12 billion for drinking water and at $4.57 billion for wastewater.[47] Coupled with the rising construction costs of utility infrastructure, this creates uncertainty about future conditions and diverging expectations. The uncertainty associated with these factors increases the industry's business risk. Additionally, environmental regulations impact the industry as standards for water quality evolve over time, and there is potential for new safety and security requirements in the future. The industry has no federal regulator (other than for environmental and health issues), and state public utility commissions regulate most investor owned water utilities. Different regulatory bodies may lead to differing regulatory requirements for companies operating in adjacent parts of the country. Taken together, these factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium necessary for the reliable application of the DCF model.

Such circumstances imply that a commission may often be faced with a wide range of DCF estimates, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist.* DCF for firms or industries in flux is *inherently* subjective with regard to the most important parameter, the long-run growth rate that drives the answer.

In short, the unavoidable questions about the DCF model's strong assumptions cause me to view the DCF method as *inherently* less reliable than the risk-positioning approach described above. This is particularly true for the water sample, because of the data problems discussed above. However, because the DCF method has been widely used in the past, I submit DCF evidence in this case, where the gas LDC sample is reasonable stable and the results are comparable to other estimates.

[47] Report Card for America's Infrastructure: Arizona, The American Society of Civil Engineers, 2009. (http://www.infrastructurereportcard.org/state-page/arizona)

In this proceeding, I give little weight to the water sample's DCF estimates, but note that the wide range of estimates spans my recommendation. The gas LDC DCF estimates are concentrated around the midpoint of my recommendation and therefore a useful check on the reasonableness of my risk-positioning estimates. While the Commission Staff in the past has given weight to the water sample's DCF results, I respectfully submit that the high variability of these growth rates and resulting wide range of estimates makes them very unreliable at this point in time. Relying on historical growth rate does not make the water sample's DCF results reliable, because (1) the DCF method's strength is being forward looking and historical data violates this principle and (2) historical growth rates for the water industry vary as much as do forecasted growth rates. A number of companies in the water industry, which has a relative small number of companies, are in flux and therefore their growth rates are very volatile. Therefore, even minor variations in methodology, timing, or sample composition drives the results which is not consistent with stable rate making.

C. THE SAMPLES AND RESULTS

1. The Water Utility Sample

Q. EARLIER YOU SAID THAT THE SAMPLE OF WATER UTILITIES HAD SERIOUS DATA WEAKNESSES. PLEASE ELABORATE ON THESE WEAKNESSES.

A. In attempting to apply the DCF model to the sample, five companies had no *BEst* growth forecasts. The size of the companies in the water sample also makes cost-of-capital estimation difficult. Currently, only four companies have more than $500 million in market value of equity. More important, however, is the fact that the stock of these companies trades relatively infrequently. Low trading volume causes concern because there may be a delay between the release of important information and the time that this

information is reflected in prices. Such delay is well known to cause beta estimates to be statistically insignificant and possibly biased.

In addition to lack of data and the small size of the companies, there are firm-specific events that render the water utility sample less reliable than would be ideal. First, Aqua America (the second largest of the companies) has gone through a large number of mergers and acquisitions in recent years. Normally, I would not include companies with significant merger or acquisition activity in a sample because the individual information about the progress of the proposed merger is so much more important for the determination of the company's stock price than day-to-day market fluctuations. In practice, beta estimates for such companies tend to be too low. The growth rates for such companies may also be affected. Second, Southwest Water Co. currently pays no dividends, has restated its financials and has announced plans to be required by private equity. Lastly American Water Works has only been publicly traded since 2008 and therefore has less than five years of data available for examination. I therefore report my results for both the full sample and for a subsample of companies that differ in the risk positioning and DCF method. Specifically, I do not include Southwest Water Co. in either subsample. In addition I do not include American Water in the risk positioning subsample as it has less than five years of data. A key reason for excluding American Water from the subsample is that it has only 2½ years of data available for beta estimation. One consequence hereof is that the precision with which the company-specific data is determined is weaker than for other companies. Value Line as a result do not report some of its standard performance measures for American Water and I find that the beta estimate for American Water is subject to larger statistical uncertainty that that of other large water utilities. In addition, I am determining the cost of capital for Arizona-American Water rather than for American Water. Therefore, it is important to include

companies that are comparable to Arizona-American Water rather than comparable to American Water. For the DCF analysis, I create a subsample of those companies that has growth estimates from at least two analysts (e.g., one BEst and one Value Line), which results in the subsample having five companies: Aqua American, California Water, SJW Corp., American States Water, and American Water Works.[48] Because the DCF method relies on current and forward looking data, the fact that American Water only has only 2½ years of data is not as large an issue although analysts clearly review a company's history when estimating their growth rate.

2. Risk-Positioning Cost-of-Capital Estimates

Q. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A. This section first describes the input data used in the CAPM and ECAPM models, then reports the resulting cost-of-equity estimates for the samples. The second section of Appendix C details the empirical analysis.

a) Interest Rate Estimate

Q. HOW DID YOU DETERMINE THE EXPECTED RISK-FREE INTEREST RATE?

A. I reviewed current constant maturity U.S. Government bond yield data available from the St. Louis Federal Reserve Bank. For the period August 24 to September 14, 2010, the average yield on long-term government bonds was 3.40 percent. To that figure I added 50 basis points in the baseline case as an adjustment for the increase in yield spread.[49] I note that in the sensitivity analyses, I reduce the adjustment for yield spread by 25 basis

[48] In my most recent testimony before the Commission, I noted that I believed the comparability of the water and the gas LDC sample had declined because *Value Line's* beta estimates for the two industries had deviated. I no longer believe that to be true as beta estimates from alternative sources such as Bloomberg and those obtained through standard regression analysis are comparable.

[49] See Table No. BV-9.

points for each 1 percent increase in the MRP. This intends to take into account the fact that bond betas may be positive and .25 is a conservative estimate hereof - - i.e., bond betas are likely to be lower, so that a .25 percent adjustment is in the upper end of the needed adjustment.

b) Betas and the Market Risk Premium

Q. WHAT BETA ESTIMATES DID YOU USE IN YOUR ANALYSIS FOR THE SAMPLES?

A. I rely upon recent beta estimates from Bloomberg but also show the beta estimates obtained by standard regression analysis and those provided by *Value Line* (see Workpaper 1 to Tables No. BV-10 and BV-21).

Q ARE THE BETA VALUES REPORTED BY BLOOMBERG ADJUSTED BETAS?

A. Yes. Both Bloomberg and *Value Line* reports betas that are adjusted towards one. For this proceeding, I rely on Bloomberg's estimated betas for both samples. In my most recent testimony before this Commission, I reversed the adjustment for the water utilities to be conservative. However, because all commercial providers rely on adjusted betas and because water utility betas have fallen to a level where they are comparable to those of other utilities, I do not adjust the reported Bloomberg betas.

Q. PLEASE SUMMARIZE THE BETA ESTIMATES YOU RELY ON.

A. The average Bloomberg beta for both the water and the gas LDC sample is about 0.8. These beta estimates are reported in Workpaper #1 to Tables No. BV-10 and BV-21.[50]

Q. PLEASE EXPLAIN THE METHOD TO ADJUST FOR DIFFERENCES IN CAPITAL STRUCTURE.

[50] The beta estimates for both the water sample and the gas LDC sample are between the beta estimates relied upon in my recent testimony before this Commission in Dockets No. W-01303A-08-0227 and W-01303A-09-0343.

A. Starting with the ATWACC, the cost of equity for any capital structure within a broad range of capital structures can be determined by the following formula:

$$\text{Return on equity} = \frac{\text{ATWACC - Return on debt} \times \text{\% debt in capital structure} \times (1 - \text{tax rate})}{\text{\% equity in capital structure}}$$

This is the calculation that is displayed in Tables No. BV-12 and BV-23.[51] The tables display the result of converting the sample average ATWACC to a return on equity for a specific capital structure. It is straightforward to use this method to determine the cost of equity consistent with the capital structure.

c) Risk-Positioning Results

Q. WHAT ARE THE COST-OF-EQUITY ESTIMATES DERIVED FROM THE RISK-POSITIONING APPROACH FOR THE WATER AND GAS LDC SAMPLE?

A. Using the long-term interest rate in the two risk-positioning models (CAPM and ECAPM), with two values of the ECAPM parameter (0.5% and 1.5%), I obtain three estimates of each sample company's cost of equity (Tables No. BV-10 for the water sample and subsample and BV-21 for the gas LDC sample). The cost-of-equity estimates are combined with the estimates of the company's cost of debt and preferred to calculate the company's ATWACC (Tables No. BV-11 and BV-22). Tables No. BV-12 and BV-23 combine the sample average ATWACC with Arizona-American Water's capital structure, cost of debt, and tax rate to obtain the cost of equity at Arizona-American Water's 45 percent equity. The baseline cost-of-equity results as well as the sensitivities are summarized below in Table 4 for the water sample and subsample and in Table 5 for the gas LDC sample.

Table 4: Water Sample and Sub-Sample

[51] For companies that have preferred equity, an additional term equal to (Return on preferred equity × % preferred in capital structure) is subtracted from the numerator of this fraction.

Return on Equity Summary and Sensitivity Analysis
Using Bloomberg Betas

Estimated Return on Equity	Baseline [1]	Scenario 2 [2]	Scenario 3 [3]
Full Sample			
CAPM	11.2%	11.6%	12.0%
ECAPM (α = 0.5%)	11.4%	11.8%	12.2%
ECAPM (α = 1.5%)	11.6%	12.0%	12.4%
Sub-Sample			
CAPM	11.7%	12.1%	12.5%
ECAPM (α = 0.5%)	11.8%	12.3%	12.7%
ECAPM (α = 1.5%)	12.1%	12.5%	12.9%

Sources and Notes:
Baseline: Long-Term Risk Free Rate of 3.90%, Long-Term Market Risk Premium of 6.50%.
Scenario 2: Long-Term Risk Free Rate of 3.77%, Long-Term Market Risk Premium of 7.00%.
Scenario 3: Long-Term Risk Free Rate of 3.65%, Long-Term Market Risk Premium of 7.50%.

Table 5: Gas LDC Sample and Sub-Sample
Return on Equity Summary and Sensitivity Analysis
Using Bloomberg Betas

Estimated Return on Equity	Baseline [1]	Scenario 2 [2]	Scenario 3 [3]	S [
Full Sample				
CAPM	11.0%	11.4%	11.7%	
ECAPM (α = 0.5%)	11.2%	11.5%	11.9%	
ECAPM (α = 1.5%)	11.5%	11.8%	12.2%	
Sub-Sample				
CAPM	11.2%	11.6%	11.9%	
ECAPM (α = 0.5%)	11.3%	11.7%	12.1%	
ECAPM (α = 1.5%)	11.7%	12.0%	12.4%	

Sources and Notes:
Baseline: Long-Term Risk Free Rate of 3.90%, Long-Term Market Risk Premium of 6.50%.
Scenario 2: Long-Term Risk Free Rate of 3.77%, Long-Term Market Risk Premium of 7.00%.
Scenario 3: Long-Term Risk Free Rate of 3.65%, Long-Term Market Risk Premium of 7.50%.

Q. PLEASE SUMMARIZE YOUR FINDINGS FROM THE RISK-POSITIONING MODEL.

A. Focusing on the middle ECAPM (α = .50%) for Baseline case, I find that the water sample's cost of equity range from 11¼ to 11¾%, while the subsample estimates range from 11½ to 12%. Thus, the baseline scenario for the water sample and sub-sample results indicate a range of 11¼ to 12 percent. The baseline estimates for the gas sample and sub-sample estimates are similar to the estimates for the water sample and range from 11 to 11¾ with the subsample estimates being slightly higher. Taking a modest increase in the MRP of say 0.5% into account increases the estimates by 30 to 50 basis points. Therefore, it the baseline estimates may under estimate the current cost of equity.

Looking at the risk positioning results for the water sample and the gas LDC sample and subsample, the best point estimate is 11½ percent in the baseline case with a range of 11 to 12 percent. The water subsample shows a higher range than other samples. I discuss the assessment of Arizona-American Water's cost of equity in the concluding section.

3. The DCF Cost-of-Capital Estimates

Q. WHAT STEPS DO YOU TAKE IN YOUR DCF ANALYSES?

A. Given the above discussion of DCF principles, the steps are to collect the data, estimate the sample companies' costs of equity at their current capital structures, and then to adjust the sample's estimates to Arizona-American Water's 45 percent equity ratio.

a) Growth Rates

Q. WHAT GROWTH RATE INFORMATION DO YOU USE?

A. For reasons discussed above and in Appendix D, historical growth rates today are not as relevant as forecasts of current investor expectations for these samples. I therefore use rates forecast by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future until a true steady state (constant) dividend growth rate was

reached, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts from a number of analysts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described in Appendix D), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecast earnings growth rates from Bloomberg and *Value Line* to the degree such forecasts are available. The details are in Appendix D. At present, *Value Line* data run through a 2013-2015 horizon, representing an average of about four years from the current earning forecasts available for 2010. Bloomberg also provides a long-term earnings growth rate estimate. The longest-horizon forecasted growth rates from these sources underlie the simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only go out four to five years, which is too short a period to make the DCF model completely reliable.

b) Dividend and Price Inputs

Q. WHAT VALUES DO YOU USE FOR DIVIDENDS AND STOCK PRICES?

A. Dividends are either for the third or the fourth quarter of 2010, depending on the most recent dividend information available at the time of estimation for each company.[52] This dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple DCF model.

[52] The dividend information was obtained from Bloomberg.

Stock prices are an average of closing stock prices for the 15-day trading period ending on the day the BEst forecast was obtained from Bloomberg. A 15-day stock price average is used to guard against anomalous price changes in any single day.

c) DCF Results

Q. WHAT ARE THE DCF ESTIMATES FOR THE SAMPLES?

A. The data are used in the two versions of the DCF method to get sample company estimates at the sample company's capital structure. The resulting cost of equity at Arizona-American Water's 45 percent equity estimates are shown in Table 6 and Table 7 below. For the water sample, there is a very large difference between the simple and multi-stage DCF as well as between the full sample and the sub-sample estimates resulting in estimates ranging from 10¼ to 14½ percent. The gas LDC estimates are concentrated in a narrow range from 11½ to 12 percent. As a result I find the water DCF estimates unreliable, but believe the gas LDC estimates are consistent with the risk positioning estimates for the water sample and gas LDC sample and subsample. I discuss the cost of equity for Arizona-American Water in *Section VI* below.

Table 6: Water Sample

DCF Return on Equity Summary

	DCF	
	Simple	Multi-stage
Full Sample		
Cost of Equity	11.7%	10.3%
Sub-Sample		
Cost of Equity	14.6%	10.5%

Table 7: Gas LDC Sample

DCF Return on Equity Summary

	DCF	
	Simple	Multi-stage
Full Sample		
Cost of Equity	11.9%	11.4%
Sub-Sample		
Cost of Equity	11.9%	11.5%

V. ARIZONA-AMERICAN WATER'S EARNED RETURN ON EQUITY

Q. WHAT RETURNS HAVE ARIZONA-AMERICAN WATER EARNED IN RECENT YEARS?

A. Unlike most of its peers, Arizona-American Water has earned a negative return on equity in 8 of the last 9 years.[53] While there will always be fluctuations in the earned return on equity, the fact that the earned return for an extended period of time is close to zero or even negative is reason for serious concern. This section first summarize Arizona-American Water's situation and second, discuss the consequences on the Company's credit metrics.

Q. PLEASE BRIEFLY DESCRIBE FINANCIAL CHALLENGES FACING ARIZONA-AMERICAN WATER.

A. As noted in the Townsley Direct, Arizona-American Water has earned a negative return on equity every year but 2004, since 2001. Further, Arizona-American Water is not paying dividends and currently has negative retained earnings, which reduces the Company's equity. In addition, Mr. Townsley has calculated some credit ratios that are typically considered by credit rating agencies when they evaluate the credit worthiness of

[53] Townsley Direct.

a company. On a stand alone basis, Arizona-American Water have several ratios that are below the level Moody's consider appropriate for an investment grade water utility.

Q. PLEASE BRIEFLY DESCRIBE CREDIT RATINGS AND WHY THEY MATTER FOR A UTILITY SUCH AS ARIZONA-AMERICAN WATER.

A. Credit rating agencies, such as Standard & Poor's (S&P), Moody's Investors Service (Moody's) and FitchRatings (Fitch), evaluate the default risk of debt issued by companies, government agencies, municipalities, state agencies, and others. As part of the rating process, the agencies assign a credit rating to the debt and to the issuing company (or other entity).[54] Using S&P's designations (Moody's equivalent in parantheses), the highest rating is AAA (Aaa), followed by AA (Aa), A (A), BBB (Baa), BB (Ba), B, CCC (Caa), CC (Ca), C, and D.[55] At times these ratings are designated with a '+' or '-', where a plus indicates higher than average and a minus indicates a lower than average rating for the category.[56] Thus, among all BBB rated entities, BBB+ rated entities are viewed more favorably than the average BBB rated entity and BBB- rated entities are viewed less favorably from a credit perspective. Ratings below BBB- are considered non-investment grade, and many institutional investors are prohibited from investing in those instruments. Investors in non-investment grade debt instruments bear substantial default risk and usually require a much higher yield to invest in such instruments; hence, non-investment grade bonds are also referred to as high-yield bonds.

Q. WHY IS A CREDIT RATING IMPORTANT TO A COMPANY?

[54] An issue of debt may have a different credit rating than the unsecured credit rating of the issuing entity because of differences in collateral or in claims to cash flow of different debt issues.

[55] Fitch Ratings uses a designation similar to that of S&P.

[56] Moody's use the designation 1, 2, and 3 to indicate a higher than average, average, and lower than average rating for the category.

A. It is usually necessary for a company to obtain a credit rating to place its bonds (or other debt) with the public. In general, the higher the credit rating, the lower the yield investors require, and the required yield increases at an increasing rate as the credit rating declines. For example, the difference between the yields on BBB and BB rated bonds is larger than is the difference in yield between A and BBB rated bonds. Recently and especially during the height of the financial crisis, the yields on BBB- rated bonds (the lowest investment grade) and on non-investment grade bonds increased much more than did the yields on higher-rated bonds. This observation is illustrated in Figure 6 below for four investment grade bond ratings. From Figure 6, it is clear that while utility bond yields have declined in recent months, the spreads between categories such as between BBB and BBB- rated utility bonds and especially between BBB and BB rated utility bonds have not returned to their pre-crisis levels. The yield spread on BB rated utility debt remains very high, about 405 basis points, compared to less than 160 basis points in April 2007. Thus, a downgrade to the BBB- or worse, the BB range, could result in a substantial increase in the expected cost of debt. Given the ongoing volatility in capital markets, yield spreads for bonds rated BBB- or lower may not return to a more normal range for an extended period of time.

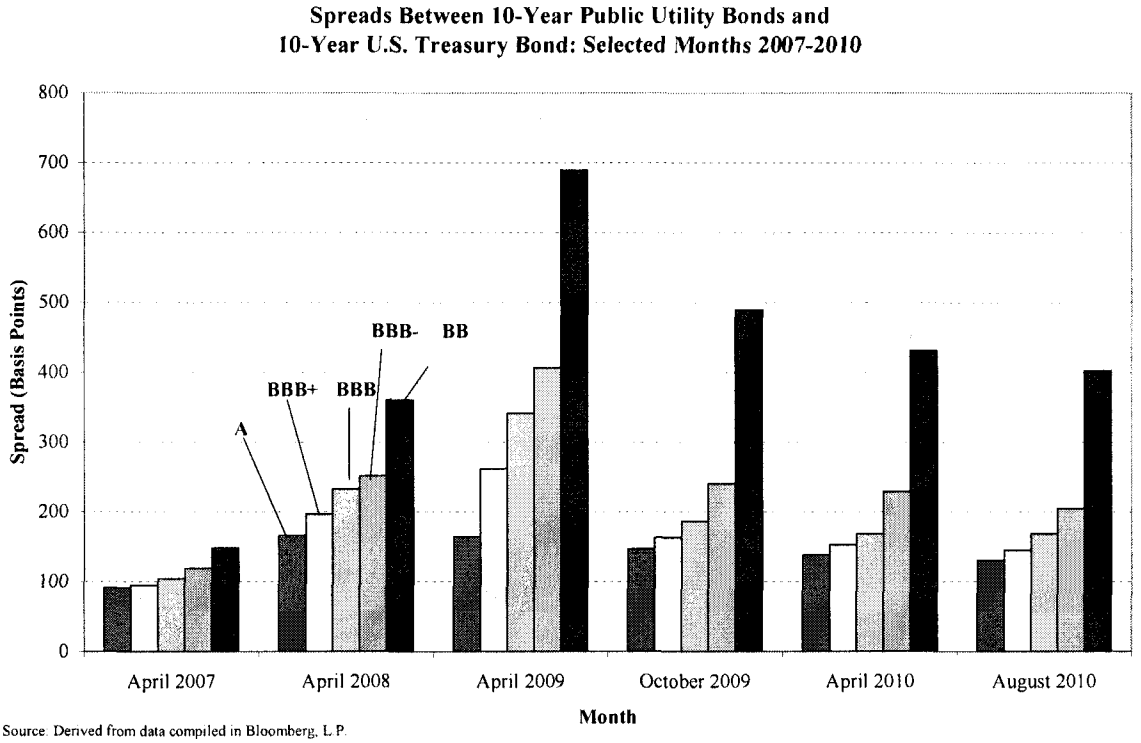

Figure 6

For a company such as Arizona-American Water, the impact of the widening yield could be very significant. If Arizona-American Water were to issue debt on a stand alone basis, the difference between issuing debt as a BBB and a BB rated entity is currently about 235 basis points for 10-year bonds. More importantly, BB rated or even BBB- rated entities have difficulty accessing credit markets during times of limited liquidity, and if they do, they must pay very high interest rates, as illustrated in the April and October 2009 data in Figure 6.

Q. ARE THERE OTHER COSTS OF A NON-INVESTMENT GRADE CREDIT RATING?

A. Yes. Mutual fund and many other financial institutions cannot hold non-investment grade paper and cannot acquire bonds with a rating below BBB-. If an entity's debt were

downgraded to non-investment grade, many financial institutions are required by their charters to sell all such bonds. The effect of forced sales by financial institutions is likely to be an increase in the required yield on non-investment grade debt. BBB- rated entities are more vulnerable to economic turmoil because they are 'closer to the edge' than other investment grade rated entities. As a result, yields on BBB- rated debt increase more when financial markets are in turmoil. In addition, companies with non-investment grade credit ratings are considered to be in financial distress and experience additional costs not borne by investment grade companies. These factors underline the importance of improving Arizona-American Water's credit metric.

Q. WHAT FACTORS DO CREDIT RATING AGENCIES CONSIDER IN DETERMINING THE RATING OF A REGULATED WATER AND WASTEWATER UTILITY SUCH AS ARIZONA-AMERICAN?

A. The three major credit rating agencies, Fitch, Moody's and S&P, all look at qualitative as well as quantitative measures. Among the qualitative measures all rating agencies review are the utility's regulatory environment and especially its ability to recover all capital expenditures and expenses in a timely fashion. Rating agencies also look to quantitative measures such as interest coverage ratios and leverage. For example, Moody's assign 40% weight to credit ratios when evaluating global water utilities[57] and consider, among other measures, interest coverage as measured by Funds from Operations (FFO) to Interest or by Adjusted Interest Coverage. S&P also looks to FFO to interest. In addition, Moody's assigns weight to (1) net debt to assets or net debt to capitalization, (2) FFO to net debt and (3) retained cash flow to capital expenditures. S&P and Fitch look to similar ratios.[58]

[57] Moody's, "Global Regulated Water Utilities," December 2009, p. 7.

[58] See, for example, FitchRatings, "Credit Rating Guidelines for Regulated Utility Companies," July 2007 and Standard & Poor's, "Corporate Ratings Criteria 2008," April 2008.

A key input to these credit ratios is FFO, which measures operating profits from continuing operations, after tax, plus depreciation and amortization, plus deferred income tax (during the period), plus other major recurring noncash items. Thus, operating profit is a key component to several ratios.

Q. DO THE CREDIT RATING AGENCIES FOCUS ON THE ALLOWED ROE OR ON THE EARNED ROE?

A. Earned or realized returns are the key. S&P is explicit in saying that it focuses on actual earned returns because cash flow depends upon what is actually earned, not what is allowed.[59] The implication is that treating the regulated company (and customers) fairly requires not only that allowed return be set equal to the cost of capital but also that the company have a fair opportunity to earn the allowed return.

Q. WHAT ARE THE IMPLICATIONS OF ARIZONA-ARMERICAN WATER HAVING EARNED A NEGATIVE PROFIT FOR A LONGER PERIOD OF TIME?

A. As shown in the Townsley Testimony, Arizona-American Water has only earned a positive income in one year since 2001, and it has not earned its allowed return in any year. Because credit agencies and investors emphasize realized return on equity, it is important that Arizona-American Water being able to earn a reasonable return on equity. If it cannot earn a reasonable return on equity, the Company will face difficulties raising both debt and equity capital on a stand alone basis. For example, J.P. Morgan emphasizes cash flow measures such as FFO Interest Coverage and FFO to debt.[60] Thus,

[59] S&P, "Assessing U.S. Utility Regulatory Environments," March 11, 2010, p. 4.

[60] Susan Voorhees, "The Changing Economic Environment: An Investor Perspective," *J.P. Morgan North America Credit Research*, April 29, 2010, p. 1, presented at the *2010 SURFA Financial Forum*.

like the credit rating agencies, fixed income investors view these credit metrics as important for regulated utilities.

Q. PLEASE SUMMARIZE THIS SECTION OF YOUR TESTIMONY AS IT PERTAINS TO ARIZONA-AMERICAN WATER.

A. Earning a solid cash flow is critical to maintenance of a strong, investment grade credit rating, which in turn is essential for access to capital markets. A regulated company, such as Arizona-American Water (or its parent), must raise debt and equity in the capital markets to finance its capital investment program. Anything that adversely affects cash flow will weaken the Company's credit metrics and increase the cost of debt and possible equity as well. Factors such as the use of a historic test year, delays in recognizing assets in rate base, and rate case moratoria work against the Company's ability to earn the allowed ROE and weakens its credit metrics. Under these circumstances, the Commission should consider allowing a ROE at the upper end of the range of reasonableness to strengthen the Company's credit metrics and to improve the chance that the ROE actually earned will equal its cost of capital.

VI. ARIZONA-AMERICAN WATER'S COST OF EQUITY

Q. WHAT CONCLUSIONS DO YOU DRAW FROM THE ABOVE DATA REGARDING EACH SAMPLE'S COST OF EQUITY AT ARIZONA-AMERICAN WATER'S 45 PERCENT EQUITY RATIO?

A. For the gas LDC sample, the estimated costs of equity from the risk-positioning model and from the DCF model are in line. These estimates are also consistent with the Water sample's risk positioning estimates, but the water sub-sample's risk positioning estimates are higher while the multi-stage DCF estimates for the water sample and subsample are a bit lower. Because the risk positioning estimates for the water sample and for the gas

LDC sample and subsample as well as the DCF estimates for the gas LDC sample are close together and reasonable, these figures deserve the most weight.

Q. DO YOU HAVE ANY COMMENTS REGARDING THE RESULTS OF THE RISK-POSITIONING MODELS?

A. Yes. If any increase in investors' risk aversion and thus the market risk premium is taken into account, the estimates are well above the baseline figures. Also, as noted in Section V above, the fact that Arizona-American Water has been unable to earn its allowed return on equity for a sustained period of time and currently face credit ratios that are problematic indicate that the allowed return on equity, if anything, should be adjusted upward from the estimates derived from the sample companies.

Q. DID YOU CONSIDER ANY OTHER EVIDENCE IN DETERMINING WHETHER ARIZONA-AMERICAN'S REQUESTED RETURN ON EQUITY WAS REASONABLE?

A. Yes. I reviewed recent water utility decisions from the Arizona Corporation Commission and compared the overall rates of return to that requested by Arizona-American Water. Specifically, I compared the overall rate of return allowed by the Commission to that requested by Arizona-American Water using two scenarios. Specifically, I compared the allowed rate of return at the time of the decision to that requested by Arizona-American today.

Q. PLEASE EXPLAIN YOUR COMPARISON TO RECENT COMMISSION DECISIONS.

A. I obtained data on 22 recent Arizona decisions on water and wastewater utilities.[61] The data is summarized in Table 8 below.

Table 8: Summary of Recent Commission Water and Wastewater Decisions[62]

Company	Decision [1]	Date [2]	Common Equity [3]	Allowed Rate of Return on Equity [4]
Bella Vista Water Company	65350	11/1/2002	68.1%	9.1%
Clearwater Utilities	66782	2/13/2004	100.0%	9.1%
Arizona Water Company	66849	3/19/2004	66.2%	9.2%
AZ-American Water Co. (Citizens)	67093	6/30/2004	39.9%	9.0%
Rio Rico Utilities	67279	10/5/2004	100.0%	8.7%
Las Quintas Serenas Water Co.	67455	1/4/2005	100.0%	8.1%
Forest Highlands	67983	7/18/2005	100.0%	8.1%
Pineview Water Co.	67989	7/18/2005	51.0%	8.9%
Chaparral City Water	68176	9/30/2005	58.8%	9.3%
Arizona Water Company	68302	11/14/2005	73.4%	9.1%
AZ-American Water Co. (PV)	68858	7/28/2006	36.7%	10.4%
Black Mountain Sewer	69164	12/5/2006	100.0%	9.6%
Far West Water & Sewer Co.	69335	2/20/2007	56.0%	9.3%
Goodman Water Co.	69404	4/16/2007	100.0%	9.3%
AZ-American Water Co. (Mohave)	69440	5/1/2007	40.0%	10.7%
Gold Canyon Sewer Company	69664	6/28/2007	100.0%	9.2%
Utility Source	70140	1/23/2008	100.0%	8.9%
Cordes Lakes Water Company	70710	2/27/2008	100.0%	10.0%
AZ -American (Sun City Wastewater)	70209	3/20/2008	38.5%	10.6%
AZ-American (Anthem)	70372	6/13/2008	39.2%	8.8%
Arizona Water Company	71845	8/24/2010	45.9%	9.5%
Global Water	71878	9/14/2010	55.5%	9.0%

Arizona-American Water's requested capital structure contains only 45 percent equity which is lower than that of any company in Table 8 other than Arizona-American Water itself. Therefore, Arizona-American Water has a higher level of financial risk and consequently its cost of equity capital is higher. As Arizona-American Water has less equity, a smaller fraction of its rate base gets an equity return while a larger fraction of

[61] The first 17 decisions were provided by Arizona-American and the last five were obtained from the Commission's website (E-dockets). Recommended opinions were not included.

[62] Decision 71878 for Global Water pertains to five districts. Therefore, the data presented in Tables 8 and 9 represent a rate base weighted average of the capital structure and allowed return on debt and equity.

the rate base gets a debt return. Henceforth, the weighted average cost of capital or overall return is not higher than that of other entities. Table 9 below shows the after-tax weighted-average cost of capital inherent in each decision listed in Table 8 using the cost of debt from the relevant decision. This figure is calculated in column [7]. Column [8] reports the corresponding cost of equity at Arizona-American Water's capital structure.

Table 9: Comparing Recent Commission Decisions at 45% Equity

Company	Decision	Common Equity	Allowed Rate of Return on Equity	Long-term Debt	Debt Cost	Implied ATWACC	Implied ROE at AZ-Am Equity %
Bella Vista Water Company	65350	68.1%	9.1%	31.9%	5.9%	7.4%	12.0%
Clearwater Utilities	66782	100.0%	9.1%	0.0%	n/a	9.1%	15.9%
Arizona Water Company	66849	70.1%	9.2%	29.9%	8.5%	8.0%	13.5%
AZ-American Water Co. (Citizens)	67093	39.9%	9.0%	60.1%	4.8%	5.4%	7.6%
Rio Rico Utilities	67279	100.0%	8.7%	0.0%	n/a	8.7%	15.0%
Las Quintas Serenas Water Co.	67455	100.0%	8.1%	0.0%	n/a	8.1%	13.7%
Forest Highlands	67983	100.0%	8.1%	0.0%	n/a	8.1%	13.7%
Pineview Water Co.	67989	51.0%	8.9%	49.0%	5.4%	6.2%	9.4%
Chaparral City Water	68176	58.8%	9.3%	41.2%	5.1%	6.8%	10.7%
Arizona Water Company	68302	73.4%	9.1%	26.6%	8.4%	8.1%	13.6%
AZ-American Water Co. (PV)	68858	36.7%	10.4%	63.3%	5.4%	5.9%	8.9%
Black Mountain Sewer	69164	100.0%	9.6%	0.0%	n/a	9.6%	17.0%
Far West Water & Sewer Co.	69335	56.0%	9.3%	44.0%	5.8%	6.8%	10.8%
Goodman Water Co.	69404	100.0%	9.3%	0.0%	n/a	9.3%	16.3%
AZ-American Water Co. (Mohave)	69440	40.0%	10.7%	60.0%	5.7%	6.4%	9.9%
Gold Canyon Sewer Company	69664	100.0%	9.2%	0.0%	n/a	9.2%	16.1%
Utility Source	70140	100.0%	8.9%	0.0%	n/a	8.9%	15.4%
Cordes Lakes Water Company	70710	100.0%	10.0%	0.0%	n/a	10.0%	17.9%
AZ -American (Sun City Wastewater)	70209	38.5%	10.6%	61.5%	5.5%	6.2%	9.4%
AZ-American (Anthem)	70372	39.2%	8.8%	60.8%	5.4%	5.5%	7.9%
Arizona Water Company	71845	45.9%	9.5%	49.4%	6.8%	6.4%	10.0%
Global Water	71878	55.5%	9.0%	44.5%	6.4%	6.8%	10.7%
Average		71.5%	9.3%	28.3%	6.1%	7.6%	12.5%
Average without AZ-Am		81.1%	9.1%	18.6%	6.5%	8.1%	13.6%
Average without AZ-Am and Companies with 100% Equity		59.8%	9.2%	39.6%	6.5%	7.0%	11.3%

As can be seen from Table 9 above, on an apples-to-apples comparison, the average return on equity allowed by the Commission at Arizona-American Water's targeted capital structure was 12.5 percent for all companies, while an exclusion of both Arizona-American Water and companies that are 100 percent equity financed decreases the comparable cost of equity to 11.3 percent, which is comparable to the Company's requested return on equity. However, the figures above do not consider the increase in the cost of debt that utilities face and therefore underestimate today's ATWACC and hence the implied cost of equity. As the comparable return allowed to water and wastewater utilities in Arizona in recent years is higher than that requested by the

Company, prior Commission decisions indicate that Arizona-American Water's request in this proceeding is conservative.

Q. BASED ON THE EVIDENCE WHAT IS YOUR CONCLUSION REGARDING ARIZONA-AMERICAN WATER'S REQUESTED 11.5 PERCENT RETURN ON EQUITY?

A. Based on the results from my cost-of-capital estimation procedures, I conclude that 11.50 percent return on equity is very reasonable and a conservative request. It is included in both the risk positioning and DCF ranges and close to the majority of the estimates. If Arizona-American Water's financial situation or the increased risk premium is considered, the request is in the lower end of the resulting cost of equity. In addition, the request is conservative when compared to the weighted average cost of capital the Commission has allowed in the past. Therefore, I fully support the Company's request.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

APPENDIX A: QUALIFICATIONS OF DR. BENTE VILLADSEN

Dr. Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused accounting issues, damages, cost of capital and regulatory finance. Among her recent accounting work, she has been involved in accounting disclosure issues and principles including impairment testing, fair value accounting, leases, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. Damages estimation has been performed in the U.S. as well as internationally for companies in the construction, telecommunications, energy, cement, and rail road industry. In the regulatory finance area, Dr. Villadsen has testified on cost of capital, analyzed credit issues in the utility industry as well the impact of regulatory initiatives such as energy efficiency and de-coupling. She has filed testimony before and testified in federal and state court, in international and U.S. arbitrations and before state and federal regulatory commissions. Her testimonies and expert reports pertain to accounting issues, damages, discount rates and cost of capital for regulated entities.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining *The Brattle Group*, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

EXPERIENCE

Regulatory Finance

- Dr. Villadsen has filed several cost of capital testimonies and appeared at hearings for water and wastewater utilities as well as for electric utilities in connection with rate hearings before state and federal regulatory commissions.

- On behalf of water and wastewater utilities, Dr. Villadsen has filed cost of capital testimony in state regulatory proceedings. In recent proceedings, her testimony included an evaluation of the impact of the financial crisis on the cost of capital.

- In a matter before Bonneville Power Administration, Dr. Villadsen filed expert testimony on behalf of customers regarding the cost of capital for electric utilities and the appropriate discount rate to apply to a government entity's cash flows.

- She estimated the cost of capital for major U.S. and Canadian utilities, pipelines, and railroads. The work has been used in connection with the companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface

Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.

- In a matter pertaining to regulatory cost allocation, Dr. Villadsen assisted counsel in collecting necessary internal documents, reviewing internal accounting records and using this information to assess the reasonableness of the cost allocation.

- Dr. Villadsen has worked on estimating the appropriate cost of capital for airport operations in the U.K.

- She has been engaged to estimate the cost of capital or appropriate discount rate to apply to segments of operations such as the power production segment for utilities.

- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.

- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.

- In a regulatory matter, she evaluated the impact of a depreciation proposal on an electric utility's financial metric and also investigated the accounting and regulatory precedent for the proposal.

- For a large integrated utility in the U.S., Dr. Villadsen has for several years participated in a large range of issues regarding the company's rate filing, including the company's cost of capital, incentive based rates, fuel adjustment clauses, and regulatory accounting issues pertaining to depreciation, pensions, and compensation.

- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.

- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.

- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

Accounting and Corporate Finance

- On behalf of a taxpayer, Dr. Villadsen recently testified in federal court on the impact of discount rates on the economic value of alternative scenarios in a lease transaction.

- In an arbitration matter before the International Centre for Settlement of Investment Disputes, she provided expert reports and oral testimony on the allocation of corporate overhead costs and damages in the form of lost profit. Dr. Villadsen also reviewed internal book keeping records to assess how various inter-company transactions were handled.

- Dr. Villadsen provided expert reports and testimony in an international arbitration under the International Chamber of Commerce on the proper application of US GAAP in determining shareholders' equity. Among other accounting issues, she testified on impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.

- In an arbitration matter before the American Arbitration Association, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies. For the purpose of determining whether the classification was appropriate, Dr. Villadsen had to review the company's internal book keeping records.

- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.

- Dr. Villadsen recently assisted counsel in a litigation matter regarding the determination of fair values of financial assets, where there was a limited market for comparable assets. She researched how the designation of these assets to levels under the FASB guidelines affect the value investors assign to these assets.

- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.

- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.

- In a securities fraud matter, Dr. Villadsen evaluated a company's revenue recognition methods and other accounting issues related to allegations of improper treatment of non-cash trades and round trip trades.

- For a multi-national corporation with divisions in several countries and industries, Dr. Villadsen estimated the appropriate discount rate to value the divisions. She also assisted the company in determining the proper manner in which to allocate capital to the various divisions, when the company faced capital constraints.

- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for overhead allocation.

- She has worked on accounting issues in connection with several tax matters. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.

- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.

- In connection with a bankruptcy proceeding, Dr. Villadsen provided litigation support for attorneys and an expert regarding corporate governance.

Damages

- In a tax matter, Dr. Villadsen testified on the economic value of alternative scenarios in a lease transaction.

- For a foreign construction company involved in an international arbitration, she estimated the damages in the form of lost profit on the breach of a contract between a sovereign state and a construction company. As part of her analysis, Dr. Villadsen relied on statistical analyses of cost structures and assessed the impact of delays.

- In an international arbitration, Dr. Villadsen estimated the damages to a telecommunication equipment company from misrepresentation regarding the product quality and accounting performance of an acquired company. She also evaluated the IPO market during the period to assess the possibility of the merged company to undertake a successful IPO.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- Dr. Villadsen was part of a team estimating the damages that may have been caused by a flawed assumption in the determination of the fair value of mortgage related instruments.

- For an electric utility, Dr. Villadsen estimated the loss in firm value from the breach of a power purchase contract during the height of the Western electric power crisis. As part of the assignment, Dr. Villadsen evaluated the creditworthiness of the utility before and after the breach of contract.

- Dr. Villadsen modeled the cash flows of several companies with and without specific power contract to estimate the impact on cash flow and ultimately the creditworthiness and value of the utilities in question.

PUBLICATIONS

"IFRS and Utilities: How the New Standards May Affect You," (with Amit Koshal and Wyatt Toolson), forthcoming *in Public Utilities Fortnightly.*

"Building Sustainable Efficiency Businesses: Evaluating Business Models," (with Joe Wharton and Peter Fox-Penner), *Edison Electric Institute*, August 2008.

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, June 2008.

"Measuring Return on Equity Correctly: Why current estimation models set allowed ROE too low," *Public Utilities Fortnightly*, August 2005 (with A. Lawrence Kolbe and Michael J. Vilbert).

"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute,* April 2005.

"Communication and Delegation in Collusive Agencies," *Journal of Accounting and Economics*, Vol. 19, 1995.

"Beta Distributed Market Shares in a Spatial Model with an Application to the Market for Audit Services" (with M. Hviid), *Review of Industrial Organization*, Vol. 10, 1995.

PRESENTATIONS

"Regulatory Issues from GAAP to IFRS," NASUCA *2009 Annual Meeting*, Chicago, November 2009.

"Subprime Mortgage-Related Litigation: What to Look for and Where to Look," *Law Seminars International: Damages in Securities Litigation*, Boston, May 2008.

"Evaluating Alternative Business / Inventive Models," (with Joe Wharton). *EEI Workshop, Making a Business of Energy Efficiency: Sustainable Business Models for Utilities*, Washington DC, December 2007.

"Deferred Income Taxes and IRS's NOPR: Who should benefit?" *NASUCA Annual Meeting*, Anaheim, CA, November 2007.

"Current Issues in Cost of Capital," (with M.J. Vilbert). *EEI Electric Rates Advanced Course*, Madison, 2005.

"Issues for Cost of Capital Estimation," (with M.J. Vilbert). *EEI Cost of Capital Conference*, Chicago, 2004.

"Discussion of 'Are Performance Measures Other Than Price Important to CEO Incentives?'" *Annual Meeting of the American Accounting Association*, 2000.

"Contracting and Income Smoothing in an Infinite Agency Model: A Computational Approach," (with R.T. Boylan) *Business and Management Assurance Services Conference*, Austin 2000.

TESTIMONY IN REGULATORY SETTINGS

Direct Testimony on the cost of capital before *the New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 09-00156-UT, August 2009.

Direct and Rebuttal Testimony and Hearing Appearance on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-09-0343, July 2009, March 2010 and April 2010.

Direct Testimony, Rebuttal Testimony and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 08-00134-UT, June 2008 and January 2009.

Direct Testimony on cost of capital and carrying charge on damages, U.S. Department of Energy, *Bonneville Power Administration*, BPA Docket No. WP-07, March 2008.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-08-0227, April 2008, February 2009, March 2009.

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0491, July 2006, July 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, Supplemental Rejoinder Testimony and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0403, June 2006, April 2007, May 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, and Hearing Appearance on cost of capital before *the Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0014, January 2006, October 2006, November 2006.

OTHER TESTIMONY

Rebuttal Expert Report, Deposition and Oral Testimony re. the impact of alternative discount rate assumptions in tax litigation. *United States Court of Federal Claims*, Case No. 06-628 T, January, February, April 2009. (*Confidential*)

Expert Report, Supplemental Expert Report, and Hearing Appearance on the allocation of corporate overhead and damages from lost profit. *The International Centre for the Settlement of Investment Disputes*, Case No. ARB/03/29, February, April, and June 2008 (*Confidential*).

Expert Report on accounting information needed to assess income. *United States District Court* for the District of Maryland (Baltimore Division), Civil No. 1:06cv02046-JFM, June 2007 (*Confidential*)

Expert Report, Rebuttal Expert Report, Hearing Appearance regarding investing activities, impairment of assets, leases, shareholder' equity under U.S. GAAP and valuation. *International Chamber of Commerce* (ICC), Case No. 14144/CCO, May 2007, August 2007, September 2007. (*Confidential*)

Expert report, rebuttal expert report, and deposition on behalf of a major oil company regarding the equity method of accounting and classification of debt and equity, *American Arbitration Association*, August 2004 and November 2004. (*Confidential*).

APPENDIX B

SELECTING THE WATER AND GAS LDC SAMPLES AND THE USE OF MARKET VALUES

I. SAMPLE SELECTION AND THE CHARACTERISTICS OF EACH SAMPLE

A. The Water Sample

Q1. How did you select your sample of water utilities?

A1. The goal was to create a sample of companies whose primary business is as a regulated water utility with business risk generally similar to that of Arizona-American Water. To construct this sample, I started with the universe of water utility companies for which *Value Line Investment Survey* - Plus Edition provides information sheets. I then eliminated Sun Hydraulics because, although listed as a water utility, its operations consist mainly of producing industrial equipment.[1]

Usually, I apply several additional selection criteria to eliminate companies with unique circumstances that may affect the cost of capital estimates. For example, I normally eliminate companies with annual revenues lower than $300 million in 2009,[2] no or low bond ratings, lack of growth estimates or Bloomberg data, and all companies with announced dividend cuts or that were involved in significant merger activity over the last five years (2005 to today). However, applying these procedures to the ten water utilities followed by *Value Line* would eliminate several companies from a sample that is already limited. I therefore try to balance stringent selection criteria against the need to have a reasonable sample size. Therefore, I use of all ten companies to form the full sample: American States Water Co., American Water Works, Aqua America Inc., California Water Service Group, Connecticut Water Service Inc., Middlesex Water Co., Pennichuck Corp., SJW Corp., Southwest Water Co., and York Water Co. I form subsamples for the analyses - - consisting of those companies that have sufficient data for analysis at hand (DCF or risk positioning). I also eliminate Southwest Water from the subsample, and

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[1] According to the company's webpage (www.sunhydraulics.com), it develops and manufactures valves and manifolds. Bloomberg lists it as part of its "metal fabricate/hardware" industry group.

[2] *Value Line* provides information on revenues and Table No. BV-2 and its associated workpapers report the share of regulated assets in 2009 for these companies. (Table No. BV-1 provides an index to the other tables.)

from the DCF analysis, because the company currently pays no dividend and because it has restated its financial statements filed with the Securities and Exchange Commission ("SEC") for 2006, 2007 and the first half of 2008.[3] Therefore, its use may bias the cost of capital estimation.[4]

Q2. Why do you usually eliminate companies currently involved in a merger from your samples?

A2. The stock prices of companies involved in mergers are often more affected by news relating to the merger than by movements in the stock market. In other words, the stock price "decouples" from its normal relationship to the stock market (the economy) which is the basis upon which a company's relative risk is calculated. Instead the stock price of a merger candidate is more affected by the latest speculation on the terms and probability of the merger.

Q3. What are some of the water sample's data problems?

A3. First, of the ten water utilities with sufficient data for analysis that Value Line follows, four companies (Connecticut Water, Middlesex Water, Pennichuck, and York Water) have 2009 revenues below $100 million and these four companies also have a market capitalization below $300 as of September 2010.[5] The stocks of small companies frequently exhibit "thin trading" which means that their stock trades infrequently.

Second, five companies lack long-term earnings forecasts from BEst and one company has an estimate that is not meaningful from *Value Line*. In addition, the existing growth rates estimates are highly variable, ranging from a low of 1.1 percent to a high of 14.3 percent (excluding Southwest Water's growth estimate). Such highly variable growth

[3] See, Southwest Water Company, "SouthWest Water Company Completed Comprehensive Financial Review of Prior Years' Financial Results," Press Release, July 9, 2009.

[4] For example, *Value Line* expects Southwest Water's earnings per share to grow in excess of 90% annually over the next 4 years, which is caused by earnings currently being very low. It is difficult to interpret these figures.

[5] The *Value Line* sheets for the sample companies contain revenues information and Table No. BV-3 provides information on current market capitalization.

rates are not indicative of an industry that is stable and cast doubt on the applicability of the DCF model to this industry at this time.

Third, individual companies in the sample have unique characteristics. For example, the fact that Aqua America is "an active participant in the ongoing consolidation within the water service industry"[6] has impacted the market perception and hence risk measures of the company. Similarly, SouthWest Water's financial restatement and its plans to be acquired have almost certainly impacted its stock price, growth rate, and systematic risk.[7]

These factors may all potentially affect the cost of equity estimates in ways not completely predictable. This is especially true for the DCF estimates which rely exclusively on current data, so that recent events impact the measurement 100 percent. Because of the data problems and the lack of a large number of publicly traded water utilities, I include all publicly traded companies with sufficient data in the full sample but also create a subsample without SouthWest Water and without companies that lack data for the analysis at hand; e.g., growth rates in the DCF analysis or less than five years' of data for the risk positioning method.

B. The Gas Local Distribution Companies Sample

Q4. How do you select your gas local distribution company sample?

A4. To select this sample, I started with the universe of publicly traded natural gas utilities covered by Value Line Investment Survey – Plus Edition.[8] This resulted in an initial group of 25 companies that are followed by *Value Line*. I then eliminated companies by applying additional selection criteria designed to eliminate companies with unique circumstances which may bias the cost of capital estimates. Sample companies must own substantial gas distribution assets, must not exhibit any signs of financial distress, must have revenues greater than $300 million, and must not be involved in any substantial

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[6] *Value Line Investment Industry*, Aqua America, July 23, 2010.

[7] *Value Line Investment Survey*, Southwest Water Co., July 23, 2010.

[8] *Value Line Investment Survey*, Plus Edition, September 10, 2010.

merger and acquisition ("M&A") activities that could bias the estimation process. I require that companies have an investment grade credit rating, a high percentage of gas distribution assets (greater than 50 percent), no significant merger activity in recent years (i.e., January 2007 to June 2010), and no dividend cuts during the past five years and no other activity that could cause the growth rates or beta estimates to be biased. I also require data from S&P or Moody's, *Value Line*, and Bloomberg be available for all sample companies. The selection criteria results in a sample of 11 companies.

Q5. Are there any issues with the remaining companies in your sample?

A5. Possibly. There are three companies in the sample, Atmos, New Jersey Resources Corp, and NiSource, that are not "pure play" gas LDCs. For example, Atmos has significant involvement in natural gas intrastate pipelines and intrastate storage segments. Also, a large portion of its income comes from natural gas marketing activities. New Jersey Resources Corp has had significant income from wholesale energy and gas marketing services in some of the recent years. NiSource has a diversified business with large intrastate transportation and storage segments as well as a large electric generation segment. As a result I create a sub-sample of those companies that are close to being a pure-play in the natural gas distribution segment. The sub-sample consists of AGL Resources, Laclede Group Inc., Nicor Inc., Northwest Natural Gas, Piedmont Natural Gas, South Jersey Industries, Southwest Gas and WGL Holdings.

Q6. What are the characteristics of the sample of gas local distribution companies you have chosen?

A6. The gas LDC sample is comprised of regulated companies whose primary source of revenues and majority of assets are in the regulated portion of the natural gas distribution industry. The final sample consists of the eleven gas LDCs from which I form a subsample of eight companies with no data issues. The purpose of the sub-sample is to guard against the possibility of unknown bias in the cost of capital estimates.

Q7. Please compare the characteristics of the water utility sample and the gas LDC sample.

A7. Both samples consist of companies with substantial capital investments in distribution facilities. Specifically, both water and gas utilities are characterized by operating large distribution systems for a mixture of residential, commercial, and industrial customers. Also, companies in both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. For both samples, I construct a subsample consisting of companies with fewer data issues. While all companies in the water sample have more than 80% of their assets subject to regulation (see Table No. BV-2), 4 of the 11 companies in the gas LDC sample have 50-79% regulated assets, but only one company has less than 70% regulated assets (See Table BV-14 and Workpaper #1 to Table BV-14). All companies in the water utility and gas LDC sample are regulated by one or more states.

Q8. What do you conclude from the comparison of the water utility and the gas LDC samples?

A8. Water and wastewater utilities like gas LDC companies are state regulated entities that invest in pipes, mains, and storage facilities. In addition, both industries face substantial infrastructure investments going forward, so aspects of their operations are very similar. Because the two industries typically have the same regulator, similar customer mix and similar infrastructure, many current issues are similar (e.g., declining usage, increasing bad debt). One difference is that while Gas LDC companies only rarely develop their commodity (gas), water utilities usually do. Given the many similarities, the gas LDC sample is a suitable benchmark for the water industry's cost of capital.

II. MARKET VALUE CAPITAL STRUCTURE, COSTS OF DEBT & COSTS OF PREFERRED EQUITY

Q9. What capital structure information do you require?

A9. For reasons discussed in my written evidence and explained in detail in Appendix E, explicit evaluation of the market-value capital structures of the sample companies versus the capital structure used for rate making is vital for a correct interpretation of the market evidence. This requires estimates of the market values of common and preferred equity and debt, and the current market costs of preferred equity and debt.

Q10. How do you calculate the market-value capital structures of the sample companies?

A10. I estimate the capital structure for each company by estimating the market values of common equity, preferred equity and debt from publicly available data. The calculations are in Panels A to J of Table No. BV-3 and Panels A to K of Table No. BV-15 for the water and gas LDC sample, respectively.

The market value of equity is straightforward: the price per share times the number of shares outstanding. The market value of preferred equity is set equal to its book value because the portion of the capital structure financed with preferred equity is generally small. The market value of debt is estimated at the book value of debt reported by Bloomberg plus or minus the difference in the estimated fair (market) value and book value of long-term debt as reported in the companies' 10-Ks or annual reports.[9]

For purposes of assessing financial risk to common shareholders, I add an adjustment for short-term debt to the debt portion of the capital structure. This adjustment is used only for those companies whose short-term (current) liabilities exceed their short-term

[9] See Panels A through J in Table No. BV-3 and Panels A through K in Table BV-15 for details. The adjustment relies on the difference between the companies' self-reported fair value of long-term debt and the carrying value of the same line items. This information was obtained from the sample companies' annual reports.

(current) assets. I add an amount equal to the minimum of the difference between short-term liabilities and short-term assets or the amount of short-term debt. The reason for this adjustment is to recognize that when current liabilities exceed current assets, a portion of the company's long-term assets are being financed, in effect, by short-term debt.

The market value capital structure is calculated to be consistent with the time period over which the cost of capital is estimated for each sample. The capital structure is determined over the historical period over which the relevant risk positioning parameters were determined and as of the date analysts provide forward looking growth forecasts. Therefore, Tables No. BV-3 and BV-15 report the market value capital structure at year end for the years ending 2005 – 2009 and as of Q2, 2010.[10] The output of each of these tables is the market equity-to-value, debt-to-value, and preferred equity-to-value ratios. The overall cost of capital calculation for the risk positioning estimates rely on the average of the market value capital structure computed for the years 2005 through Q2, 2010 as shown in Tables No. BV-4 and BV-16, respectively. The results in columns [1]-[3] are used in the DCF model calculations, while columns [4]-[6] are for the risk positioning models.

Q11. How do you estimate the current market cost of preferred equity?

A11. For companies with preferred equity, the cost of preferred equity for each company was set equal to the yield on an index of preferred stock as reported in the Mergent Bond Record corresponding to the S&P rating of that company's debt. The yields from Mergent Bond Record were as of September 2010. In general, the amount of preferred equity in the sample companies' capital structures is very small or zero and no company had more than 1% preferred (Tables No. BV-4 and BV-16)

[10] For American Water Works only data for 2008 through Q2, 2010 were used as the company only became publicly traded in 2008.

Q12. How do you estimate the current market cost of debt?

A12. The market cost of debt for each company in the DCF analysis is the current yield reported by Bloomberg for a public utility company bond corresponding to the sample company's current debt rating as classified by S&P. The risk positioning analysis, on the other hand, uses the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used to estimate company betas. The current S&P debt ratings were obtained from Bloomberg.[11]

The 15-day yield on Moody's A-rated Utility bonds was 4.95 percent as of September 15, 2010, and 5.49 percent on Moody's BBB-rated Utility bonds. (See Workpaper #1 to Table No. BV-11 for the yields on utility bonds and preferred stock by credit rating.) Based on information from the Company, the corporate tax rate was set at 38.6 percent. Calculation of the after-tax cost of debt uses the marginal tax rate 38.6 percent.

[11] Debt ratings were not available for Pennichuck Corp., SJW Corp, and Southwest Water Co.'s. I assumed a rating in the A category (A+, A, or A-), which is the same as that of all other water utilities in the sample.

APPENDIX C

RISK POSITIONING METHODOLOGY AND RESULTS

Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the risk positioning methodologies, describes the estimation of the parameters used in the models, and details the cost of capital estimates obtained from these methodologies. This appendix intentionally repeats portions of my direct testimony, because I want the reader to be able to have a full discussion of the issues addressed here, rather than having to continually turn back to the corresponding section of the testimony.

I. EQUITY RISK PREMIUM METHODOLOGY

Q2. How is this section of the appendix organized?

A2. It first reviews the basic nature of the equity risk premium approach. It then discusses the individual components of the model: the risk premium, the relative risk of the company or line of business in question, the appropriate interest rate, and the combination of these elements in a particular equity risk premium model.

A. THE BASIC EQUITY RISK PREMIUM MODEL

Q3. How does the equity risk premium model work?

A3. The equity risk premium approach estimates the cost of equity as the sum of a current interest rate and a risk premium. (It therefore is sometimes also known as the "risk premium" or the "risk positioning" approach.)

This approach may sometimes be applied informally. For example, an analyst or a commission may check the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at one time, and then apply that spread to changed interest rates to get a new estimate of the cost of capital at another time.

More formal applications of the equity risk premium method implement theoretical finance models of cost of capital. They use information on all securities to identify the security market line (Figure 1 in the body of the testimony) and derive the cost of capital

for the individual security based on that security's relative risk. This equity risk premium approach is widely used and underlies most of the current scholarly research on the nature, determinants and magnitude of the cost of capital.

Q4. How are "more formal applications" put into practice?

A4. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the equity risk premium approach the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

In principle, there may be more than one factor affecting the expected stock return, each with its own security-specific measure of relative risk and its own benchmark risk premium. For example, the "arbitrage pricing theory" and other "multi-factor" models have been proposed in the academic literature. These models estimate the cost of capital as the sum of a risk-free rate and several security-specific risk premia. However, none of these alternative models has emerged in practice as "the" improvement to use instead of the original, single-factor model. I use the traditional single-factor model in this testimony.

Accordingly, the required elements in my formal equity risk premium approach are the market risk premium, an objective measure of relative risk, the risk-free rate that corresponds to the measure of the market risk premium, and a specific method to combine these elements into an estimate of the cost of capital.

B. MARKET RISK PREMIUM

Q5. Why is a risk premium necessary?

A5. Experience (e.g., the recent financial crisis and the U.S. market's October Crash of 1987) demonstrates that shareholders, even well diversified shareholders, are exposed to

enormous risks. By investing in stocks instead of risk-free Government bills, investors subject themselves not only to the risk of earning a return well below what they expected in any year but also to the risk that they might lose much of their initial capital. This is why investors demand a risk premium.

Because short-term risk-free rates currently are influenced substantially by monetary policy, I estimate only a long-term version of the Capital Asset Pricing Model ("CAPM") for this proceeding. This version of the CAPM measures the market risk premium as the risk premium of average risk common stocks over the long-term risk-free rate. The use of the long-term version of the CAPM is consistent with the Commission Staff's past practice.[1]

Q6. Please discuss some of the issues involved in selecting the appropriate MRP.

A6. To determine the cost of capital in a regulatory proceeding, the MRP should be used with an estimate of the same interest rate used to calculate the MRP (i.e., the short-term Treasury bill rate or the long-term Government rate). For example, it would be inconsistent to utilize a short-term risk-free with an estimate of the MRP derived from comparisons to long-term interest rates. In addition, the appropriate measure of the MRP should be based upon the arithmetic mean not the geometric mean return.[2] The arithmetic mean is the simple average while the geometric mean is the compound rate of return between two periods.

Q7. How do you estimate the MRP?

A7. There is presently little consensus on "best practice" for estimating the MRP, which does not mean that each approach is equally valid. For example, the leading graduate textbook in corporate finance, after recommending use of the arithmetic average realized excess return on the market for many years (which for a while was noticeably over 9 percent), now reviews the current state of the research and expresses the view that the a range

[1] See, for example, Direct Testimony of Juan C. Manrique in Docket No. W-01303A-09-0343, Schedule JCM-3. In this testimony, Staff relied on the both a 5, 7, 10-year government bond measure as well as the 30-year government bond measure.

[2] See, for example, Morningstar, *Ibbotson IBBS Valuation Yearbook 2010*, p. 55-56.

between 5 to 8 percent is reasonable for the U.S.[3] At the same time, Dimson, Marsh, and Staunton (2010) estimate that the average arithmetic risk premium of stocks *over bonds* in the U.S. was 6.3% for the period 1900 to 2009.[4] In a recent proceeding the Surface Transportation Board ("STB") decided to switch from a DCF model to the CAPM model when estimating the cost of equity for U.S. railroads. The STB further decided to rely on the arithmetic risk premium of stocks over long-term bonds as reported in Morningstar / Ibbotson (at the time 7.1 percent).[5]

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect. I consider the historical difference in returns between the Standard and Poor's 500 Index ("S&P 500") and the risk-free rate, recent academic literature on the MRP and the results of recent surveys to estimate the market risk premium.

Q8. Please summarize your conclusions on the MRP literature.

A8. Some research based upon U.S. data challenges the conventional wisdom of using the arithmetic average historical excess returns to estimate the MRP. However, after reviewing the issues in the debate, I remain skeptical for several reasons that the market risk premium has declined in the U.S. Instead, the recent financial crisis and the increased volatility in financial markets have likely increased investors risk aversion.[6]

First, despite eye-catching claims like "equity risk premium as low as three percent,"[7] and "the death of the risk premium,"[8] not all recent research arrives at the same

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[3] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 9th edition, 2008, pp. 173-180.

[4] Credit Suisse, "*Global Investment Returns Yearbook 2010*," Table 10.

[5] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

[6] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, pp 3.

[7] Claus, J. and J. Thomas, (2001), "Equity Risk Premium as Low as Three Percent: Evidence from Analysts' Earnings Forecasts for Domestic and International Stocks," *Journal of Finance* 56:1629-1666.

conclusion. In his presidential address to the American Finance Association in 2001, Professor Constantinides seeks to estimate the unconditional equity premium based on average historical stock returns.[9] (Note that this address was based upon evidence just before the major fall in market value.) He adjusts the average returns downward by the change in price-earnings ratio because he assumes no change in valuations in an unconditional state. His estimates for 1926 to 2000 and 1951 to 2000 are 8.0 percent and 6.0 percent, respectively, over the 3-month T-bill rate. In another published study in 2001, Professors Harris and Marston use the DCF method to estimate the market risk premium for the U.S. stocks.[10] Using analysts' forecasts to proxy for investors' expectation, they conclude that over the period 1982-1998 the MRP over the *long-term* risk-free rate is 7.14 percent. As yet another example, the paper by Drs. Ibbotson and Chen (2003) adopts a supply side approach to estimate the forward looking long-term sustainable equity returns and equity risk premium based upon economic fundamentals. Their equity risk premium over the *long-term* risk-free rate is estimated to be 3.97 percent in geometric terms and 5.90 percent on an arithmetic basis. They conclude their paper by stating that their estimate of the equity risk premium is "far closer to the historical premium than being zero or negative."[11]

Second, Professor Ivo Welch surveyed a large group of financial economists in 1998 and 1999. The average of the estimated MRP was 7.1 percent in Prof. Welch's first survey and 6.7 percent in his second survey which was based on a smaller number of individuals. A subsequent survey[12] by Prof. Welch reported only a 5.5 percent MRP.[13] In

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[8] Arnott, R. and R. Ryan, (2001), "The Death of the Risk Premium," *Journal of Portfolio Management* 27(3):61-84.

[9] Constantinides, G.M. (2002), "Rational Asset Prices," *Journal of Finance* 57:1567-1591.

[10] Robert S. Harris and Felicia C. Marston, "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," *Journal of Applied Finance* 11 (1) 6-16, 2001.

[11] Ibbotson, R. and P. Chen (2003), "Stock Market Returns in the Long Run: Participating in the Real Economy," *Financial Analyst Journal*, 59(1):88-98. Cited figures are on p. 97.

[12] Ivo Welch (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 73(4):501-537. The cited figures are in Table 2, p. 514.

[13] Ivo Welch (2001), "The Equity Premium Consensus Forecast Revisited," School of Management at Yale University working paper. The cited figure is in Table 2.

characterizing these results Prof. Welch notes that "[T]he equity premium consensus forecast of finance and economics professors seems to have dropped during the last 2 to 3 years, a period with low realized equity premia."[14] However, in the most recent survey,[15] conducted in December 2007, Prof. Welch finds that the average estimate has increased to about 5.7 percent.

The above quotation from Prof. Welch emphasizes the caution that must attend survey data even from knowledgeable survey participants: the outcome is likely to change quickly with changing market circumstances.

Third, some of the evidence for negative or close to zero market risk premium simply does not make sense. Despite the relatively high valuation levels, stock returns remain much more volatile than Treasury bond returns. I am not aware of any empirical or theoretical evidence showing that investors would rationally hold equities and not expect to earn a positive risk premium for bearing their higher risk.

Fourth, I am unaware of a convincing theory for why the future MRP should have substantially declined. At the height of the stock market bubble in the U.S., many claimed that the only way to justify the high stock prices would be if the MRP had declined dramatically,[16] but this argument was heard less frequently after the market declined substantially from its tech bubble high. All else equal, a high valuation ratio such as price-earnings ratio implies a low required rate of return, hence a low MRP. However, there is considerable debate about whether the high level of stock prices (despite the burst of the internet bubble from its high in the summer of 2000) represents the transition to a new economy or is simply an "irrational exuberance," which cannot be sustained for the long term. If the former case is true, then the MRP may have decreased

[14] *Ibid*, p. 8.

[15] See Ivo Welch (2008), "The Consensus Estimate for the Equity Premium by Academic Financial Economists in December 2007," School of Management at Yale University working paper. The cited figure is in Table 2.

[16] See Robert D. Arnott and Peter L. Bernstein, "What Risk Premium is 'Normal'?," *Financial Analysts Journal* 58:64-85, for an example.

permanently. Conversely, the long-run MRP may remain the same even if expected market returns in the short-term are smaller.

Another common argument for a lower expected MRP is that the U.S. experienced very remarkable growth in the 20th century that was not anticipated at the start of the century. As a result, the average realized excess return is overestimated meaning the standard method of estimating the MRP would be biased upward. However, one recent study by Professors Jorion and Goetzmann finds, under some simplifying assumptions, that the so-called "survivorship bias" is only 29 basis points.[17] Furthermore, "[I]f investors have overestimated the equity premium over the second half of the last century, Constantinides (2002) argues that 'we now have a bigger puzzle on our hands' Why have investors systematically biased their estimates over such a long horizon?"[18]

To sum up the above, I cite two passages from Profs. Mehra and Prescott's review of the theoretical literature on equity premium puzzle:[19]

> Even if the conditional equity premium given current market conditions is small, and there appears to be general consensus that it is, this in itself does not imply that it was obvious either that the historical premium was too high or that the equity premium has diminished.
>
> In the absence of this [knowledge of the future], and based on what we currently know, we can make the following claim: over the long horizon the equity premium is likely to be similar to what it has been in the past and the returns to investment in equity will continue to substantially dominate that in T-bills for investors with a long planning horizon.

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[17] Jorion, P., and W. Goetzmann (1999), "Global Stock Markets in the Twentieth Century," *Journal of Finance* 54:953-980. Dimson, Marsh, and Staunton (2003) make a similar point when they comment on the equity risk premia for 16 countries based on returns between 1900 and 2001: "While the United States and the United Kingdom have indeed performed well, compared to other markets there is no indication that they are hugely out of line." p.4.

[18] Mehra, R., and E.C. Prescott (2003), "The Equity Premium in Retrospect," in *Handbook of the Economics of Finance*, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier B.V, p. 926

[19] *Ibid*, p. 926.

Q9. Is there other scholarly support for the conclusion?

A9. Yes. Another line of research was pursued by Steven N. Kaplan and Richard S. Ruback. They estimate the market risk premium in their article, "The Valuation of Cash Flow Forecasts: An Empirical Analysis."[20] Professors Kaplan and Ruback compare published cash flow forecasts for management buyouts and leveraged recapitalization over the 1983 to 1989 period against the actual market values that resulted from these transactions. One of their results is an estimate of the market risk premium over the long-term Treasury bond yield that is based on careful analysis of actual major investment decisions, not realized market returns. Their median estimate is 7.78 percent and their mean estimate is 7.97 percent.[21] This is considerably higher than my estimate of 6.5 percent. Even if the maturity premium of Treasury bonds over Treasury bills were only 1 percent, well below the best estimate of 1.5 percent the resulting estimate of the market risk premium over Treasury bills is higher than my estimate of 8.0 percent.

Q10. In addition to the scholarly articles and survey evidence you discussed in Section I of your Direct Testimony, what other evidence do you consider to estimate the MRP?

A10. I also consider the long-run realized equity premia reported in Morningstar's Ibbotson SBBI Valuation Yearbook 2010. The data provided cover the period 1926 through 2009. The results are discussed below.

Q11. What is the "long-run realized risk premium" in the U.S.?

A11. From 1926 to 2009, the full period reported, Morningstar's data show that the average premium of stocks over Treasury bills is 8.1 percent. I also examine the "post-War" period. The risk premium for 1947-2009 is 7.9 percent.[22] (I exclude 1946 because its economic statistics are heavily influenced by the War years; e.g., the end of price controls yielded an inflation rate of 18 percent. It is not really a "post-War" year, from an economic viewpoint.) These averages usually change slightly when another year of data

[20] *Journal of Finance*, 50, September 1995, pp. 1059-1093.

[21] *Ibid*, p. 1082.

[22] Morningstar, *Ibbotson SBBI Valuation Yearbook 2010*, Appendix A, Table A-3.

is added to the Ibbotson series, but the effect of adding 2008 was far from trivial due to the ongoing financial turmoil. The average premium of stocks over the income returns on long-term Government bonds is 6.7 percent for the 1926 to 2009 period.

Prior to the economic crisis that started in the second half of 2008, there had been a great deal of academic research on the MRP. This research put practitioners in a dilemma: there was nothing close to a consensus about how the MRP should be estimated, but a general agreement in the academic community seemed to be emerging that the old approach of using the average realized return over long periods gave too high an answer. Realized returns were negative in 2008 and caused the observed long-term risk premium to fall, but the MRP currently exceeds the average of realized returns because of increased risk aversion among investors.[23]

Q12. Do you have any additional comments on your choice of the MRP?

A12. Yes. All of the debate discussed above has taken place before the current financial turmoil, ensuing economic downturn, and highly uncertain timing of recovery. As discussed at length in my direct testimony, the recent events in the financial markets have likely increased investors risk aversion. Therefore, there are strong reasons to expect that the current level of the MRP may in fact be significantly higher than what has been reported traditionally and higher than the base level MRP that I use in my testimony.

Q13. Have any of the prior academic studies shed any light on why the MRP would be higher under current circumstances?

A13. Yes. First and foremost, the standard consumption-based asset pricing theory suggests that, all else equal, higher risk aversion implies higher MRP.[24] To the extent that there has been an adverse shock to risk aversion of investors, the MRP is likely to have increased.

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[23] See, for example, *The Economist*, "A Bull Market in Pessimism," August 21st to 27th, 2010, pp. 59-60.

[24] See, for example, Mehra and Prescott (1985).

Second, the academic literature contains studies of the impact of recessions on investors' attitude towards risk. These studies find that the risk aversion and hence the risk premium required to hold equity rather than debt increases in economic downturns. Several articles suggest that the market risk premium is higher during times of recession. Constantinides (2008) studies a classical utility model where consumers are risk averse and also summarizes some of the empirical literature. Constantinides draws from empirical evidence that shows that consumers become risk averse in times of economic recession or downturn, and equity investments accentuate this risk.[25] (Increased risk aversion leads to a higher expected return for investors before they will invest.) Specifically, equities are pro-cyclical and decline in value when the probability of a job loss increases; thus, they fail to hedge against income shocks that are more likely to occur during recessions.[26] Consequently, investors require an added risk premium to hold equities during economic downturns:

> In economic recessions, investors are exposed to the double hazard of stock market losses and job loss. Investment in equities not only fails to hedge the risk of job loss but also accentuates its implications. Investors require a hefty equity premium in order to be induced to hold equities. This is the argument that I formalize below and address the predictability of asset returns and their unconditional moments.[27]

And

> The first implication of the theory is an explanation of the counter-cyclical behavior of the equity risk premium: the risk premium is highest in a recession because the stock is a poor hedge against the uninsurable income shocks, such as job loss, that are more likely to arrive during a recession.
>
> The second implication is an explanation of the unconditional equity premium puzzle: even though per capita consumption growth is poorly correlated with stocks returns, investors require a hefty premium to hold

[25] Constantinides, G. M., "Understanding the equity risk premium puzzle". In R. Mehra, ed., *Handbook of the Equity Risk Premium*, 2008, Elsevier, Amsterdam.

[26] Constantinides, G.M., and D. Duffie (1996), "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy*, Vol. 104 (2): 219-240.

[27] G.M. Constantinides (2008), "Understanding the equity risk premium puzzle." In R. Mehra, ed., *Handbook of the Equity Risk Premium*. Elsevier, Amsterdam.

> stocks over short-term bonds because stocks perform poorly in recessions, when the investor is most likely to be laid off.[28]

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson (2004)[29] find that

> When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.[30]

Additionally, in their article that won the annual Smith-Breeden Paper Award given by the American Finance Association and the *Journal of Finance*, Bansal and Yaron (2004) demonstrate that economic uncertainty plays an important role in explaining the MRP.[31] In particular, they show that uncertainty is priced in the market. In their model, higher uncertainty (measured in their paper by volatility of consumption) leads to higher conditional MRP. Another implication of the analysis in Bansal and Yaron (2004) is that even the unconditional MRP can increase if any of the following materialize: (i) investors become more risk-averse; (ii) shocks to economic uncertainty become more pronounced; (iii) periods of high economic uncertainty become longer lasting. To the extent that risk aversion has experienced an adverse shock, the MRP must have increased. Furthermore, perception of more severe shocks to economic uncertainty and slower decay of higher uncertainty periods are likely to cause the MRP to remain higher even in the absence of any shock to the risk aversion parameter.

Gabaix (2010) provides an alternative channel for interrelating time-varying risk premium in his newly circulated working paper.[32] The argument is that the MRP is

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[28] *Ibid*, p. 353.

[29] C-J. Kim, J.C. Morley and C.R. Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium," *Journal of Money, Credit and Banking*, Vol. 36.

[30] *Ibid.* p. 357. The authors rely on a statistical (Markov-switching) model of the ARCH type and data for the period 1926 to 2000 for their analysis.

[31] Bansal, R., and A. Yaron (2004), "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles", *Journal of Finance*, Vol. 59 (4): 1481-1509.

[32] Gabaix, X. (2010), "Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro Finance", *Working Paper, New York University Stern School of Business* and *NBER*.

linked to the fear of rare but large "disasters". The time-varying nature of the severity of those disasters leads to time-varying risk premium. To the extent we are still recovering from an economic downturn of a magnitude not seen since the times of the Great Depression, I find the argument presented in the above mentioned paper to be supportive of the idea that currently the MRP is higher than its normal level.

As shown in Figure 5 in my written evidence, the volatility in both the stock market spiked to 4 times the normal level of a bit below 20 percent during the financial crisis. Current volatility is still above historical averages.

Q14. What is your conclusion regarding the MRP?

A14. Estimation of the MRP remains controversial. There is no consensus on its value or even how to estimate it. Given a careful review of all of the information, I estimate the risk premium for average risk stocks to be 6.5 percent over long-term Government bonds prior to the crisis in the U.S. economy. At this time, an additional upward adjustment likely is warranted in recognition of the unsettled condition of the capital markets. Therefore, I report the sensitivity of the results to an upward adjustment of ½ and 1 percent in Tables 7 and 8 of my direct testimony. Section II.C explains the details of the sensitivity analyses.

C. RELATIVE RISK

Q15. How do you measure relative risk?

A15. The risk measure I examine is the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates. It is the most commonly used measure of risk in capital market theories.

Q16. Please explain beta in more detail.

A16. The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification.

Diversification is a vital concept in the study of risk and return. (Harry Markowitz won a Nobel Prize for work showing just how important it was.) Over the long run, the rate of return on the stock market has a very high standard deviation, on the order of 15 - 20 percent per year. But many individual stocks have much higher standard deviations than this. The stock market's standard deviation is "only" about 15 - 20 percent because when stocks are combined into portfolios, some of the risk of individual stocks is eliminated by diversification. Some stocks go up when others go down, and the average portfolio return — positive or negative — is usually less extreme than that of individual stocks within it.

In the limiting case, if the returns on individual stocks were completely uncorrelated with one another, the formation of a large portfolio of such stocks would eliminate risk entirely. That is, the market's long-run standard deviation would be not 15-20 percent per year, but virtually zero.

The fact that the market's actual annual standard deviation is so large means that, in practice, the returns on stocks are correlated with one another, and to a material degree. The reason is that many factors that make a particular stock go up or down also affect other stocks. Examples include the state of the economy, the balance of trade, and inflation. Thus some risk is "non-diversifiable". Single-factor equity risk premium models derive conditions in which all of these factors can be considered simultaneously, through their impact on the market portfolio. Other models derive somewhat less restrictive conditions under which several of them might be individually relevant.

Again, the basic idea behind all of these models is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification, because there are a large number of large portfolios whose managers actively seek the best risk-reward tradeoffs available. Of course, undiversified investors would like to get a premium for bearing diversifiable risk, but they cannot.

Q17. Why not?

A17. Well-diversified investors compete away any premium rates of return for diversifiable risk. Suppose a stock were priced especially low because it had especially high diversifiable risk. Then it would seem to be a bargain to well diversified investors. For example, suppose an industry is subject to active competition, so there is a large risk of loss of market share. Investors who held a portfolio of all companies in the industry would be immune to this risk, because the loss on one company's stock would be offset by a gain on another's stock. (Of course, the competition might make the whole industry more vulnerable to the business cycle, but the issue here is the diversifiable risk of shifts in market share among firms.)

If the shares were priced especially low because of the risk of a shift in market shares, investors who could hold shares of the whole industry would snap them up. Their buying would drive up the stocks' prices until the premium rates of return for diversifiable risk were eliminated. Since all investors pay the same price, even those who are not diversified can expect no premium for bearing diversifiable risk.

Of course, substantial non–diversifiable risk remains, as the ongoing financial turmoil and the October Crash of 1987 demonstrate. Even an investor who held a portfolio of all traded stocks could not diversify against that type of risk. Sensitivity to such market–wide movements is what beta measures. That type of sensitivity, whether considered in a single- or multi-factor model, determines the risk premium in the cost of equity.

Q18. What does a particular value of beta signify?

A18. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market: stocks with betas of 2.0 tend to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 are less volatile than the market. A stock with a beta of 0.5 will tend to rise 5 percent when the market rises 10 percent.

Q19. How is beta measured?

A19. The usual approach to calculating beta is a statistical comparison of the sensitivity of a stock's (or a portfolio's) return to the market's return. Many investment services report betas, including Bloomberg and the Value Line Investment Survey. Betas are not always calculated the same way, and therefore must be used with a degree of caution, but the basic point that a high beta indicates a risky stock has long been widely accepted by both financial theorists and investment professionals.

Q20. Are there circumstances when the "usual approach to calculating beta" should not be used?

A20. There are at least two cases where the standard estimate of beta should be viewed skeptically.

First, companies in serious financial distress seem to "decouple" from their normal sensitivity to the stock market. The stock prices of financially distressed companies tend to change based more on individual news about their particular circumstances than upon overall market movements. Thus, a risky stock could have a low estimated beta if the company was in financial distress. Other circumstances that may cause a company's stock to decouple include an industry restructuring or major changes in a company's supply or output markets.

Second, similar circumstances seem to arise for companies "in play" during a merger or acquisition. Once again, the individual information about the progress of the proposed takeover is so much more important for that stock than day-to-day market fluctuations that, in practice, beta estimates for such companies seem to be too low.

Q21. How reliable is beta as a risk measure?

A21. Scholarly studies have long confirmed the importance of beta for a stock's required rate of return. It is widely regarded as the best single risk measure available. The merits of beta seemed to have been challenged by widely publicized work by Professors Eugene F.

Fama and Kenneth R. French.[33] However, despite the early press reports of their work as signifying that "beta is dead," it turns out that beta is still a potentially important explanatory factor (albeit one of several) in their work. Thus, beta remains alive and well as the best single measure of relative risk.

D. INTEREST RATE ESTIMATE

Q22. What interest rates do your procedures require?

A22. Modern capital market theories of risk and return use the short-term risk-free rate of return as the starting benchmark. However, as the short-term risk-free rate has dropped to near-zero, the implementation becomes meaningless. Therefore, like many practitioners, I rely on the long-term risk-free rate. Specifically, I calculate the average yield on long-term Government bonds using a 15-day period ending September 14, 2010. To this figure I add 50 basis points to account for the substantial increase in the spread between investment-grade utility bond yields and government bond yields. Table 3 in my testimony provides data on the increase in the spread between utility and government bond yields.

Q23. Do you vary the risk-free rate in your sensitivity analyses?

A23. Yes. In the sensitivity analyses I decrease the risk-free rate by 25 basis points for each 100 basis points increase in the MRP. This is intended to take into account that bond betas may be positive so that part of the increase in the MRP is captured in the increase in yield spread. A bond beta measures the systematic risk of the bond relative to the market and is determined in the same manner as the stock beta. As .25 is in the high end of the likely bond beta, the adjustment is conservative.

[33] See for example, "The Capital Asset Pricing Model: Theory and Evidence", Eugene F. Fama and Kenneth R. French, *Journal of Economic Perspectives*, Volume 18, Summer 2004, pp. 25-46.

E. COST OF CAPITAL MODELS

Q24. How do you combine the above components into an estimate of the cost of capital?

A24. By far the most widely used approach to estimation of the cost of capital is the "Capital Asset Pricing Model," and I do calculate CAPM estimates. However, the CAPM is only one equity risk premium approach technique, and I also use another.

Q25. Please start with the CAPM, by describing the model.

A25. As noted above, the modern models of capital market equilibrium express the cost of equity as the sum of a risk-free rate and a risk premium. The CAPM is the longest-standing and most widely used of these theories. The CAPM states that the cost of capital for investment s (e.g., a common stock) is given by the following equation:

$$k_s = r_f + \beta_s \times MRP \qquad \textbf{(C-1)}$$

where k_s is the cost of capital for investment s; r_f is the risk-free rate, β_s is the beta risk measure for the investment s; and MRP is the market risk premium.

The CAPM relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities do. It says that the security market line starts at the risk-free interest rate (that is, that the return on a zero-risk security, the y-axis intercept in Figure 1 in the body of my testimony, equals the risk-free interest rate). Further, it says that the risk premium over the risk-free rate equals the product of beta and the risk premium on a value-weighted portfolio of all investments, which by definition has average risk.

Q26. What other equity risk premium approach model do you use?

A26. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high-beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to explain this finding. The difference between the CAPM and the type of relationship identified in the empirical studies is depicted in Figure BV-C1.

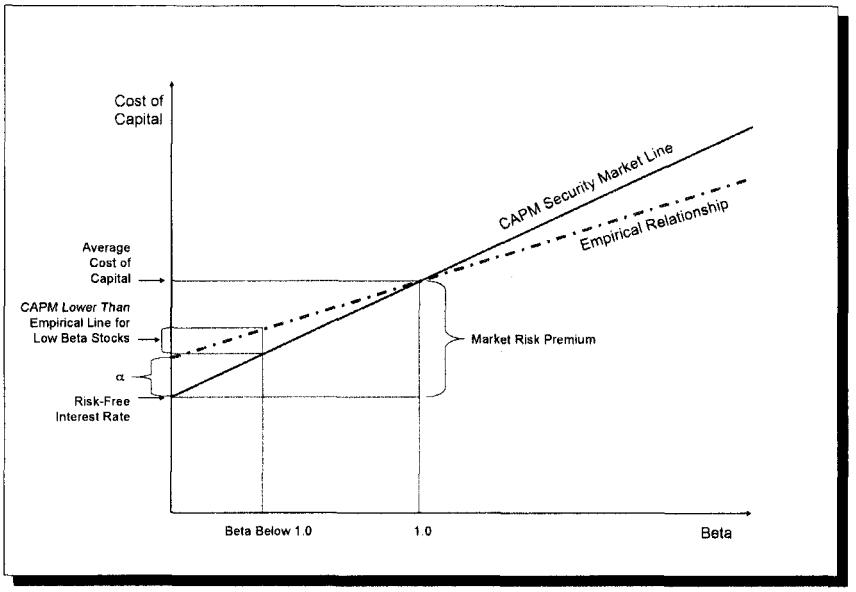

Figure BV-C1: The Empirical Security Market Line

The second model makes use of these empirical findings. It estimates the cost of capital with the equation,

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad \textbf{(C-2)}$$

where α is the "alpha" of the risk-return line, a constant, and the other symbols are defined as above. I label this model the Empirical Capital Asset Pricing Model, or "ECAPM." For the short-term risk-free rate models, I set alpha equal to 1, 2, and 3 percent which are values somewhat lower than that estimated empirically. For low-beta stocks such as regulated utilities, the use of a lower value for alpha leads to a lower estimate of the cost of capital. For the long-term risk-free rate models, I set alpha equal to both 0.5 percent and 1.5 percent, but I rely more heavily on the 0.5 percent results. The use of a long-term risk-free rate incorporates some of the desired effect of using the ECAPM. That is, the long-term risk-free rate version of the Security Market Line has a higher intercept and a flatter slope than the short-term risk-free version which has been tested. Thus, it is likely that I do not need to make the same degree adjustment when I use the long-term risk-free rate. A summary of the empirical evidence on the magnitude of alpha is provided in Table No. BV-C1 at the end of the appendix.

II. EMPIRICAL EQUITY RISK PREMIUM RESULTS

Q27. How is this part of the appendix organized?

A27. This section presents the full details of my equity risk premium approach analyses, which are summarized in the body of my testimony. Details behind the estimates of the short-term and the long-term risk-free interest rates are discussed. Next, the beta estimates, and the estimates of the MRP I use in the models are addressed. Finally, this section reports the CAPM and ECAPM results for the sample's costs of equity, and then describes the results of adjusting for differences between the benchmark sample and Arizona-American's regulated capital structures.

A. RISK-FREE INTEREST RATE

Q28. How do you obtain estimates of the risk-free interest rates over the period the utility rates set here are to be in effect?

A28. I obtain these rates using data from the Federal Reserve and provided by Bloomberg. In particular, I use their reported government debt yields from the "constant maturity series". This information is displayed in Table No. BV-9.

Q29. What values do you use for the long-term risk-free interest rate?

A29. I use a baseline value of 3.9 percent for the long-term risk-free interest rate including the baseline adjustment for the increase in the spread between the yield on investment-grade utility bonds and government bonds. I note that the 3.9 percent I use is lower than the forecasted yield on 10-year government bonds for 2012.[34]

[34] Federal Reserve Bank of Philadelphia, "Survey of Professional Forecasters: Third Quarter 2010," August 13, 2010.

B. BETAS AND THE MARKET RISK PREMIUM

1. Beta Estimation Procedures

Q30. Which betas do you use in your risk positioning models?

A30. I obtained estimates from Bloomberg for the sample companies.[35]

Q31. How does Bloomberg estimate the reported betas?

A31. *Bloomberg* estimates the reported betas using weekly data for a five year period.[36] As a market index, *Bloomberg's* default index is the New York Stock Exchange. Also *Bloomberg* reports so-called adjusted betas, i.e. the betas reported by *Bloomberg* are calculated as follows:

$$\beta_{Value\ Line} = 2/3 \times \beta + 1/3 \qquad \textbf{(C-3)}$$

where β is the estimate obtained from a regression of the company's return on the return of the market index.

Q32. Is this a deviation from your last testimony before the Commission?

A32. Yes, it is. Because I was unable to replicate *Value Line's* betas for the gas LDC sample using standard regression techniques, I choose to rely on Bloomberg betas, which are close to the estimates, I obtained. Further, I have in the past reversed the adjustment with which commercial data providers report beta estimates. However, in the past I reversed the adjustment to be conservative - - not because I disagreed with the adjustment. Now that beta estimates have declined, there is no need to be conservative.

Q33. Please summarize the beta estimates you rely on.

A33. The *Bloomberg* betas range from .56 to 1.1 for the water sample with one company, SJW Corp. having a beta above 1. The gas LDC companies' betas fall in a much narrower range from .71 to .92. The beta estimates for individual sample companies are reported in Workpaper #1 to Tables No. BV-10 and BV-21, respectively. This table also reports

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[35] For each sample I used Bloomberg's estimated beta as of September 10, 2010.

[36] An exception is made for American Water, which has only 2½ years of pricing data is available.

Value Line's beta estimates and my beta estimates. For the water sample, *Value Line*, *Bloomberg* and I obtain very similar beta estimates, but for the gas LDC sample, *Value Line* betas are different from those *Bloomberg* or I estimate.

C. MARKET RISK PREMIUM ESTIMATION

Q34. Given all of the evidence, what MRP do you use in your analysis?

A34. It is clear that market return information is volatile and difficult to interpret in the current environment, but my baseline estimate for the MRP is 6.5 percent. However, this figure does not take the ongoing financial turmoil into account, so I also report results for two alternative sensitivity analyses with an MRP of 7.0 and 7.5 percent, respectively. Because it is possible that bonds are correlated with equity markets, I allow for the bond beta to be different from zero. Specifically, I conservatively assume that the bond beta is .25, so that a 1.0% increase in the MRP would lower the risk-free rate by 0.25%.[37] Therefore, in the first sensitivity analysis, the MRP is 7.0% and the risk-free rate is 3.77%, while in the second sensitivity analysis, the MRP is 7.5% and the risk-free rate is 3.65%.

D. COST OF CAPITAL ESTIMATES

Q35. Based on these data, what are the values you calculate for the overall cost of capital and the corresponding cost of equity for the samples?

A35. Tables No. BV-10 and BV-21 present the cost of equity results using the equity risk positioning methods at the sample companies' market value capital structures.

Q36. What does the water market data imply about the sample's cost of equity at the proposed 45 percent equity ratio for Arizona-American Water?

A36. The return on equity and the overall cost of capital for the various equity risk positioning methods are reported in Tables No. BV-12 and BV-23.

[37] For example, Edwin J. Elton, Martin J. Gruber, Deepak Agrawal and Christopher Mann, Explaining the Rate Spread on Corporate Bonds, *The Journal of Finance* LVI, 2001 footnote 32 reports bond betas range from 0.12 to 0.76 with the average BBB-rated bond having a beta of 0.26.

Q37. What are the implications of the risk positioning results for Arizona-American's estimated cost of equity?

A37. I discuss the implications of the risk positioning results for the two samples in the main body of my testimony.

Table BV-C1

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Litzenberger and Ramaswamy (1979)[4]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[5]	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1]Black estimates alpha in a one step procedure rather than in an un-biased two-step procedure.

[2]Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.

[3]Calculated using Ibbotson's data for the 30-day treasury yield.

[4]Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

[5]Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:

Black, Fischer. 1993. Beta and Return. *The Journal of Portfolio Management* 20 (Fall): 8-18.

Black, F., Michael C. Jensen, and Myron Scholes. 1972. The Capital Asset Pricing Model: Some Empirical Tests, from Studies in the theory of Capital Markets. In *Studies in the Theory of Capital Markets*, edited by Michael C. Jensen, 79-121. New York: Praeger.

Fama, Eugene F. and James D. MacBeth. 1972. Risk, Returns and Equilibrium: Empirical Tests. *Journal of Political Economy* 81 (3): 607-636.

Fama, Eugene F. and Kenneth R. French. 1992. The Cross-Section of Expected Stock Returns. *Journal of Finance* 47 (June): 427-465.

Fama, Eugene F. and Kenneth R. French. 2004. The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives* 18 (3): 25-46.

Litzenberger, Robert H. and Krishna Ramaswamy. 1979. The Effect of Personal Taxes and Dividends on Capital Asset Prices, Theory and Empirical Evidence. *Journal of Financial Economics* XX (June): 163-195.

Litzenberger, Robert H. and Krishna Ramaswamy and Howard Sosin. 1980. On the CAPM Approach to Estimation of a Public Utility's Cost of Equity Capital. *The Journal of Finance* 35 (2): 369-387.

Pettengill, Glenn N., Sridhar Sundaram and Ike Mathur. 1995. The Conditional Relation between Beta and Returns. *Journal of Financial and Quantitative Analysis* 30 (1): 101-116.

1

APPENDIX D

DISCOUNTED CASH FLOW METHODOLOGY AND RESULTS

Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the discounted cash flow or "DCF" methodology and the details of the cost-of-capital estimates obtained from this methodology.

I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES

Q2. How is this section of the appendix organized?

A2. The first part discusses the general principles that underlie the DCF approach. The second portion describes the strengths and weaknesses of the DCF model and why it is generally less reliable for estimating the cost of capital for the sample companies at the present time than the risk positioning method discussed in Appendix C.

A. Simple And Multi-Stage Discounted Cash Flow Models

Q3. Please summarize the DCF model.

A3. The DCF model takes the first approach to cost-of-capital estimation discussed with Figure 1 in Section II-A of my direct testimony. That is, it attempts to measure the cost of equity in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad \textbf{(D-1)}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t; "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (*i.e.*, unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k-g)} \qquad \textbf{(D-2)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation D-2 is a simplified version of Equation D-1 that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \qquad \textbf{(D-3)}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation D-3 says that if Equation D-2 holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong (*i.e.*, very unrealistic) assumptions.

Q4. Are there other versions of the DCF models besides the "simple" one?

A4. Yes. If Equation D-2 and its underlying assumptions do not hold, sometimes other variations of the general present value formula, Equation D-1, can be used to solve for k in ways that differ from Equation D-3. For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (e.g., over the next five or ten years as compared with subsequent periods), these forecasts can be used to specify the early dividends in Equation D-1. Once the near-term dividends are specified, Equation D-2 can be used to

specify the share price value at the end of the near-term (e.g., at the end of five or ten years), and the resulting cash flow stream can be solved for the cost of capital using Equation D-1.

More formally, the "multistage" DCF approach solves the following equation for k:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T + P_{TERM}}{(1+k)^T} \quad \textbf{(D-4)}$$

The terminal price, P_{TERM} is estimated as

$$P_{TERM} = \frac{D_{T+1}}{(k - g_{LR})} \quad \textbf{(D-5)}$$

where T is the last of the periods in which a near term dividend forecast is made and g_{LR} is the long-run growth rate. Thus, Equation D-4 defers adoption of the very strong perpetual growth assumptions that underlie Equation D-2 — and hence the simple DCF formula, Equation D-3 — for as long as possible, and instead relies on near term knowledge to improve the estimate of k. I examine both simple and multistage DCF results below.

Q5. Please describe the multi-stage DCF model you use.

A5. The multi-stage model I use is presented in Equations D-4 and D-5 above, and assumes that the long-term perpetual growth rate for all companies in the two samples is the forecast long-term growth rate of the GDP. This model allows growth rates to differ across companies during the first ten years before settling down to a single long-term growth rate. The growth rate for the first five years is the long-term growth rate derived from analysts' reports. After year five, the growth rate is assumed to converge linearly to the GDP growth rate. In other words, the growth rate in year 6 is adjusted by $1/6^{th}$ of the difference between each company's 5-year growth rate forecast and the GDP forecast. The growth rates in years 7 to 10 are adjusted by an additional $1/6^{th}$ so that the earning growth rate pattern converges on the long-term GDP growth rate forecast.

Q6. Why do you assume that the long-term growth rate of the sample companies will converge to the long-term growth rate of GDP?

A6. Recall that the DCF model assumes that dividends grow at a constant rate literally forever. If the growth rate of earnings (and therefore, dividends) were greater than (less than) the long-term growth rate of the economy, mathematically it would mean that the company (and the industry) would become an ever increasing (or decreasing) proportion of the economy. Therefore, the most logical assumption is that the company's earnings grow at the same rate as the economy on average over the long run.

Q7. What are the merits of the DCF model?

A7. The DCF approach is conceptually sound only if its assumptions are met. In actual practice one can run into difficulty because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well-known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula, Equation D-1, that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems.

The DCF model assumes that investors expect the cost of capital to be the same in all future years. Investors may not expect the cost of capital to be the same, which can bias the DCF estimate of the cost of capital in either direction.

The DCF model only works for companies for which the standard present value formula works. The standard formula does *not* work for companies that operate in industries or markets options (*e.g.*, puts and calls on common stocks), and so it will not work for companies whose stocks behave as options do. Option-pricing effects will be important for companies in financial distress, for example, which implies the DCF model will *understate* their cost of capital, all else equal.

In recent years even the most basic DCF assumption, that the market price of a stock in the absence of growth options is given by the standard present value formula (*i.e.*, by

Equation D-1 above), has been called into question by a literature on market volatility.[1] In any case, it is still too early to throw out the standard formula, if for no other reasons than that the evidence is still controversial and no one has offered a good replacement. But the evidence suggests that it must be viewed with more caution than financial analysts have traditionally applied. Simple models of stock prices may not be consistent with the available evidence on stock market volatility.

Q8. Normally DCF debates center on the right growth rate. What principles underlie that choice?

A8. Finding the right growth rate(s) is indeed the usual "hard part" of a DCF application. The original approach to estimation of g relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates g as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that historical averages over periods with widely varying rates of inflation, interest rates and costs of capital, such as in the relatively recent past, will equal current growth rate expectations.

A better approach is to use the growth rates currently expected by investment analysts, if an adequate sample of such rates is available. Analysts' forecasts are superior to time series forecasts based upon single variable historical data as has been documented and confirmed extensively in academic research.[2] If this approach is feasible and if the

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[1] See for example, Robert J. Shiller (1981), "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?," *The American Economic Review*, Vol. 71, No. 3, pp. 421-436. John Y. Campbell and Robert J. Shiller (1988), "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *The Review of Financial Studies*, Vol. 1, No. 3, pp. 195-228. Lucy F. Ackert and Brian F. Smith (1993), "Stock Price Volatility, Ordinary Dividends, and Other Cash Flows to Shareholders," *Journal of Finance*, Vol. 48, No. 1, pp. 1147-1160. Eugene F. Fama and Kenneth R. French (2001), "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?," *Journal of Financial Economics*, Vol. 60, pp. 3-43. Borja Larrain and Motohiro Yogo (2005), "Does Firm Value Move Too Much to be Justified by Subsequent Changes in Cash Flow?," Federal Reserve Bank of Boston, *Working Paper*, No. 05-18.

[2] Lawrence D. Brown and Michael S. Rozeff (1978), "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings," *Journal of Finance*, Vol. XXXIII, No. 1, pp. 1-16. J. Cragg and B.G. Malkiel (1982), *Expectations and the Structure of Share Prices*, National Bureau of Economic Research, University of Chicago Press. R.S. Harris (1986), "Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring Issue, pp. 58-67. J. H. Vander

person estimating the cost of capital is able to select the appropriate version of the DCF formula, the DCF method should yield a reasonable estimate of the cost of capital for companies not in financial distress and without material option-pricing effects (always subject to recent concerns about the applicability of the basic present value formula to stock prices as well as issues of optimism bias). However, for the DCF approach to work, the basic stable-growth assumption must become reasonable and the underlying stable-growth rate must become determinable *within the period for which forecasts are available.*

Q9. What is the so called "optimism bias" in the earnings growth rate forecasts of security analysts and what is its effect on the DCF analysis?

A9. Optimism bias is related to the observed tendency for analysts to forecast earnings growth rates that are higher than are actually achieved. This tendency to over estimate growth rates is perhaps related to incentives faced by analysts that provide rewards not strictly based upon the accuracy of the forecasts. To the extent optimism bias is present in the analysts' earnings forecasts, the cost-of-capital estimates from the DCF model would be too high.

Q10. Does optimism bias mean that the DCF estimates are completely unreliable?

A10. No. The effect of optimism bias is least likely to affect DCF estimates for large, rate regulated companies in relatively stable segments of an industry. Furthermore, the magnitude of the optimism bias (if any) for regulated companies is not clear. This issue is addressed in a paper by Chan, Karceski, and Lakonishok (2003)[3] who sort companies on the basis of the size of the I/B/E/S forecasts to test the level of optimism bias. Utilities constitute 25 percent of the companies in lowest quintile, and by one measure the level of optimism bias is 4 percent. However, the 4 percent figure does not represent the

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Weide and W. T. Carleton (1988), "Investor Growth Expectations: Analysts vs. History," *Journal of Portfolio Management*, spring, pp. 78-82. T. Lys and S. Sohn (1990), "The Association Between Revisions of Financial Analysts Earnings Forecasts and Security Price Changes," *Journal of Accounting and Economics*, vol 13, pp. 341-363.

[3] L. K.C. Chan, J. Karceski, and J. Lakonishok, 2003, "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2):643-684.

complete characterization of the results in the paper. Table IX of the paper shows that the median I/B/E/S forecast for the first (lowest) quintile averages 6.0 percent. The realized "Income before Extraordinary Items" is 2.0 percent (implying a four percent upward bias in I/B/E/S forecasts), but the "Portfolio Income before Extraordinary Items" is 8.0 percent (implying a two percent downward bias in I/B/E/S forecasts).

The difference between the "Income before Extraordinary Items" and "Portfolio Income before Extraordinary Items" is whether individual firms or a portfolio are used in estimating the realized returns. The first is a simple average of all firms in the quintile while the second is a market value weighted-average. Although both measures of bias have their own drawbacks according to the authors,[4] the Portfolio Income measure gives more weight to the larger firms in the quintile such as regulated utilities. In addition, the paper demonstrates that "analysts' forecasts as well as investors' valuations reflect a wide-spread belief in the investment community that many firms can achieve streaks of high growth in earnings."[5] Therefore, it is not clear how severe the problem of optimism bias may be for regulated utilities or even whether there is a problem at all.

Finally, the two-stage DCF model also adjusts for any over optimistic (or pessimistic) growth rate forecasts by substituting the long-term GDP growth rate for the 5-year growth rate forecasts of the analysts in the years beginning in year 11. I linearly trend the 5-year forecast growth rate to the GDP forecast growth rate in years 6 to 10.

Q11. What about the reforms by the National Associate of Security Dealers (NASD) that were designed to reduce the conflicts of interest and pressures brought against security analysts? Have those reforms been generally successful?

A11. Yes. The conclusion from the Joint Report by NASD and the New York Stock Exchange ("NYSE") on the reforms states

> ... the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and

[4] Chan, Karceski, and Lakonishok, *op. cit.*, p. 675.

[5] Chan, Karceski, and Lakonishok, *op. cit.*, p. 663.

> promoting transparency of other potential conflicts of interest. Evidence also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[6]

The report does note additional reforms are advisable, but the situation is far different today than during the height of the tech bubble when analyst objectivity was clearly suspect.

B. Conclusions About DCF

Q12. Please sum up the implications of this part of the appendix.

A12. The unavoidable questions about the DCF model's strong assumptions — whether the basic present value formula works for stocks, whether option pricing effects are important for the company, whether the right variant of the basic formula has been found, and whether the true growth rate expectations have been identified. Because the growth rates for the water companies fluctuate substantially and some have engaged in recent merger and acquisition activity, I believe the DCF method for those companies in less reliable than the risk positioning method. However, the gas LDC companies are substantially more stable and there for the DCF method is more reliable for gas LDC companies than for water companies.

II. EMPIRICAL DCF RESULTS

Q13. How is this part of the appendix organized?

A13. This section presents the details of my DCF analyses for the water and gas LDC samples, which are summarized in my written testimony.

Implementation of the simple DCF models described above requires an estimate of the current price, the dividend, and near-term and long-run growth rate forecasts. The simple DCF model relies only on a single growth rate forecast, while the multistage DCF model

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[6] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

employs both near-term individual company forecasts and long-run GDP growth rate forecasts. The remaining parts of this section describe each of these inputs in turn.

A. PRELIMINARY MATTERS

Q14. In Appendix C you discuss estimating cost of capital and implied cost of equity using the risk positioning methodology. What, if anything, is different when you use the DCF method?

A14. The timing of the market value capital structure calculations is different in the DCF method than in the equity risk premium method. The equity risk premium method relies on the average capital structure over the five-year period *Bloomberg* uses to estimate beta while the DCF approach uses only current data, so the relevant market value capital structure measure is the most recent that can be calculated. This capital structure for the water sample companies is reported in columns [1]-[3] of Table No. BV-4, and for the gas LDC sample companies in columns [1]-[3] of Table No. BV-16.

B. GROWTH RATES

Q15. What growth rates do you use?

A15. For reasons discussed above, historical growth rates today are not useful as forecasts of current investor expectations for the water utility industry. I therefore use rates forecasted by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described previously), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecasted earnings growth rates. In particular, I utilize Bloomberg's BEst and *Value Line's* forecasted earnings growth.[7] The projected earnings growth rates for the water sample companies are in Table No. BV-5, and those for the gas LDC sample companies are in Table No. BV-17. Column [1] reports Bloomberg's BEst analysts' forecasts of the long-term earnings growth for the sample companies. Column [2] reports the number of analysts that provided a forecast. Columns [3] and [4] report *Value Line's* forecasted earnings per share ("EPS") value for each company for 2010 and 2013-2015 respectively. Column [5] provides *Value Line's* implied long-term growth rate forecast, and column [6] provides a weighted average growth rate for each company across the two sources. (I treat the *Value Line* forecasts as though they overlap exactly with the forecasts from Bloomberg.) These growth rates underlie my simple and multistage DCF analyses.

In the simple DCF, I use the five-year average annual growth rate as the perpetual growth rate.[8] In the multistage model, I rely on the company-specific growth rate through the third quarter of 2015 and on the long-term GDP forecast from the fourth quarter of 2020 onwards. During the intervening five-year period, I assume the growth rate converges linearly towards the long-term GDP forecast.[9]

Q16. Do these growth rates correspond to the ideal you mentioned above?

A16. No. While forecasted growth rates are the quantity required in principle, the forecasts need to go far enough out into the future so that it is reasonable to believe that investors expect a stable growth path afterwards. As can be seen from Table No. BV-5 and Table No. BV-17, the growth rate forecasts vary widely from company to company. For example, the *Value Line's* growth forecast for Southwest Water as the 93.4% are driven

[7] The BEst growth rates were downloaded from Bloomberg on September 15, 2010 for the gas LDC sample and on September 30, 2010 for the water sample. *Value Line* estimates are from the most recent report available, dated July 23, 2010 for the water sample utilities, and September 10, 2010 for the gas LDCs.

[8] This growth rate is in column [6] of Table No. BV-5 (Table No. BV-17 for the gas LDC sample).

[9] I use the long-term U.S. GDP growth forecast from *Blue Chip Economic Indicators* (March 10, 2010). *Blue Chip* only issues long-term GDP growth forecasts in March and October each year.

by the very low earnings estimate for 2010. Further, Southwest Water currently pays no dividend, so a standard DCF analysis is not feasible. At the same time Middlesex Water's growth rate was estimated at 1.1%.[10] The variation in growth estimates among the gas LDC companies is much lower and range form 3.0% to 7.5%.

Q17. How well are the conditions needed for DCF reliability met at present?

A17. The requisite conditions for especially the water companies are not fully met at this time; where only half of the companies have a growth estimate from BEst and several of the companies for which *Value Line* did not report growth estimates a year ago, now have either very low or very high estimates.[11] The volatility in the water companies' growth estimates make an interpretation of this sample's DCF estimates difficult. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (*i.e.*, the growth rate after the industry settles into a steady state, which is certainly *beyond* the next five years for water industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that if the company or industry in question is in transition, then the growth forecast may not be representative for the company's long-term growth.

This is a problem at present because it is hard to imagine that today's water industry would accurately be described as stable. There is great uncertainty about the costs required to undertake the large investments in infrastructure forecasted for the industry. Indeed, *Value Line* notes the need for investments aimed at replacing the aging infrastructure and complying with increasingly stringent water safety regulations, partially driven by increased fear of bioterrorism. The American Society of Civil Engineers recently estimated that that the drinking water and wastewater shortfall in infrastructure investments needs are $255 billion over the next five years while the

[10] See Table No. BV-5.

[11] For example, in April 2009, neither Middlesex Water nor SJW Corp. had growth forecasts from Value Line, but in its July 2010 issue, Value Line growth estimates for Middlesex Water is 1.1%, while the estimate for SJW Corp. is 14.7%.

expected spending (including the American Recovery and Reinvestment act) is $146.4 for a shortfall of about $108.6 billion.[12] The water industry also has seen a number of mergers and acquisitions, which affects the companies' earnings growth rate estimates. This is one reason why companies heavily involved in mergers and acquisitions are normally excluded from the sample. Taken together, these factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium.

Such circumstances imply that a regulator may often be faced with a wide range of DCF numbers, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist.* DCF for firms or industries in flux is *inherently* subjective with regard to a parameter (the long-run growth rate) that drives the answer one gets.

It is clear that much longer detailed growth rate forecasts than currently available from Bloomberg and *Value Line* would be needed to implement the DCF model in a completely reliable way for the water sample at this time; however, the general stability of the 5-year growth rate forecasts for the gas LDC sample indicates a substantially higher degree of reliability than for the water sample at this time.

C. DIVIDEND AND PRICE INPUTS

Q18. What values do you use for dividends and stock prices?

A18. Dividends are the most recent recorded dividend payments as reported by Bloomberg. For most companies this is the third quarter 2010 dividend, but for some it is the 4th quarter 2010. The most recent dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple and multistage DCF models.

[12] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2009, p. 7.

Stock prices are the average of the closing stock prices for the 15 trading days ending on the day the BEst forecasts were released (September 15, 2010). Using these dates ensures that the information in growth rates and stock prices are contemporaneous. I use a 15-day average as a compromise. Using a longer period would be inconsistent with the principles that underlie the DCF formula. The DCF approach assumes the stock price is the present value of future expected dividends. Stock prices six months or a year ago reflect expectations at that time, which are different from those that underlie the currently available growth forecasts. At the same time, use of an average over a brief period helps guard against a company's price on a particular day price being unduly influenced by mistaken information, differences in trading frequency, and the like.

The closing stock price is used because it is at least as good as any other measure of the day's outcome, and may be better for DCF purposes. In particular, if there were any single price during the day that would affect investors' decisions to buy or sell a stock, I would suspect that it would be each day's closing price, not the high or low during the day. The daily price changes reported in the financial pages, for example, are from close to close, not from high to high or from low to low.

D. COMPANY-SPECIFIC DCF COST-OF-CAPITAL ESTIMATES

Q19. What DCF estimates do these data yield?

A19. The cost-of-equity results for the simple and multistage DCF models are shown in Table No. BV-6 for the water utility sample and in Table No. BV-18 for the gas LDC sample. In both tables, Panel A reports the results for the simple DCF method while Panel B reports the results for the multistage DCF method using the long-term GDP growth rate as the perpetual growth rate.

Q20. What overall cost-of-capital estimates result from the DCF cost-of-equity estimates?

A20. The capital structure, DCF cost of equity, and cost of debt estimates are combined to obtain the overall after-tax weighted-average cost of capital for each sample company. These results are presented in Table No. BV-7 for the water sample and in Table No. BV-

19 for the gas LDC sample. Again, Panel A relies on the simple DCF cost-of-equity results while Panel B relies on the multistage DCF cost-of-equity results.

Q21. What information do you report in Table No. BV-8 and in Table No. BV-20?

A21. These tables report, for each sample, the return on equity consistent with that sample's estimated overall after-tax weighted-average cost of capital and the proposed equity thickness of 45 percent for Arizona-American Water. For both the simple DCF and multistage DCF methods, the sample's average ATWACC is reported in column [1]. Column [6] reports the return on equity as if the sample companies' average market value capital structure had been that currently proposed for Arizona-American Water.

Q22. What are the implications of these results?

A22. The implication of these numbers is discussed in my direct testimony, along with the findings of the equity risk premium approach.

APPENDIX E

EFFECT OF DEBT ON THE COST OF EQUITY

Q1. What is the purpose of this Appendix?

A1. In this appendix, I provide details on the effects of debt on the cost of equity. First, I summarize a fairly large body of financial research on capital structure. Second, I provide an extended example to illustrate the effect of debt on the cost of equity.

I. AN OVERVIEW OF THE ECONOMIC LITERATURE

Q2. What is the focus of the economic literature on the effects of debt?

A2. The economic literature focuses on the effects of debt on the value of a firm. The standard way to recognize one of these effects, the impact of the fact that interest expense is tax-deductible, is to discount the all-equity after-tax operating cash flows generated by a firm or an investment project at a weighted average cost of capital, typically known in textbooks as the "WACC." The textbook WACC equals the *market*-value weighted average of the cost of equity and the *after-tax*, *current* cost of debt. However, rate regulation in North America has a legacy of working with another weighted-average cost of capital, the *book*-value weighted average of the cost of equity and the *before-tax*, *embedded* cost of debt. To distinguish the concepts, I refer to the after-tax weighted-average cost of capital as ATWACC.

Q3. How is this section of the appendix organized?

A3. It starts with the tax effects of debt. It then turns to other effects of debt.

A. TAX EFFECTS

Q4. What are the key findings in the literature regarding tax effects?

A4. Three seminal papers are vital for this literature. The first assumes no taxes and risk-free debt. The second adds corporate income taxes. The third adds personal income taxes.

1. Base Case: No Taxes, No Risk to High Debt Ratios

Q5. Please start by explaining the simplest case of the effect of debt on the value of a firm.

A5. The "base case," no taxes and no costs to excessive debt, was worked out in a classic 1958 paper by Franco Modigliani and Merton Miller, two economists who eventually won Nobel Prizes in part for their body of work on the effects of debt.[1] Their 1958 paper made what is in retrospect a very simple point: if there are no taxes and no risk to the use of excessive debt, use of debt will have no effect on a company's operating cash flows (i.e., the cash flows to investors as a group, debt plus equity combined). If the operating cash flows are the same regardless of whether the company finances mostly with debt or mostly with equity, then the value of the firm cannot be affected at all by the debt ratio. In cost-of-capital terms, this means the overall cost of capital is constant regardless of the debt ratio, too.

In the base case, issuing debt merely divides the cash flows into two pools, one for bondholders and one for shareholders. If the divided pools have different priorities in claims on the cash flows, the risks and costs of capital will differ for each pool. But the risk and overall cost of capital of the entire firm, the sum of the two pools, is constant regardless of the debt ratio. Thus,

$$r_1^* = r_{A1} \qquad \text{(E-1a)}$$

where r_1^* is the overall after-tax cost of capital at any particular capital structure and r_{A1} is the all-equity cost of capital for the firm. (The "1" subscripts distinguish the case where there are no taxes from subsequent equations that consider first corporate and then both corporate and personal taxes.) With no taxes and no risk to debt, the overall cost of capital does not change with capital structure.

This implies that the relationship of the overall cost of capital to the component costs of debt and equity is

[1] Franco Modigliani and Merton H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, 48, pp. 261-297.

$$r_{E1} \times \left(\frac{E}{V}\right) + r_{D1} \times \left(\frac{D}{V}\right) = r_1^* \qquad \text{(E-1b)}$$

with the overall cost of capital (r^*) on the *right* side, as the *independent* variable, and the costs of equity (r_E) and debt (r_D) on the left side, as *dependent* variables determined by the overall cost of capital and by the capital structure (i.e., the shares of equity (E) and debt (D) in overall firm value ($V = E + D$) that the firm happens to choose. Note that if equation (E-1a) were correct, the equation that solved it for the cost of equity would be,

$$r_{E1} = r_1^* + (r_1^* - r_D) \times \left(\frac{D}{E}\right) \qquad \text{(E-1c)}$$

Note also that (D/E) gets exponentially higher in this equation as the debt-to-value ratio increases[2] i.e., the cost of equity increases exponentially with leverage.

2. Corporate Tax Deduction for Interest Expense

Q6. What happens when you add corporate taxes to the discussion?

A6. If corporate taxes exist with risk-free debt (and if only taxes at the corporate level matter, not taxes at the level of the investor's personal tax return), the initial conclusion changes. Debt at the corporate level reduces the company's tax liability by an amount equal to the marginal tax rate times the interest expense. All else equal, this will add value to the company because more of the operating cash flows will end up in the hands of investors as a group. That is, if only corporate taxes mattered, interest would add cash to the firm equal to the corporate tax rate times the interest expense. This increase in cash would increase the value of the firm, all else equal. In cost-of-capital terms, it would reduce the overall cost of capital.

How much the value of the firm would rise and *how far* the overall cost of capital would fall would depend in part on how often the company adjusts its capital structure, but this is a second-order effect in practice. (The biggest effect would be if companies could

[2] For example, at 20-80, 50-50, and 80-20 debt-equity ratios, (D/E) equals, respectively, (20/80) = 0.25, (50/50) = 1.0, and (80/20) = 4.0. The extra 30 percent of debt going from 20-80 to 50-50 has much less impact on (D/E) [i.e., by moving it from 0.25 to 1.0] than the extra 30 percent of debt going from 50-50

issue riskless perpetual debt, an assumption Profs. Modigliani and Miller explored in 1963, in the second seminal paper;[3] this assumption could *not* be true for a real company.) Prof. Robert A. Taggart provides a unified treatment of the main papers in this literature and shows how various cases relate to one another.[4] Perhaps the most useful set of benchmark equations for the case where only corporate taxes matter are:

$$r_2^* = r_{A2} - r_D \times t_C \times \left(\frac{D}{V}\right) \quad \text{(E-2a)}$$

$$r_2^* = r_{E2} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1 - t_C) \quad \text{(E-2b)}$$

which imply for the cost of equity,

$$r_{E2} = r_{A2} + (r_{A2} - r_D) \times \left(\frac{D}{E}\right) \quad \text{(E-2c)}$$

where the variables have the same meaning as before but the "2" subscripts indicate the case that considers corporate but not personal taxes.

Note that Equation (E-2a) implies that when only corporate taxes matter, the overall after-tax cost of capital declines steadily as more debt is added, until it reaches a minimum at 100 percent debt (i.e., when $D/V = 1.0$). Note also that Equation (E-2c) still implies an exponentially increasing cost of equity as more and more debt is added. In fact, except for the subscript, Equation (E-2c) looks just like Equation (E-1c). However, whether any value is added and whether the cost of capital changes at all also depends on the effect of taxes at the personal level.

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to 80-20 [i.e., by moving it from 1.0 to 4.0]. Since the cost of equity equals a constant risk premium times the debt-equity ratio, the cost of equity grows ever more rapidly as you add more and more debt.

[3] Franco Modigliani and Merton H. Miller (1963), "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, 53, pp. 433-443.

[4] Robert A. Taggart, Jr. (1991), "Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes," *Financial Management* 20, pp. 8-20.

3. Personal Tax Burden on Interest Expense

Q7. How do personal taxes affect the results?

A7. Ultimately, the purpose of investment is to provide income for consumption, so personal taxes affect investment returns. For example, in the U.S., municipal bonds have lower interest rates than corporate bonds because their income is taxed less heavily at the personal level. In general, capital appreciation on common stocks is taxed less heavily than interest on corporate bonds because (1) taxes on unrealized capital gains are deferred until the gains are realized, and (2) the capital gains tax rate is lower. Dividends are currently taxed less heavily than interest. However, the current legislation regarding personal taxes on dividend income is set to expire at the end of 2010 and unless a new law or an extension of the existing rules is passed, the tax rate on dividend income will increase.[5] The effects of personal taxes on the cost of common equity are hard to measure, however, because common equity is so risky.

Professor Miller explored how personal taxes affect the overall cost of capital.[6] He found that personal tax effects could offset the effect of corporate taxes entirely.

Q8. Does the effect of personal taxes neutralize the effect of corporate taxes?

A8. The likelihood hereof would be increased if the current federal tax reductions on dividends and capital gains became permanent rather than expiring in 2010. However, personal taxes are important even if they do not make the corporate tax advantage on interest vanish entirely. Capital gains and dividend tax advantages definitely convey some personal tax advantage to equity, and even a partial personal advantage to equity reduces the corporate advantage to debt.

The Taggart paper explores the case of a partial offset, also. With personal taxes, the risk-free rate on the security market line is the after-personal-tax rate, which must be

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[5] According to Edison Electric Institute, "Raising Dividend Tax Rates Will Cause Unintended Consequences," June 2010, the dividend income tax rate would increase from the current 15% to 39.6%.

[6] Merton H. Miller (1977), "Debt and Taxes," *The Journal of Finance*, 32: 261-276, the third of the seminal papers mentioned earlier.

equal for risk-free debt and risk-free equity.[7] Therefore, the pre-personal-tax risk-free rate for equity will generally not be equal to the pre-personal-tax risk-free rate for debt. In particular, $r_{fE} = r_{fD} \times [(1-t_D)/(1-t_E)]$, where r_{fE} and r_{fD} are the risk-free costs of equity and debt and t_E and t_D are the personal tax rates for equity and debt, respectively. In terms of the cost of debt, the Taggart paper's results imply that a formal statement of these effects can be written as:[8]

$$r_3^* = r_{A3} - r_D \times t_N \times \left(\frac{D}{V}\right) \quad \text{(E-3a)}$$

$$= r_{E3} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1-t_C) \quad \text{(E-3b)}$$

which imply

$$r_{E3} = r_{A3} + \left[r_{A3} - r_D \times \left(\frac{1-t_D}{1-t_E}\right)\right] \times \left(\frac{D}{E}\right) \quad \text{(E-3c)}$$

Suppose, for example, that t_C = 35 percent, t_E = 7.7 percent and t_D = 40 percent. Then, $[(1-t_D)/(1-t_E)] = 0.65 = (1-t_C)$. That condition corresponds to Miller's 1977 paper, in which the net personal tax advantage of equity fully offsets the net corporate tax advantage of debt. Note also that in that case, $t_N = 0$.[9] Therefore, if the personal tax advantage on equity fully offsets the corporate tax advantage on debt, Equation (E-3a) confirms that the overall after-tax cost of capital is a constant.

However, it is unlikely that the personal tax advantage of equity fully offsets the corporate tax advantage of debt. If taxes were all that mattered (i.e., if there were no

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[7] As Prof. Taggart notes (his footnote 9), it is not necessary that a specific, risk-free equity security exist as long as one can be created synthetically, through a combination of long and short sales of traded assets. Such constructs are a common analytical tool in financial economics.

[8] The net all-tax effect of debt on the overall cost of capital, t_N, equals $\{[t_C+t_E-t_D-(t_C \times t_E)] / (1-t_E)\}$, where t_D is the personal tax rate on debt, as before. This measure of net tax effect is designed for use with the cost of debt in Equation (E-3a), which seems more useful in the present context. The Taggart paper works with a similar measure, but one which is designed for use with the cost of risk-free equity in the equivalent Taggart equation.

[9] In the above example, $t_N = \{[0.35+0.077-0.4-(0.35 \times 0.077)] / (1.0-0.077)\} = 0.0/0.923 = 0$.

other costs to debt), the overall after-corporate-tax cost of capital would still fall as debt was added, just not as fast.

Finally, note that the overall after-tax cost of capital, Equation (E-3b), still uses the corporate tax rate even when personal taxes matter. Equations (E-2b) and (E-3b) both correspond to the usual formula for the ATWACC. Personal taxes affect the way the cost of equity changes with capital structure – Equation (E-3c) – but not the formula for the overall after-tax cost of capital given that cost of equity.

B. NON-TAX EFFECTS

Q9. Please describe the non-tax effects of debt.

A9. If debt is truly valuable, firms should use as much as possible, and competition should drive firms in a particular industry to the same, optimal capital structure for the industry. If debt is harmful on balance, firms should avoid it. Neither picture corresponds to what we actually see. A large economic literature has evolved to try to explain why.

Part of the answer clearly is the costs of excessive debt. Here the results cannot be reduced to equations, but they are no less real for that fact. As companies add too much debt, the costs come to outweigh the benefits. Too much debt reduces or eliminates financial flexibility, which cuts the firm's ability to take advantage of unexpected opportunities or weather unexpected difficulty. Use of debt rather than internal financing may be taken as a negative signal by the market.

Even if the company is generally healthy, more debt increases the risk that the company cannot use all of the interest tax shields in a bad year. As debt continues to grow, this problem grows and others may crop up. Management begins to worry about meeting debt payments instead of making good operating decisions. Suppliers are less willing to extend trade credit, and a liquidity shortage can translate into lower operating profits.

Ultimately, the firm might have to go through the costs of bankruptcy and reorganization. Collectively, such factors are known as the costs of "financial distress."[10]

The net tax advantage to debt, if positive, is affected by costs such as a growing risk that the firm might have to bear the costs of financial distress. First, the expected present value of these costs offsets the value added by the interest tax shield. Second, since the likelihood of financial distress is greater in bad times when other investments also do poorly, the possibility of financial distress will increase the risks investors bear. These effects increase the variability of the value of the firm. Thus, firms that use too much debt can end up with a higher overall cost of capital than those that use none.

Other parts of the answer include the signals companies send to investors by the decision to issue new securities, and by the type of securities they issue. Other threads of the literature explore cases where management acts against shareholder interests, or where management attempts to "time" the market by issuing specific securities under different conditions. For present purposes, the important point is that no theory, whether based on taxes or on some completely different issue, has emerged as "the" explanation for capital structure decisions by firms. Nonetheless, despite the lack of a single "best" theory, there is a great deal of relevant empirical research.

Q10. What does that research show?

A10. The research does not support the view that debt makes a material difference in the value of the firm, at least not once a modest amount of debt is in place. If debt were truly valuable, competitive firms should use as much debt as possible short of producing financial distress, and competitive firms that use less debt ought to be less profitable. The research shows exactly the opposite.

[10] See, for example, Section 19.3 of Brealey, Myers and Allen, *Principles of Corporate Finance*, 9th Edition, McGraw-Hill/Irwin, 2008.

For example, Kester[11] found that firms in the same industry in both the U.S. and Japan do not band around a single, "optimal" capital structure, and the most profitable firms are the ones that use the *least* debt. This finding comes despite the fact that both countries at the time (unlike the U.S. currently) had fully "classical" tax systems, in which dividends are taxed fully at both the corporate and personal level. Wald[12] confirms that high profitability implies low debt ratios in France, Germany, Japan, the U.K., and the U.S. Booth *et al.* find the same result for a sample of developing nations.[13] Fama and French[14] analyze over 2000 firms for 28 years (1965-1992, inclusive) and conclude, "Our tests thus produce no indication that debt has net tax benefits."[15] A paper by Graham[16] carefully analyzes the factors that might have led a firm not to take advantage of debt. It confirms that a large proportion of firms that ought to benefit substantially from use of additional debt, including large, profitable, liquid firms, appear not to use it "enough."

This research leaves us with only three options: either (1) apparently good, profit-generating managers are making major mistakes or deliberately acting against shareholder interests, (2) the benefits of the tax deduction on debt are less than they appear, or (3) the non-tax costs to use of debt offset the potential tax benefits. Only the first of these possibilities is consistent with the view that the tax deductibility of debt conveys a material cost advantage. Moreover, if the first explanation were interpreted to mean that otherwise good managers are acting against shareholder interests, either deliberately or by mistake, it would require the additional assumption that their competitors (and potential acquirers) let them get away with it.

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[11] Carl Kester (1986), "Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Concerns," *Financial Management*, 15:5-16.

[12] John K. Wald (1999), "How Firm Characteristics Affect Capital Structure: An International Comparison," *Journal of Financial Research*, 22:161-167.

[13] Laurence Booth *et al.* (2001), "Capital Structures in Developing Countries," *The Journal of Finance* Vol. LVI, pp. 87-130, finds at p. 105 that "[o]verall, the strongest result is that profitable firms use less total debt. The strength of this result is striking ..."

[14] Eugene F. Fama and Kenneth R. French (1998), "Taxes, Financing Decisions and Firm Value," *The Journal of Finance*, 53:819-843.

[15] *Ibid.*, p. 841.

[16] John R. Graham (2000), "How Big Are the Tax Benefits of Debt," *The Journal of Finance*, 55:1901-1942.

Q11. Are there any explanations in the financial literature for this puzzle other than stupid or self-serving managers at the most profitable firms?

A11. Yes. For example, Stewart C. Myers, a leading expert on capital structure, made it the topic of his Presidential Address to the American Finance Association.[17] The poor performance of tax-based explanations for capital structure led him to propose an entirely different mechanism, the "pecking order" hypothesis. This hypothesis holds that the net tax benefits of debt (i.e., corporate tax advantage over personal tax disadvantage) are at most of a second order of importance relative to other factors that drive actual debt decisions.[18] Similarly, Baker and Wurgler (2002)[19] observe a strong and persistent impact that fluctuations in market value have on capital structure. They argue that this impact is not consistent with other theories. The authors suggest a new capital structure theory based on market timing -- capital structure is the cumulative outcome of attempts to time the equity market.[20] In this theory, there is no optimal capital structure, so market timing financing decisions just accumulate over time into the capital structure outcome. (Of course, this theory only makes sense if investors do not recognize what managers are doing.)

Q12. Do inter-firm differences within an industry explain the wide variations in capital structure across the firms in an industry?

A12. No. This view is contradicted by the empirical research. As mentioned before, it has long been found that the most profitable firms in an industry, i.e., those in the best position to take advantage of debt, use the least.[21] Graham (2000) carefully examines differences in firm characteristics as possible explanations for why firms use "too little"

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[17] Stewart C. Myers (1984), "The Capital Structure Puzzle," *The Journal of Finance*, 39: 575-592. See also S. C. Myers and N. S. Majluf (1984), "Corporate Financing Decisions When Firms Have Information Investors Do Not Have," *Journal of Financial Economics* 13:187-222.

[18] See also Stewart C. Myers (1989), "Still Searching for Optimal Capital Structure," *Are the Distinctions Between Debt and Equity Disappearing?*, R.W. Kopke and E. S. Rosengren, eds., Federal Reserve Bank of Boston.

[19] Malcolm Baker and Jeffrey Wurgler (2002), "Market Timing and Capital Structure," *The Journal of Finance* 57:1-32.

[20] *Ibid.*, p. 29.

[21] For example, Kester, *op. cit.* and Wald, *op. cit.*

debt and concludes that such differences are *not* the explanation: firms that ought to benefit substantially from more debt by all measurable criteria, if the net tax advantage of debt is truly valuable, voluntarily do not use it.[22]

Nor does the research support the view that firms are constantly trying to adjust their capital structures to optimal levels. Additional research on the pecking order hypothesis demonstrates that firms do not tend towards a target capital structure, or at least do not do so with any regularity, and that past studies that seemed to show the contrary actually lacked the power to distinguish whether the hypothesis was true or not.[23] In the words of the Shyam-Sunder - Myers paper p. 242, "If our sample companies did have well-defined optimal debt ratios, it seems that their managers were not much interested in getting there."

II. EXPANDING THE EXAMPLE FROM THE DIRECT TESTIMONY

Q13. What topics do you cover in this section?

A13. My direct testimony did not detail the impact of different starting points for the level of debt nor did it address income earned on the investment, interest expense, or taxes. This section covers these topics. First, it discusses how the level of debt affects the cost of equity. Second, it addresses the influence of income and interest on the investment. Third, it explains the impact of taxes on capital structure decisions. The final topic covered in this section is the combined consequence of tax and non-tax effects of debt.

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[22] While not contradicting Graham's finding that differences in firm characteristics do not explain capital structure differences, Nengjiu Ju, Robert Parrino, Allen M. Poteshman, and Michael S. Weisbach, "Horses and Rabbits? Trade-Off Theory and Optimal Capital Structure," *Journal of Financial and Quantitative Analysis*, June 2005, pp. 1-24, looks at the issue in a different manner. Their paper uses a dynamic rather than static model to analyze the tradeoff between the tax benefits of debt and the risk of financial distress. It finds that bankruptcy costs by themselves are enough to explain observed capital structures, once dynamic effects are considered. This means debt is not as valuable as suggested by the traditional static analysis (of the sort used by Graham).

[23] Lakshmi Shyam-Sunder and Stewart C. Myers (1999), "Testing static tradeoff against pecking order models of capital structure," *Journal of Financial Economics* 51:219-244.

A. DETAILS OF DIFFERENT LEVELS OF DEBT

Q14. Please repeat briefly the setup in the example discussed in the direct testimony.

A14. The example considered an investor who purchases $100,000 in real estate. The future value of the real estate is uncertain. Figures 2 and 3 in my direct testimony show how the return on equity to the investor differs if he finances the purchase with 100 percent equity, and if he finances it with 50 percent equity and 50 percent mortgage debt. The example illustrates the fact that debt adds risk to equity.

Q15. What happens if the investor finances the real estate purchase with different proportions of debt?

A15. The equity return becomes more variable when the mortgage percentage is a greater proportion of the initial price. Table E-1 below calculates the return on equity when real estate prices increase by 10 percent when mortgages are 0 percent, 30 percent, 50 percent, and 70 percent of the initial price.

Table E-1: The Impact of Leverage on the Return on Equity

	100% Equity	70% Equity	50% Equity	30% Equity
Debt	$0	$30,000	$50,000	$70,000
Original Equity Investment	$100,000	$70,000	$50,000	$30,000
Increase in Market Value of Equity	$10,000	$10,000	$10,000	$10,000
Return on Equity Investment	10%	14.3%	20%	33.3%

Note that going from 70 percent equity down to 50 percent equity increases the return on the equity investment by 5.7 percent while going from 50 percent equity to 30 percent equity increases the return on equity by 13.3 percent. This illustrates a general point; the rate of return on equity increases more quickly at higher levels of debt than at lower levels. Investors demand a higher equity rate of return to bear more risk and debt magnifies equity's risk at an ever increasing rate. Therefore, the required equity rate of

return goes up at an ever increasing rate as debt is added. This is not only basic finance theory, it is the everyday experience of anyone who buys a home. The bigger the mortgage, the more percentage risk the equity faces from changes in housing prices.

B. THE IMPACT OF INCOME AND INTEREST

Q16. How does earning income from the investment and paying interest on debt affect the results?

A16. In the following explanation, I ignore income taxes which I deal with in Section C below. Assume the investor is receiving income, e.g., rent, from the real estate. Specifically, assume the investor receives $500 per month in income after all non-interest expenses ($6,000 per year). Also, assume that the expected appreciation is 5 percent per year, so the expected market value is $105,000 after one year. Then the expected rate of return from the real estate with all equity financing is:

$$\text{Expected Return on Equity @ 0\% debt} = \frac{\text{Expected Net Income + Expected Appreciation}}{\text{Initial Investment}}$$

$$= \frac{\$6{,}000 + (\$105{,}000 - \$100{,}000)}{\$100{,}000}$$

$$= 11\%$$

Now suppose that the mortgage interest rate were 5 percent. Then at a mortgage equal to 50 percent, or $50,000, interest expense would be ($50,000 x 0.05), or $2,500. The expected equity rate of return would be:

$$\text{Expected Return on Equity @ 50\% debt} = \frac{\text{Expected (Net Income + Appreciation) – Int. Expense}}{\text{Initial } \textit{Equity} \text{ Investment}}$$

$$= \frac{\$6{,}000 + \$5{,}000 - \$2{,}500}{\$50{,}000}$$

$$= 17\%$$

Notice that the expected return on equity is higher as is the risk carried by equity.

Q17. Can you provide a more general illustration?

Yes. Figure E-1 uses these assumptions at different mortgage levels to plot both (i) the expected rate of return on the equity in the real estate, and (ii) the realized rate of return on that equity in a year if the real estate value increases by 10 percent more than the expected 5 percent rate (i.e., if the value increases by 15 percent) or by 10 percent less than expected (i.e., if it decreases by 5 percent).[24]

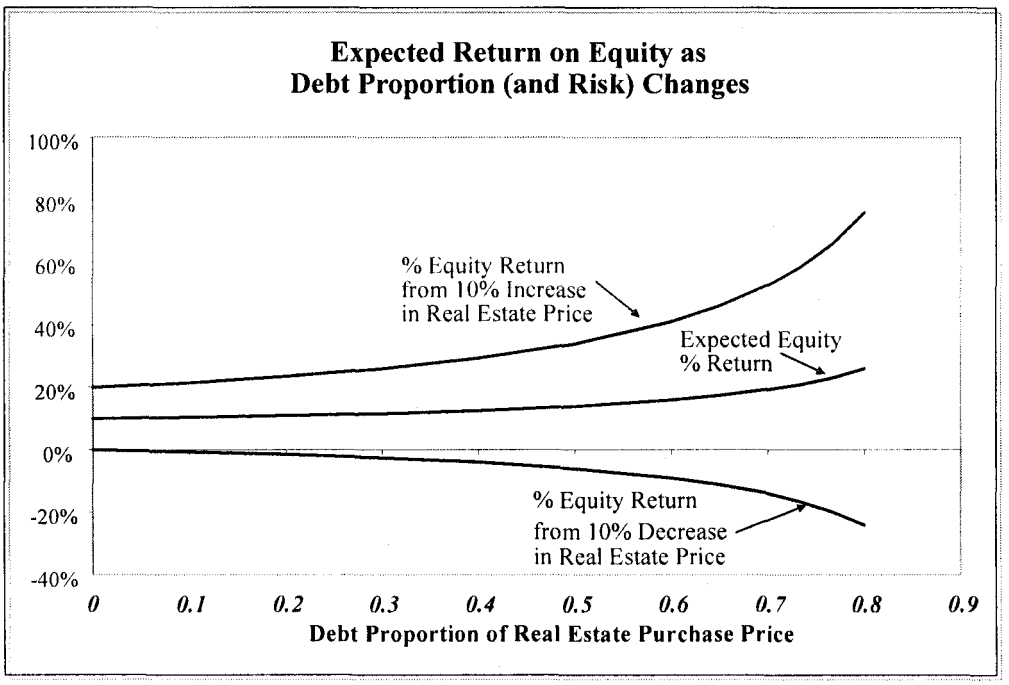

Figure E-1

The expected rate of return on equity increases at an increasing rate as the investor finances more and more of the real estate through loans (e.g., with a mortgage). Since equity bears all the risk of increases or decreases in real estate values (absent financial distress or bankruptcy), the amount of risk the buyer bears grows at an ever increasing rate as the mortgage percentage also increases.

[24] For simplicity, the figure assumes the debt's interest rate is independent of the debt proportion. This might not always be true, and in general would not be true for a corporation that issued debt. However, the general shape of the graphs remains the same.

Q18. What are the implications of this example?

A17. When a company uses debt to finance part an investment, the risk magnifies. For example, if an investor buys stocks "on margin" -- by borrowing part of the money used to buy the stock -- the expected rate of return will be higher as will the risks the investor carries. As an everyday example, imagine investing your retirement savings in a stock portfolio bought with as much margin as possible. If you were lucky, you could end up living very well in retirement. However, it is very risky and likely you would have lost substantial value over the past year. Specifically, your portfolio could decline by more than 100 percent of your initial investment. The same risk-magnifying effects happen when companies borrow to finance part of their investments.

C. THE EFFECT OF TAXES

Q19. What is the impact of taxes?

A18. Analyzing the net effect of taxes in capital structure decisions by corporations is an important part of the financial research. The bottom line is that taxes complicate the picture without changing the basic conclusion.

Q20. Please describe the potential impact of taxes.

A19. Interest expense is tax-deductible for corporations. That increases the pool of cash the corporation gets to keep out of its operating earnings (i.e., its earnings before interest expense). With no debt, 100 percent of operating income is subject to taxes. With debt, only the equity part of the operating income is subject to taxes. All else equal, the extra money kept from operating income increases the value of the corporation. The standard way to recognize that increase in value is to use an after-tax weighted-average cost of capital as a discount rate when valuing a company's operating cash flows.

Q21. Do personal taxes affect the value of debt, too?

A20. Yes, but in the other direction. One offset to debt's tax benefits at the corporate level is its higher tax burden at the personal level. Investors care about the money they get to keep after all taxes are paid, and while the corporation saves taxes by opting for debt over

equity, individuals pay more taxes on interest than on capital gains from equity (and for now, on dividends as well).

Q22. Are there factors other than taxes matter?

A21. Yes. The "all else" does not remain equal as more debt is added. The more debt, the more the non-tax effects of debt offset the tax benefits. Other costs include such effects as a loss of flexibility, the possibility of sending negative signals to investors, and a host of costs and risks associated with the danger of financial distress.

Q23. Does the tradeoff between the tax and non-tax effects of debt mean that firms have well-defined, optimal capital structures?

A22. No, the "tradeoff" model does not explain actual corporate behavior. Economic research confirms that real-world corporations act as if, after a moderate amount of debt is in place, the tax benefits of debt are not worth debt's other costs. In country after country and in industry after industry, the most profitable corporations in an industry tend to use the least debt. Economic research finds that the most profitable companies tend to use the least debt in a given industry. Yet these are the companies with the most operating income to shield from taxes, who would benefit most if interest tax shields were truly valuable net of debt's other costs. They also presumptively are the best-managed on average (else why are they the most profitable?). This means it is unrealistic to suppose that more debt is always better, or that greater tax savings due to higher interest expense always add value to the firm on balance.

Q24. If the tradeoff model doesn't explain capital structure decisions by firms, is there a model that does?

A23. No single model has (yet) emerged as 'the" explanation of capital structure. However, several alternative models attempt to model the tradeoff (e.g., the "pecking order" hypothesis and "agency cost" explanations).

Q25. What does the absence of an agreed theory of capital structure in the financial literature imply about the overall effect of debt on the value of the firm?

A24. The findings of the financial literature mean that within an industry, there is no well-defined optimal capital structure. The use of some debt does convey some value advantage in most industries, but that advantage is offset by other costs as firms add more debt.[25] The range of capital structures over which the value of the firm in any industry is maximized is wide and should be treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry.

Figure E-2 illustrates the picture that emerges from the research. This figure shows the present value of an investment in each of four different industries. For simplicity, the investment is expected to yield $1.00 per year forever. For firms in relatively high-risk industries (Industry 1 in the graph, the lowest line), the $1.00 perpetuity is not worth much and any use of debt decreases firm value. For firms in relatively low-risk industries (Industry 4 in the graph), the perpetuity is worth more and substantial amounts of debt make sense. Industries 2 and 3 are intermediate cases.

The maximum net rate at which taxes can increase value in this figure equals 20 percent of interest expense, representing a balance between the corporate tax advantage to debt and the personal tax disadvantage. The figure plots the maximum possible impact of taxes on value as a separate line, starting at the all-equity value of the lowest-risk industry (Industry 4).

[25] Note that if debt did increase the value of the firm materially, competition would tend to take that value away, since issuing debt is an easy-to-copy competitive strategy. Prices would fall as firms copied the strategy, lowering operating earnings and passing the net tax advantages to debt through to customers (just as happens under rate regulation). Therefore, if also there were a narrow range of optimal capital structures within an industry, competition would drive all firms in the industry to capital structures within that range. This does not happen in practice, which contradicts one or both of the assumptions, i.e., (1) that debt adds material value on balance, and/or (2) that there is a narrow range of optimal capital structures.

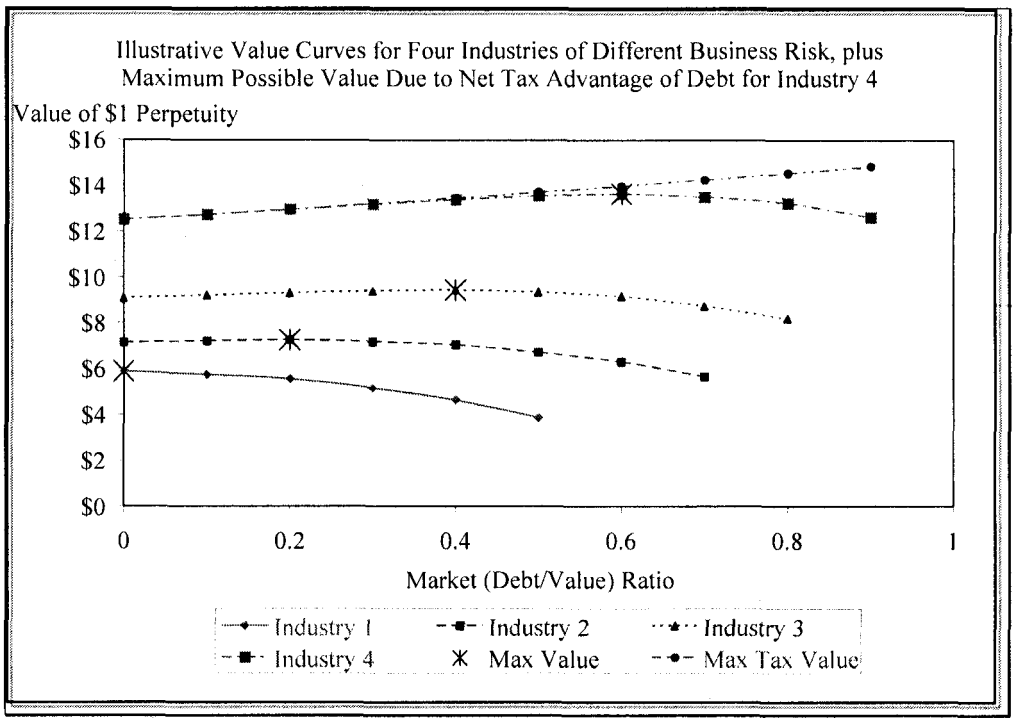

Figure E-2

Figure E-2 identifies a particular point as the maximum value on each of the four curves. However, the research shows that reliable identification of this maximum point, except in the extreme case where no debt should be used, is impossible. In accord with the research, the graph is prepared so that in none of the industries does a change in capital structure make much difference near the top of the curve. Even Industry 4, which increases in value at the maximum rate as quite a lot of debt is added, eventually must reach a broad range where changes in the debt ratio make little difference to firm value, given the research. For Industry 4, debt makes less than a 2 percent difference in the total value of the firm for debt-to-value ratios between 40 and 70 percent.

Q26. What does this imply for the overall cost of capital?

A25. Figure E-3 plots the after-tax weighted-average costs of capital ("ATWACCs") that correspond to the value curves in Figure E-2. This picture just turns Figure E-2 upside down. All the same conclusions remain, except that they are stated in terms of the overall cost of capital instead of the overall firm value. In particular, except for high-risk

industries, the overall cost of capital is essentially flat across a broad middle range of capital structures for each industry, which is the only outcome consistent with the research. For Industry 4, for example, the ATWACC changes by less than 15 basis points for debt-to-value ratios between 40 and 70 percent.

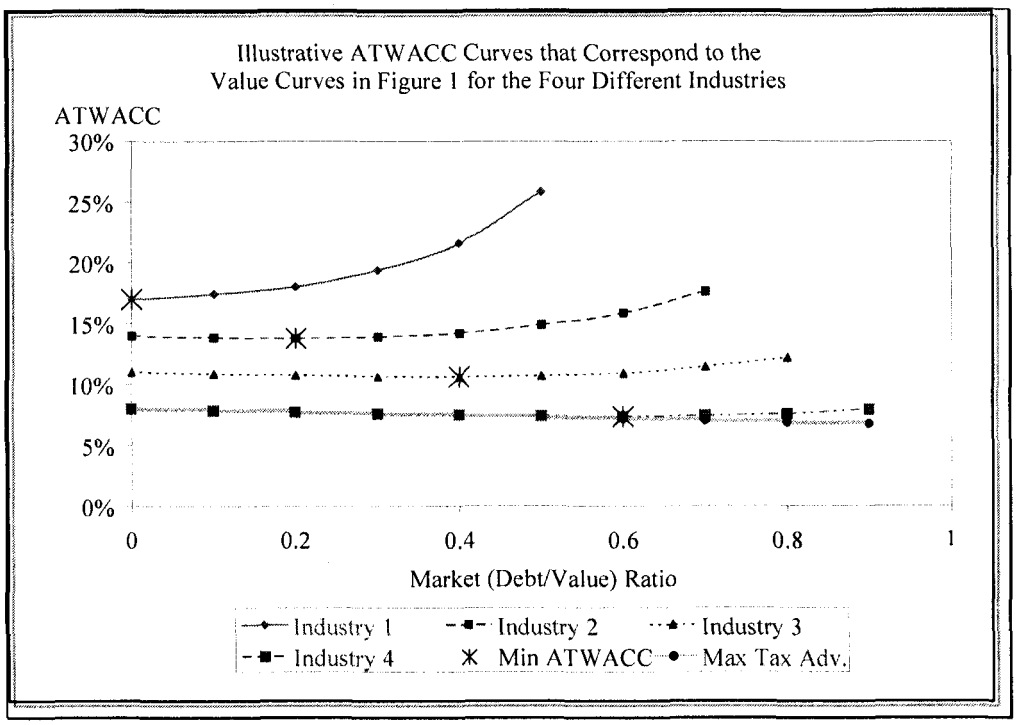

Figure E-3

Q27. How does this discussion relate to estimation of the right cost of equity for ratemaking purposes?

A26. When an analyst estimates the cost of equity for a sample of companies, s/he does so at the sample's actual market-value capital structure. That is, the sample evidence corresponds to ATWACCs that are already out somewhere in the broad middle range in which changes in the debt ratio have little or no impact on the overall value of the firm or the ATWACC.

The ATWACC curve is therefore virtually flat in a broad middle range. This assumption provides the tradeoff between the cost of equity and capital structure.

D. COMBINED EFFECTS

Q28. Please summarize the implications for the combined impact of the tax and non-tax effects of debt.

A27. The most profitable firms do not behave as if the precise amount of debt they use makes any material difference to value, and competition does not force them into an alternative decision, as it would if debt were genuinely valuable. The explanation that fits the facts and the research is that within an industry, there is no well-defined optimal capital structure. Use of some debt does convey an advantage in most industries, but that advantage is offset by other costs as firms add more debt. The range of capital structures over which the value of the firm in any industry is maximized is wide and should be treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry. To conclude that more debt does add more value, once the firm is somewhere in the normal range for the industry, is to conclude that corporate management in general is either blind to an easy source of value or otherwise incompetent (and that their competitors let them get away with it).

The finding that there is no narrowly defined optimal capital structure implies that the ATWACCs for a sample of companies in a given industry is independent of capital structure (at least within a broad middle range of capital structures). The cost of equity for a rate-regulated company in the same industry is the number that yields the same ATWACC at the capital structure used to set the revenue requirement, since that is the cost of equity that (estimation problems aside) the sample companies would have had if their market-value capital structures had been equal to the regulatory capital structure.