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 ANTHEM WATER AND SUN CITY WATER DISTRICTS	DOCKET NO. W-01303A-09-
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DIRECT TESTIMONY
OF
BENTE VILLADSEN
ON BEHALF OF
ARIZONA-AMERICAN COMPANY
JUNE 2009

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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 Anthem and Sun City water districts as well as for its Anthem /Agua Fria, Sun City and Sun City West wastewater 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 cut its dividend and also have announced it will restate part of its financials. 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 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, as Arizona-American Water's requested target of 45 percent equity is lower than the percentage equity among many utilities, 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

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

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 ongoing financial crisis on utilities' cost of capital and notes that while the yield on government issued bills and bonds is currently very low, the yield on investment-grade utility bonds is not. 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 have lost substantial value in capital markets over the past ¾ year 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 other words, her recommended return on equity does not include the current higher risk premium making her recommendation more conservative.

In addition to the cost of capital estimation discussed above, Dr. Villadsen reviewed 20 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 targeted equity percentage.

Lastly, Dr. Villadsen notes that the water industry has seen substantial stock price drops in recent months, volatility in stock prices, and increased cost of debt. At the same time, the most commonly used measure of companies' systematic risk, the stock's beta, has remained high for water utilities. This indicates that capital markets continue to perceive water utilities as risky investments rather than safe havens. At the same time the water industry, including Arizona-American Water needs to invest substantial amounts in infrastructure to upgrade the distribution and transmission system as well as to develop new water resources. The industry also need 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 during an economic recession, it is necessary to attract needed capital. Specifically, the increase in investment-grade utility bond yields and the decline in available equity capital show that investors are holding onto their funds and in order to attract investments, they will need to expect that they can earn a sufficient return on their investment that it is worth the risk. The June 2009 sale of American Water stock had been expected by the market for a long time and was priced at 80 percent of American Water's April 2008 Initial Public Offering price. The lower price means that everything else equal, investors expect to realize a higher return on their investment than they did a year ago. Thus, at the same income level as a year ago, it is consistent with an increased market risk premium.

Based on the evidence from the samples, Dr. Villadsen finds that Arizona-American Water's request for 12.25% return on equity is reasonable and fully supported by her analysis. The financial crisis has made the range of a reasonable return on equity wider and especially increased the upper bound on the range, so the requested return on equity is below the midpoint of the best range estimate of 11¾ percent to 13 percent.

I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A1. My name is Bente Villadsen. My business address is *The Brattle Group*, 44 Brattle Street, Cambridge, MA 02138.

Q2. PLEASE DESCRIBE YOUR JOB AND EDUCATIONAL EXPERIENCE.

A2. 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.

Q3. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A3. 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 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 a 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 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.

Q4. PLEASE SUMMARIZE ANY PARTS OF YOUR BACKGROUND AND EXPERIENCE THAT ARE PARTICULARLY RELEVANT TO YOUR TESTIMONY ON THESE MATTERS.

A4. 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 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 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.

Q5. PLEASE SUMMARIZE YOUR APPROACH TO ESTIMATING THE COST OF CAPITAL FOR ARIZONA-AMERICAN WATER.

A5. 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 the water companies which are less likely to have unique issues that may affect the cost of capital estimates. I give greater weight to the results from the gas LDC sample and the water subsample than to the full water sample. For each sample, I estimate the sample companies' cost of equity using several versions of the DCF method and of the risk-positioning model. Based on data availability and the current state of the water and gas distribution industries I assign the most weight to the risk-positioning models.

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 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.)

Focusing on the overall cost of capital rather than its components avoids potential problems of inconsistency between the estimated cost of equity and the level of financial risk at the regulated company's capital structure.

Q6. ARE THERE ANY UNIQUE ISSUES IN ESTIMATING THE COST OF CAPITAL AT THIS POINT IN TIME?

A6. Yes. I discuss the effect of the credit crisis on the cost of capital 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. Unfortunately, the turmoil in the financial markets also affects the results of the estimation models so that estimating the cost of capital under current conditions is more difficult than it would normally be. Because of the unusual conditions prevailing today, I report the cost of capital from several sensitivity analyses in addition to a baseline result. These analyses are discussed further below.

Q7. USING YOUR BASELINE RESULTS, PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING ARIZONA-AMERICAN WATER'S COST OF EQUITY.

A7. Using the risk positioning models, the baseline cost of equity estimate for both the water subsample and the gas LDC sample is about 12½ percent at Arizona-American Water's regulatory capital structure. The result for the full water sample is higher at about 13 percent. However, it is more accurate to say that the estimated range for the water subsample is approximately 12 to 13 percent while the range for the gas LDC sample is narrower at about 12 to 12¾. The range for the full water sample is a bit higher at about 12½ to 13¾ percent. The DCF estimates for the water sample and subsample vary widely from approximately 11½ to 16½ percent while the gas LDC sample estimates are in a narrow range from 12 to 12¼ percent. Because the growth rates underlying the water sample's DCF estimates wary widely not only among companies but also among analysts, little weight is attached to the water sample's (or water subsample's) DCF estimates.

The sensitivity analyses that incorporate the impact of the current financial crisis on the cost of equity lead to higher cost of equity estimates. Thus, I believe 12¼ percent is a conservative estimate of the current cost of equity for Arizona-American water which is fully supported by all analyses. Therefore, in my opinion, Arizona-American Water's request for 12.25 percent return on equity is very reasonable.

Q8. WHY DO YOU NEED TO CONSIDER ARIZONA-AMERICAN WATER'S REGULATORY CAPITAL STRUCTURE?

A8. 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.

Q9. HOW IS THE REST OF YOUR TESTIMONY ORGANIZED?

A9. 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 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

Q10. PLEASE FORMALLY DEFINE THE "COST OF CAPITAL."

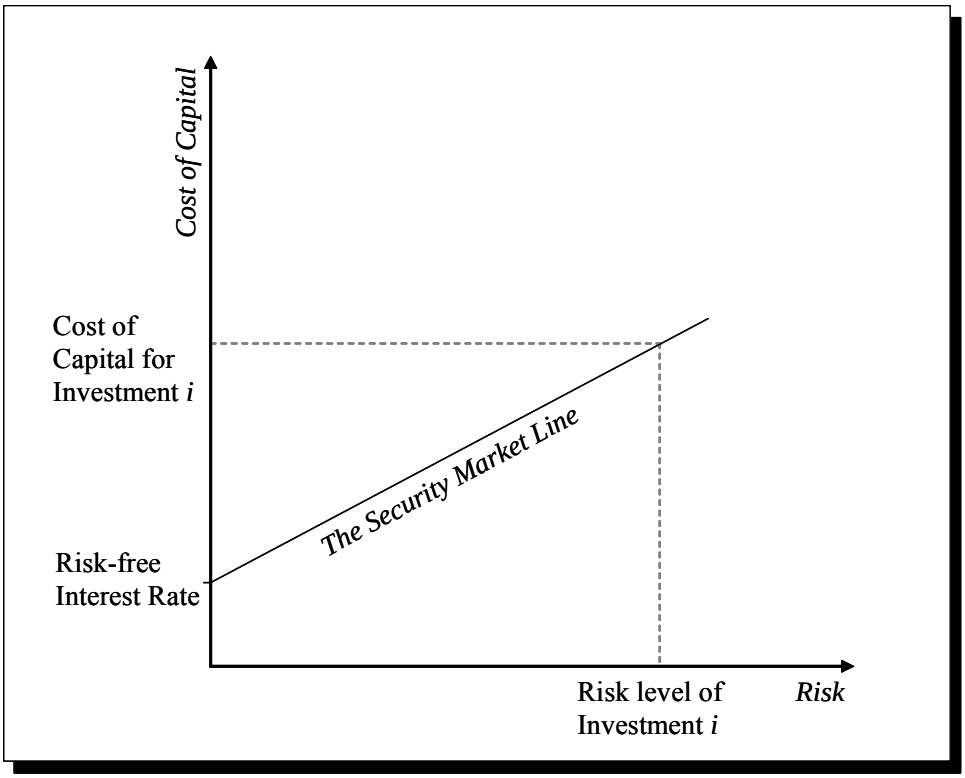
A10. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of

capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[2]

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.

[2] "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.

Figure 1: The Security Market Line



Q11. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A11. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility investment.[3] 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 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),[4] 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.

[3] 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).

[4] Capital expenditures among water utilities have in the last several years exceeded 3 times income.

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 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

Q12. WHAT IS THE DIFFERENCE BETWEEN BUSINESS RISK AND FINANCIAL RISK?

A12. 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.

Q13. PLEASE EXPLAIN WHY IT IS NECESSARY TO REPORT THE COST OF EQUITY ADJUSTED FOR CAPITAL STRUCTURE.

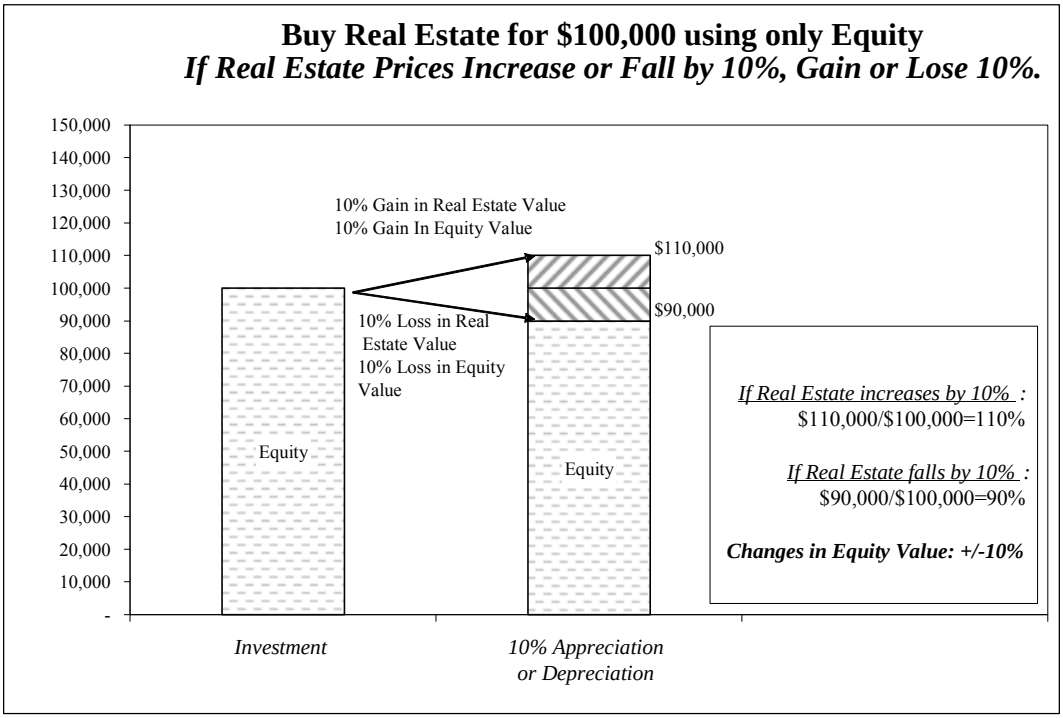
A13. Rate regulation in North America has traditionally focuses on the components of the rates.[5] In other words, the focus of cost-of-capital estimation is usually on determining the "right" cost of equity, and to a lesser degree on setting the allowed capital structure. While the overall cost of capital 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 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.

Q14. PLEASE PROVIDE AN EXAMPLE ON HOW DEBT ADDS RISK TO EQUITY.

A14. 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.

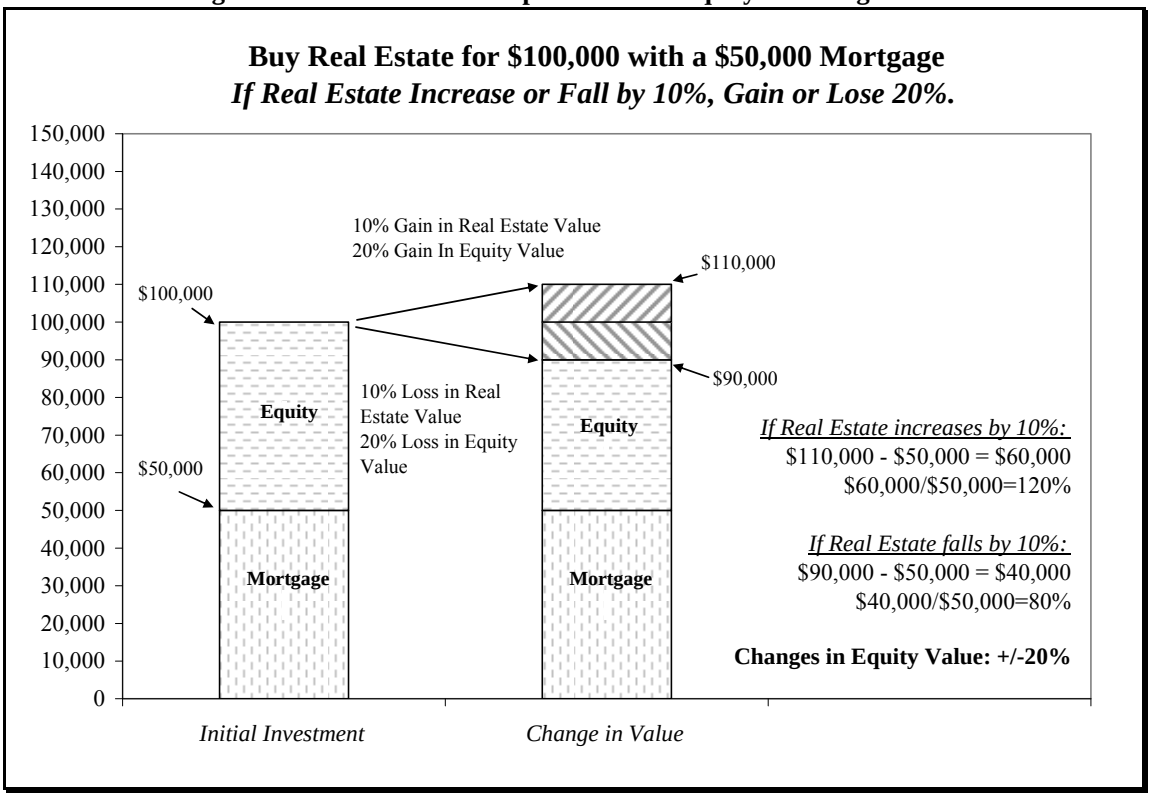
[5] An exception is the recent decision by the National Energy Board of Canada which in its RH-1-2008 decision, issued March 2009, determined the after-tax weighted average cost of capital rather than a return on equity and a capital structure.

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

Q15. PLEASE EXPLAIN THE IMPLICATIONS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY FOR RATE REGULATION.

A15. 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.

Q16. TO ASSESS THE MAGNITUDE OF FINANCIAL RISK FOR A RATE REGULATED COMPANY, SHOULD YOU USE THE MARKET-VALUE OR THE BOOK-VALUE CAPITAL STRUCTURE?

A16. The market-value capital structure is the relevant quantity for analyzing the cost-of-equity evidence, which is based on market information.[6]

Q17. PLEASE PROVIDE AN EXAMPLE THAT ILLUSTRATES WHY MARKET VALUES ARE RELEVANT.

A17. 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:

[6] 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%

Q18. PLEASE EXPLAIN THE IMPLICATIONS FOR RATE REGULATION AND YOUR TESTIMONY.

A18. 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..

Q19. 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?

A19. 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.*

Q20. PLEASE SUM UP THE IMPLICATIONS OF THIS SECTION.

A20. The market risk, and therefore the cost of equity depends directly 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.

Q21. HOW SHOULD A COST-OF-CAPITAL ANALYST IMPLEMENT THIS PRINCIPLE?

A21. 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, analysts should 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. Sample evidence should be analyzed to determine the sample's average ATWACC, which can be compared across different firms or industries. 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. That value is the cost of equity that the sample would have had, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q22. HOW DO YOU CALCULATE THE COST OF EQUITY CONSISTENT WITH THE MARKET-DETERMINED ESTIMATE OF THE SAMPLE'S AVERAGE COST OF CAPITAL?

A22. For simplicity assume that all sample companies have only common stock and debt. Then the ATWACC is calculated as:

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \qquad \textbf{(1)}$$

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.

Q23. WHY DOESN'T ARIZONA-AMERICAN WATER SIMPLY INCREASE ITS EQUITY RATIO SO THAT NO ADJUSTMENT IS NEEDED?

A23. 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, the current financial crisis has made it difficult or costly to raise capital and especially equity capital at a time when American Water is working towards an increase in its equity ratio. As stock prices, including that of American Water, have declined, the amount of equity capital that can be raised by increasing the number of shares by, for example, 10 percent declines. Therefore, it is at the moment not straightforward to increase the equity percentage significantly. Third, the higher return on equity at 45.15 percent equity than at 50 or 60 percent equity is not a reward for having a low equity ratio, but simply a mechanism to guarantee that the overall return on capital is similar for utilities with different capital structure. In summary, there is no harm to ratepayers because rates are affected by the total return rather than the return on equity, so it would be misguided to raise equity capital for the sole purpose of having an average capital structure.

Q24. CAN YOU PROVIDE AN EXAMPLE OF HOW THIS FORMULA IS USED TO DETERMINE THE COST OF EQUITY?

A24. 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.

Q25. BUT IS IT NOT THE CASE THAT IF THE ALLOWED RATE OF RETURN ON EQUITY IS LOWER, THEN ALL ELSE EQUAL RATEPAYERS PAY LESS?

A25. Yes, for a given equity percentage. However, it comes at a cost: if the rate of return on equity appropriate 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 appropriately compensated for the 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.

Q26. 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?

A26. 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 and relied upon the so-called Hamada methodology to compensate Arizona-American Water for having higher financial risk that the sample companies.[7] However, the Hamada article that derives the Hamada methodology clearly uses market values[8] as do newer expositions of the results. It is also noteworthy that the National Energy Board of Canada in a recent decision granted an ATWACC rather than a return on equity stating that "the ATWACC approach better utilizes financial market information" and "market values reflect the level of financial risk that equity holders bear for the sample companies."[9] Thus, the National Energy Board and financial economists agree that market values are what determine the financial risk.

[7] See, for example, Direct Testimony of Pedro M. Chaves in Docket WS-01303A-06-0491 p. 12 and pp. 35-36.

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

[9] National Energy Board, RH-1-2008, p. 18 and p. 29.

III. IMPACT OF CURRENT ECONOMIC TURMOIL ON THE COST OF CAPITAL

Q27. WHAT DO YOU DISCUSS IN THIS SECTION?

A27. This section addresses the effect of the current economic situation on the cost of capital and modifications to my standard procedures that are necessary to estimate the cost of capital more accurately.

Q28. PLEASE SUMMARIZE THE EFFECT OF CURRENT ECONOMIC CONDITIONS ON THE COST OF CAPITAL.

A28. The ongoing economic situation in the U.S. as well as most of the rest of the world makes investments highly uncertain. Economic growth has slowed, and it is negative in many countries. Stock markets worldwide have lost substantial value over a short period of time. For example, the S&P 500 fell by about 30 percent over the five month period from the beginning of August 2008 to the end of December 2008. At the same time the volatility of the index and financial markets in general has increased dramatically. (See Figure 4 below.) The likely result of the increased uncertainty is that investors' risk aversion has increased, which, in turn, means that the cost of capital is higher today than in the recent past.

Q29. WHAT DO YOU MEAN BY THE TERM INVESTOR "RISK AVERSION"?

A29. Risk aversion is simply the recognition that investors dislike risk. A fundamental tenet of investing is that investors face a risk-return tradeoff in selecting from among the various investment options. Risk-averse investors can only be induced to accept more risk if the expected return is higher. When investors' risk aversion increases, the expected return (sometimes called the required return) increases for any level of risk.[10] In other words, the market risk premium, the premium required for an average risk stock, is higher today than it was in the recent past.

[10] The term "coefficient of risk aversion" is frequently used in academic articles in conjunction with an assumption regarding investors' utility functions. In this testimony, I am using the term in a more generic sense.

Q30. WHAT EVIDENCE DO YOU HAVE THAT INVESTORS' RISK AVERSION HAS INCREASED?

A30. A number of readily observable factors indicate an increase in investors' risk aversion. Unprecedented defaults in debt instruments that had previously been highly rated (AA or A), such as collateralized debt obligations and mortgage-backed securities, and the fall in value of most securities caused investors to seek investments that would preserve the value of their investments. As a result, there has been a "flight to safety" by investors seeking to maintain the value of their investments. In general, investors perceive bonds as less risky (safer) than equity and government bonds as safer than corporate bonds. As a result, the demand for bonds, particularly government debt, has increased substantially. In fact, at what *may* have been the height of the crisis, the demand for and hence the price of U.S. Treasury bills was so high that the yield (or return) on U.S. Treasury bills actually fell below zero![11] The flight to safety had two other results. First, the yield spread between corporate bonds and government bonds has increased dramatically. Although the yield spreads have declined somewhat from their highest levels, they remain high by historical standards as can be seen in Table 3 below. Therefore, using the current risk-free rate in the risk-positioning models will not accurately reflect the risk inherent in owning equity. Specifically, the ***increase*** in yield spread has to be taken into account.

[11] "Treasury Bills Trade at Negative Rates as Haven Demand Surges", by Daniel Kruger and Cordell Eddings, *Bloomberg*, December 9, 2008.

Table 3

Spreads between US Utility Bond (20 year maturity) and US Treasury Bond (20 year maturity)					
Periods	Bloomberg A-Rated Utility and Treasury	Bloomberg BBB-Rated Utility and Treasury	Moody's A-Rated Utility and Treasury	Moody's BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.95	1.25	1.13	1.44	[a]
Period 2 - Average Aug-2008 - 2009	2.69	3.55	2.70	3.96	[b]
Period 3 - Average Apr-2009	2.39	3.61	2.53	3.98	[c]
Period 4 - Average 15-Day (April 27, 2009 to May 15, 2009)	2.19	3.41	2.39	3.69	[d]
Spread Increase between Periods 2 and 1	1.74	2.30	1.45	2.71	[e] = [b] - [a].
Spread Increase between Periods 3 and 1	1.43	2.36	1.28	2.73	[f] = [c] - [a].
Spread Increase between Periods 4 and 1	1.24	2.16	1.14	2.44	[g] = [d] - [a].

Source:
Spreads for the periods are calculated from Bloomberg and Moody's yield data.
Average monthly yields for the indices were retrieved from May 18, 2009.

Second, the stock market has plummeted in value as investors attempted to move out of investments considered risky to those of lower risk. Increased risk aversion translates into a requirement for an investment to provide a higher expected return for a given level of risk. Under such circumstances, prices of investments fall until investors can again expect to earn their (now higher) required rate of return. Of course, part of the fall in prices is the result of a fall in expected cash flows, but it is also the result of increased risk aversion as indicated by the differential decrease in investments of different risk.

Q31. HOW DIFFERENT IS THE OVERALL ECONOMIC ENVIRONMENT NOW COMPARED TO OTHER TIME PERIODS IN WHICH YOU HAVE TESTIFIED?

A31. We now live in a very different economic environment compared to one or two years ago. The U.S. and world economies are in a state of recession triggered by the deep financial crisis that emerged from the housing bubble and from financial institutions' use of sophisticated structures that concealed the true risk faced by the investors. Stock markets are down, market volatility and the spread on corporate debt is high, and for most firms it has become hard to gain access to external financing on reasonable terms.

More specifically, as Figure 4 below indicates, the S&P 500 index declined by approximately 35 percent between mid 2008 and May 2009. The average water utility

followed by *Value Line* saw its stock price decline by 15-20 percent over the past year, but Southwest Water's stock price was cut in half while, for example, California Water saw only a modest decline.[12]

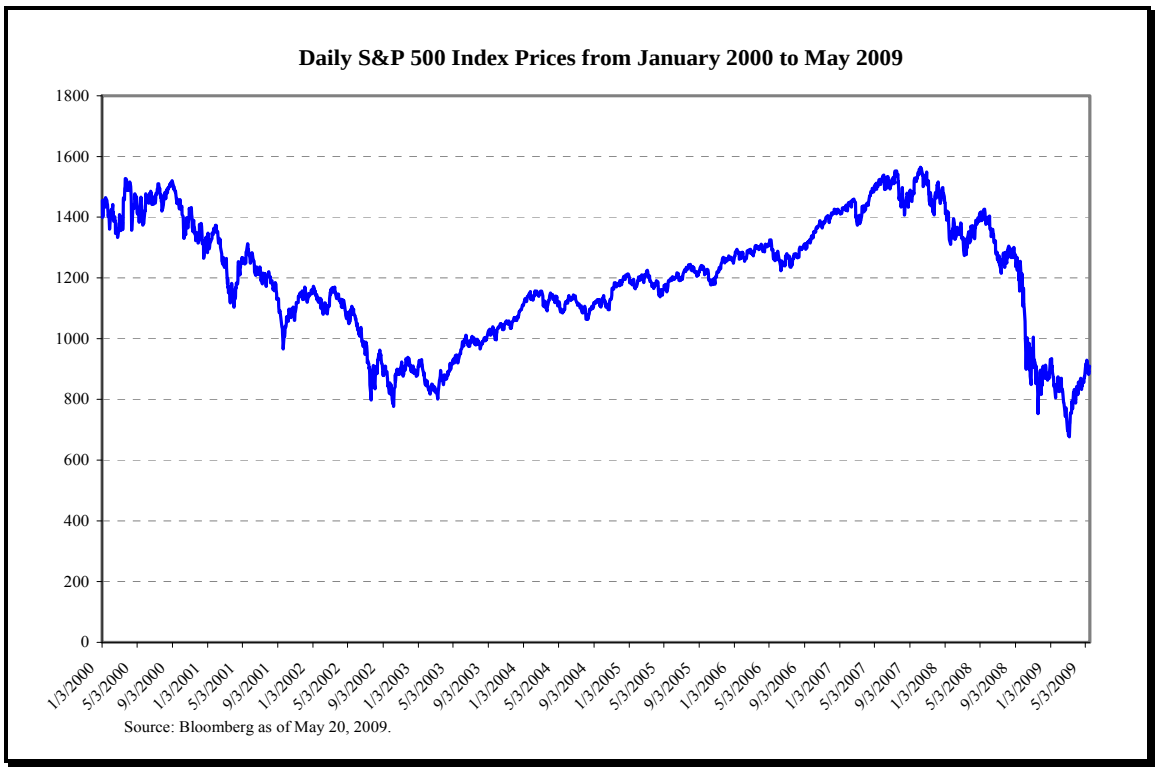


Figure 4

Figure 5 below displays the market volatility, measured by the Chicago Board Options Exchange ("CBOE") Volatility Index (also know as *VIX*), over the period beginning in 1998 through the first week of May 2009.[13]

[12] Southwest Water had as of May 15, 2009 not yet filed its 2008 form 10-K with the Securities and Exchange Commission and has recently cut dividend. Price information was obtained from Bloomberg.

[13] The *VIX* is a measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices.

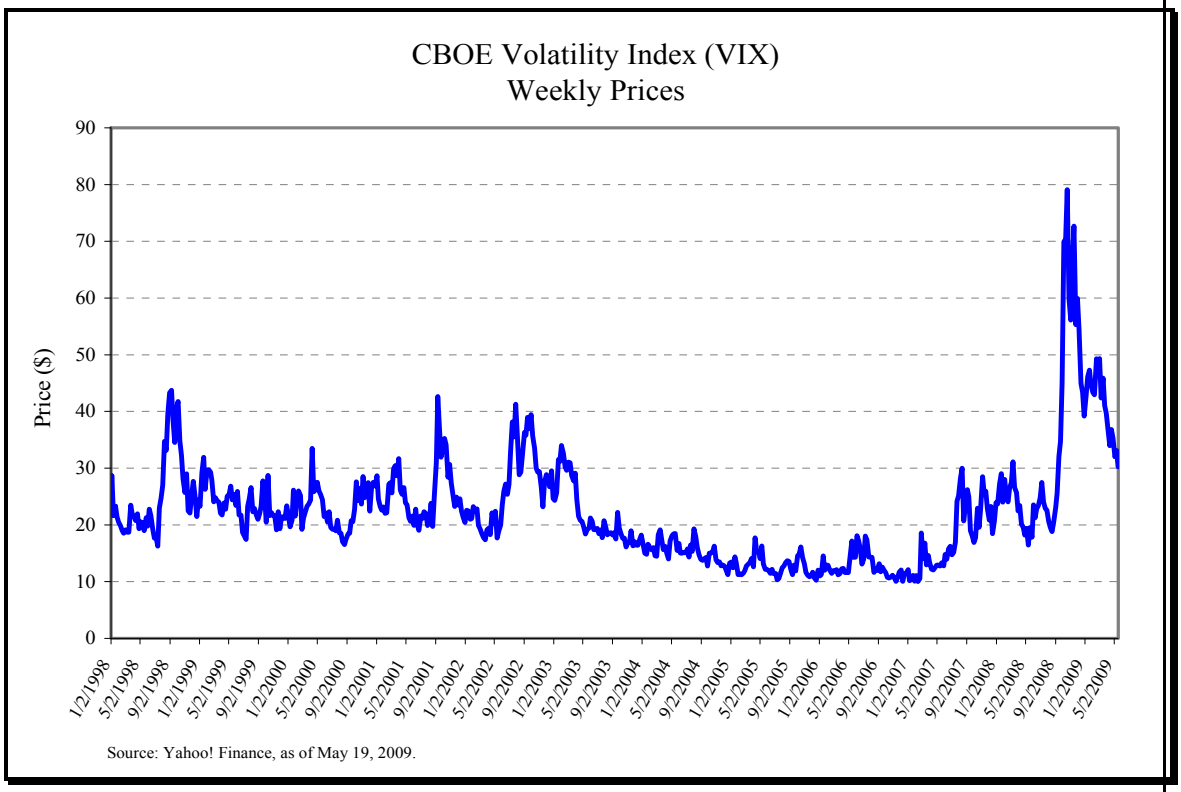


Figure 5

Until relatively recently, average volatility was in the 10-20 percent range, but it spiked 80 percent in late 2008. Although volatility has decreased somewhat over the last couple of months, it is still significantly higher than the average value for the first half of 2008 (prior to the crisis).

At the same time the Federal Reserve has cut interest rates and by now the yield on the Treasury bills is at extraordinarily low levels with yields close to zero. However, the lower yields on government debt have not translated into lower yields on corporate debt (including the yields on investment grade utility bonds). As Figure 6 shows, the spreads over Treasury bonds for long-term A and BBB utility debt remain at historically high levels. Figure 7 displays the yields on A and BBB-rated utility debt relative to government bond yields.

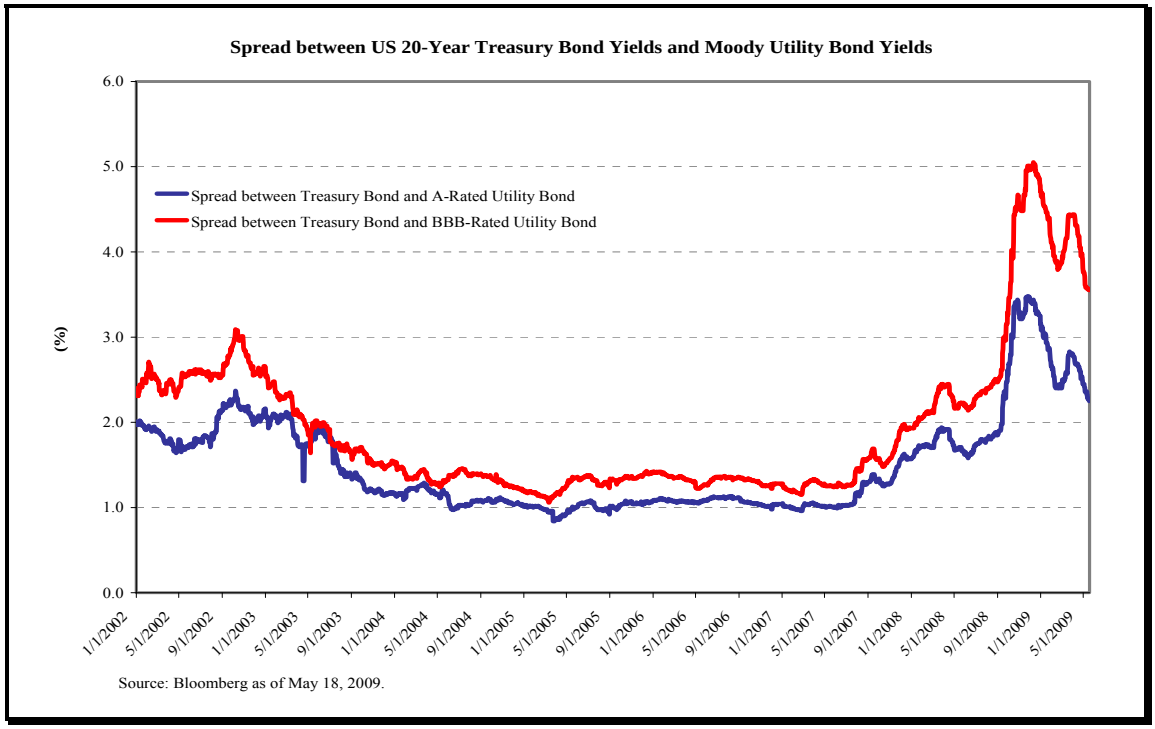


Figure 6

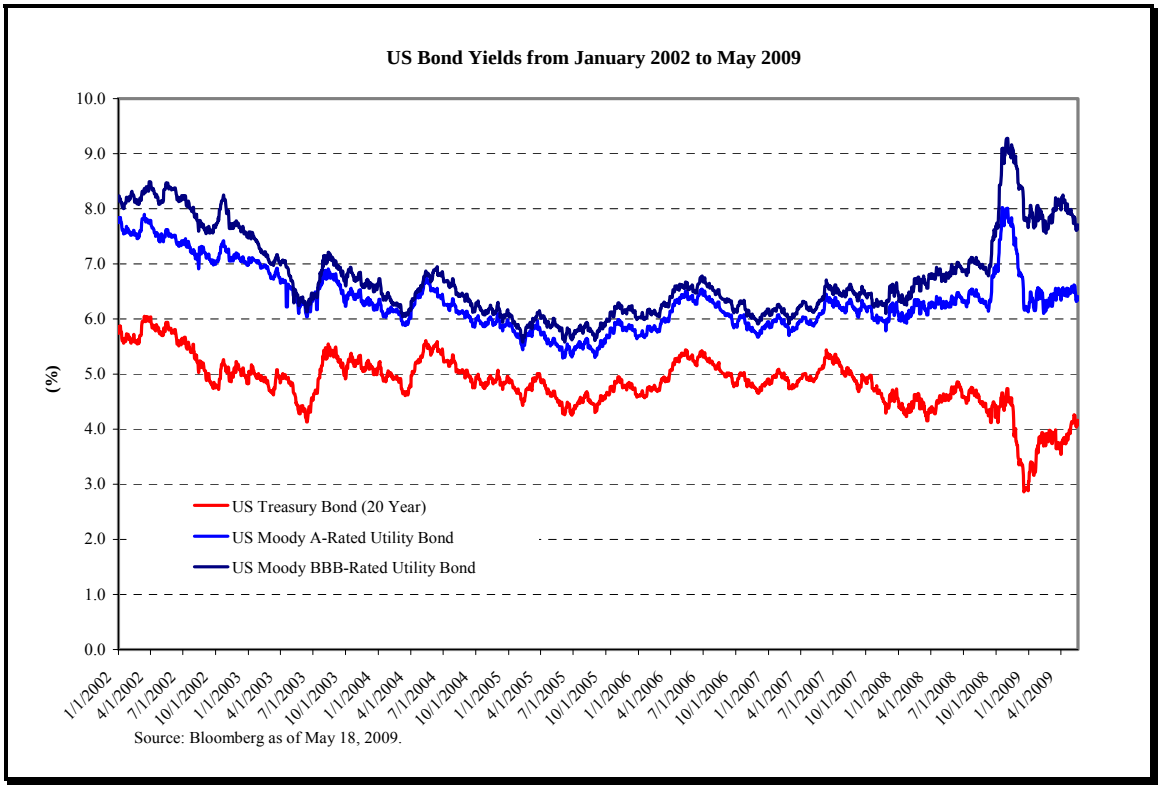


Figure 7

Q32. DO YOU HAVE ANY EVIDENCE ON HOW MUCH THE MARKET RISK PREMIUM ("MRP") HAS INCREASED?

A32. Yes. I have estimated the increase in MRP that is necessary for investors to earn an overall return that is no less than prior to the crisis. The result is that the MRP has increased by at least 1 percent over its level prior to the crisis.

Q33. HOW DID YOU ESTIMATE THE INCREASED MRP?

A33. The method I used to estimate the increased MRP is based upon the recognition that the sharp decrease in the average market price of equity has unexpectedly increased the level of financial risk in the stock market. Higher financial risk leads to a higher required rate of return on equity, so I compute the average capital structure of the stock market as measured by the S&P 500 before the crisis and after the crisis to measure the change in financial risk.

Q34. ONCE YOU ESTIMATE THE CAPITAL STRUCTURE OF THE MARKET AT TWO DIFFERENT TIMES, PLEASE OUTLINE THE STEPS YOU USED TO ESTIMATE THE CHANGE IN MRP.

A34. Once I estimated the average capital structure of the market, I estimated the average cost of equity for the market in August 2008 and calculated an ATWACC for the market using the cost of debt for an A rated company and a 35 percent marginal tax rate. The cost of equity for the market is simply the sum of the long-term risk-free rate and my 6.5 percent estimate of the MRP. I then calculated the ATWACC for the market using Equation 1 above. The next step was to determine how much the market ROE would change solely as a result of the change in financial risk stemming from the drop in market values assuming that the pre-crisis market ATWACC did not change. In the table below, I calculated the ROE corresponding to 60 percent equity instead of 70 or 75 percent equity. These values are roughly comparable to the capital structure of the S&P500 before the crisis and as of today.[14] As shown in the calculations in Table 4 below, the

[14] For example, in August of 2008, about the time the stock market began to decline dramatically, the average capital structure for the companies in the S&P500 was about 72.0 percent equity compared to about 59.3 percent in April 2009. In principle, the appropriate metric would be the average market value capital

estimated MRP increased by more than 1 percent, but this is likely to be lower than the actual increase in the *expected* MRP.

Table 4

Estimating Change in MRP for US Market Based on Data for 500 Companies in S&P 500 Index			
1. Inputs			
Parameters in CAPM:			Source and Notes:
MRP (pre-crisis)	6.5%	[a]	Dr. Villadsen's Tables and Workpapers.
Long-term risk-free rate (pre-crisis)	4.7%	[b]	Dr. Villadsen's Tables and Workpapers.
Parameters for ATWACC:			
Cost of debt for A-Rated Utility (pre-crisis)	6.59%	[c]	15-day average yield ending on 8/8/2008 for A-Rated Utility bond with 20 year maturity
Cost of debt for BBB-Rated Utility (pre-crisis)	7.06%	[d]	15-day average yield ending on 8/8/2008 for BBB-Rated Utility bond with 20 year maturity
Common Equity (pre-crisis)* [see legend below]	70.0%	[f]	Assumption based on actual calculations of S&P 500 data from Bloomberg as of May 20, 2009.
Debt (pre-crisis)	30.0%	[g]	= 1 - [f].
Common Equity (post-crisis)	60.0%	[h]	Assumption based on actual calculations of S&P 500 data from Bloomberg as of May 20, 2009.
Debt (post-crisis)	40.0%	[i]	= 1 - [h].
Tax Rate	35%	[j]	Assumption
2. Estimation Results:			
Step 1: Estimating Return on Equity using pre-crisis data			
ROE (pre-crisis)	11.2%	[k]	= [a] + [b].
Step 2: Estimating ATWACC using pre-crisis data			
ATWACC (pre-crisis)	9.1%	[l]	= (1 - [j]) x [g] x [c] + [f] x [k].
Step 3: Estimating Return on Equity for with Reduced Equity Share			
Assuming ATWACC constant			
(i) ROE - Using Cost of Debt for A-Rated Utility	12.4%	[m]	= {[l] - (1 - [j]) x [i] x [c])} / [h].
(ii) ROE - Using Cost of Debt for BBB-Rated Utility	12.2%	[n]	= {[l] - (1 - [j]) x [i] x [d])} / [h].
Step 4: Estimating MRP with Reduced Equity Share			
(i) MRP (post-crisis) - Using Cost of Debt for A-Rated Utility	7.65%	[o]	= [m] - [b].
(ii) MRP (post-crisis) - Using Cost of Debt for BBB-Rated Utility	7.45%	[p]	= [n] - [b].
Step 5: Estimating change in MRP due to Reduction in Equity Share			
(i) Change in MRP - Using Cost of Debt for A-Rated Utility	1.2%	[q]	= [o] - [a].
(ii) Change in MRP - Using Cost of Debt for BBB-Rated Utility	1.0%	[r]	= [p] - [a].
* If using 75.00% instead of 70.00% [f] for the common equity (pre-crisis) and following the same methodology from Step 1 to Step 5, one will retrieve the following results for changes in MRP: 1.73% [q] and 1.53% [r].			

structure of the S&P500 over the period used to estimate the MRP, i.e., 1926 to the present, but this is prohibitively time consuming to calculate.

Q35. WHY DO YOU BELIEVE THAT THE 1 PERCENT ESTIMATED INCREASE IN THE MRP IS LOWER THAN THE ACTUAL INCREASE?

A35. My calculation of the increase in the MRP assumes that the market ATWACC is constant, but the evidence indicates that the price of risk has increased substantially. Research indicates, for example, that the MRP is related to volatility in the stock market, which as shown in Figure 5 above has increased dramatically and currently is well above its pre-crisis level. A higher ATWACC would indicate an even greater increase in the estimated MRP than estimated in Table 4 above.

Q36. IS THE INCREASE IN INVESTORS' RISK AVERSION FROM CURRENT ECONOMIC CONDITIONS LIKELY TO BE A TEMPORARY OR PERMANENT CHANGE?

A36. It is likely that some of the increase in risk aversion stems from the chaotic market conditions and will be transitory in nature, but there is a strong possibility that there will also be a longer-term and perhaps permanent effect as market participants draw conclusions from the crisis on the fundamental risk-return characteristics of investment alternatives.

Q37. 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?

A37. 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 more normal conditions, so it is difficult to predict when the market cost of risk will return to more normal levels. Even when market conditions are more normal, 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 it has signaled that it intends to overhaul the financial regulatory environment in order to restrict the

behavior by financial institutions that led to the current crisis. 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.

Q38. ARE NOT THE LOW REALIZED RETURNS ON THE MARKET INDEX RECENTLY A CLEAR INDICATION THAT MARKET PARTICIPANTS ARE WILLING TO ACCEPT A LOWER EXPECTED RETURN ON THEIR INVESTMENTS?

A38. Absolutely not. To the contrary – market values have been falling in order to allow an increase in the expected returns on investment. As risk aversion increases, expected returns must increase in order to induce investors to buy, so prices must fall. In other words, realized returns over the last few months are not indicative of investors' required rate of return. Investors have undoubtedly been disappointed recently. This process is well known to bond investors. As the general level of interest rates in the economy increases, the market price of a bond will decrease so that the yield-to-maturity will increase to the level required by the market. The same phenomenon occurs with equities as well. When the required return on investment increases, market prices must fall.

Q39. CAN YOU PROVIDE ANY FACTUAL EVIDENCE THAT THE CONDITIONS IN THE FINANCIAL MARKETS AND THE ECONOMY AS A WHOLE LIMIT THE ACCESS OF UTILITY COMPANIES TO THE FINANCIAL MARKETS?

A39. Yes. The increased yield spreads on utility debt compared to government debt impedes access because the cost of new utility debt is higher. For example, for investment grade debt issued in the fourth quarter of 2008, a recent EEI report shows the impact of the financial crisis on the electric utility industry. The average spread over Treasury bonds

for A-rated debt was 432 basis points, while the coupon rate was 6.96 percent.[15] For the BBB-rated debt these numbers are, respectively, 520 basis points and 8.45 percent.[16] Unfortunately, we do not have access to a similar data covering new issuances for earlier period(s). However, we can observe the change in the yield on utility sector fair market indices published by Bloomberg as well as the corresponding spreads. More specifically, the average A and BBB utility bond yields for 1991 through 2007 interval were, respectively, 6.98 percent and 7.28 percent, while the spreads over 20-year treasuries equaled 93 basis points and 123 basis points, respectively. For comparison, the average spread and yield for the fourth quarter of 2008 obtained from the same data indicates the yields of 7.38 percent and 7.99 percent for A and BBB-rated utilities, respectively; and spreads over 20-year Treasuries of 342 basis points and 402 basis points for A and BBB-rated utilities, respectively. These figures demonstrate not only the increased cost of new utility debt, but also the importance of maintaining strong credit ratings in current market conditions. Utilities with lower credit ratings face proportionally higher debt costs as a result of increased investor risk aversion.

Q40. HOW HAVE THESE CONDITIONS AFFECTED THE WATER INDUSTRY AND AMERICAN WATER?

A40. 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.[17] 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.

[15] "The Financial Crisis and Its Impact On the Electric Utility Industry", prepared by Julie Cannell (J.M. Cannell, Inc) for *Edison Electric Institute*, February 2009, p.6.

[16] *Ibid.*

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

Q41. ARE NOT WATER UTILITIES ATTRACTIVE INVESTMENTS IN TODAY'S CLIMATE BECAUSE THEY ARE SAFE AND STABLE?

A41. As noted above, the stock market has responded in a mixed way to water utility stocks, so the industry as a whole does not provide a safe haven for investors. This is true even for a fairly large, geographically diverse water utility such as American Water, which experienced a significant decrease in its stock price and a significant increase in its cost of debt over the past year. American Water Works' recent stock offering has been anticipated by the market for a while, so it is not surprising that American Water Works' stock price moved little on the actual sale. However, it is interesting to note that the offering was priced at 20 percent below the Initial Public Offering ("IPO") price in April 2008 and that the market value of American Water's shares dropped by approximately 14 percent over the same period.[18] Thus, American Water, like most companies in the U.S., has seen a substantial drop in its stock value over the past year. As the stock price declines, investors' expected return increases everything else equal. While American Water has too short a history for me to compare its expected earnings growth a year ago to that expected today, the average and median earnings growth in the water industry is currently very similar to that I found about a year ago.[19]

Further, American Water has issued non-secured notes recently at rates quite a bit above its historical debt cost. For example, its November 2008 offering had a 10 percent coupon, its February 2009 offering had an 8.25 percent coupon, and its May 2009 offering had a coupon of 7.21 percent. These issuances traded at a yield near the coupon for a while after issuance. While the rates are down from the height of the credit crisis, they are substantially higher than the embedded cost of debt and indicate that the cost of

[18] For price information, see American Water Works press releases, "American Water Prices Initial Public Offering," April 22, 2008 and "American Water Prices Commons Stock Offering," June 4, 2009. According to American Water's 2008 10-K p. 93, 160 million shares were outstanding as of year end 2008. Thus, at the IPO price of $21.50, the market value of the shares was $3,440 million. The June 2009 stock offering consisted of 11.5 million new shares and 14.5 million shares from RWE AG. At a price of $17.25 per share, the market value of the shares (160 million + 11.5 million) becomes $2,980 million for a drop of approximately 14%.

[19] See Table BV-5 and my Direct Testimony in Docket No. W-01303A-08-0227 (Table No. BV-5).

debt capital for American Water and hence New Mexico-American Water has increased substantially during the financial crisis.

In addition, a common measure of the systematic risk of companies, the so-called beta, has moved very little for water utilities and remains at about 80% of the overall market. As noted by Debra G. Coy in testimony before the California PUC,

> Water utilities have historically been viewed as low-risk, predictable, regulated monopolies, and they have attracted equity investors who appreciated those characteristics. Now, investors are more wary

And

> [i]nvestors have come to understand that 'low risk' water utilities in fact carry a variety of potential risks, the largest of which is their raising need to repair and replace aging infrastructure, resulting in high capex requirements, low depreciation rates, and negative free cash flow, along with the negative effects of regulatory lag on earnings.[20]

These facts indicate that investors in the water utility industry are exposed to substantial risks.

Q42. WHAT DO YOU CONCLUDE FROM THE EVIDENCE ON CURRENT ECONOMIC CONDITIONS?

A42. The cost of capital is much higher today than in the relatively recent past. Although some of the increase in the cost of equity capital will hopefully reverse when stable economic conditions return, it may be many years before investors regain the confidence in financial markets and the cost of equity capital returns to its pre-crisis level. Until economic conditions stabilize, it is critical that the major infrastructure investment necessary for regulated utilities not be hampered by inadequate allowed rates of return.

[20] Debra G. Coy, Testimony before the California PUC, p. 7.

As a result, the cost of capital that I estimated for Arizona-American Water shortly before the crisis in 2008 is below the cost of capital that is currently applicable.[21]

Q43. HOW DO YOU ADJUST YOUR COST OF CAPITAL ESTIMATION METHODS TO CORRECT FOR CURRENT ECONOMIC CONDITIONS?

A43. I make no adjustment to the DCF method because determining whether an adjustment is necessary and if so, what are the appropriate adjustments to the parameters of the DCF model, would be more difficult. Because the DCF results rely on analysts' growth forecasts, I need to know if and how they have incorporated the ongoing financial crisis to determine the appropriate adjustment to growth rates, if any. As financial analysts rarely disclose how they determine the growth rates they publish, I cannot know if an adjustment to the DCF model is warranted.

For the risk positioning method, I recognize the unusually large yield spread on utility debt 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. I present results from the risk positioning model from keeping the MRP at 6.5 percent and by increasing the MRP by 1, 1.5 and 2 percent over the 6.5 percent. I believe that both adjustments are warranted, but Arizona-American's requested 12.25 percent return on equity is conservative as it ignores the in the MRP. Including the adjustment for the increased MRP would increase the estimated cost of equity. Specifically, if I rely on the water subsample and the gas LDC sample, a modest increase of one percent in the MRP, increases the estimate for the cost of equity by 50-75 basis points to no less than 12¾ percent. [See Tables 7 and 8 for details]

[21] In April 2008 (Docket No. W-01303A-08-0227), I estimated a cost of equity of 11¾ percent on 46.75% equity. The current cost of equity capital on 45.15% equity is necessarily higher than 11¾ percent.

Q44. WOULD YOU PLEASE ILLUSTRATE THE EFFECT ON THE SECURITY MARKET LINE ("SML") OF THE TWO ADJUSTMENTS THAT YOU PROPOSE TO USE?

A44. Yes. The total effect is best illustrated in two steps. The first step is to consider how the SML changes as an adjustment to the yield spread is added to the risk-free interest rate. This is shown in Figure 8 below.

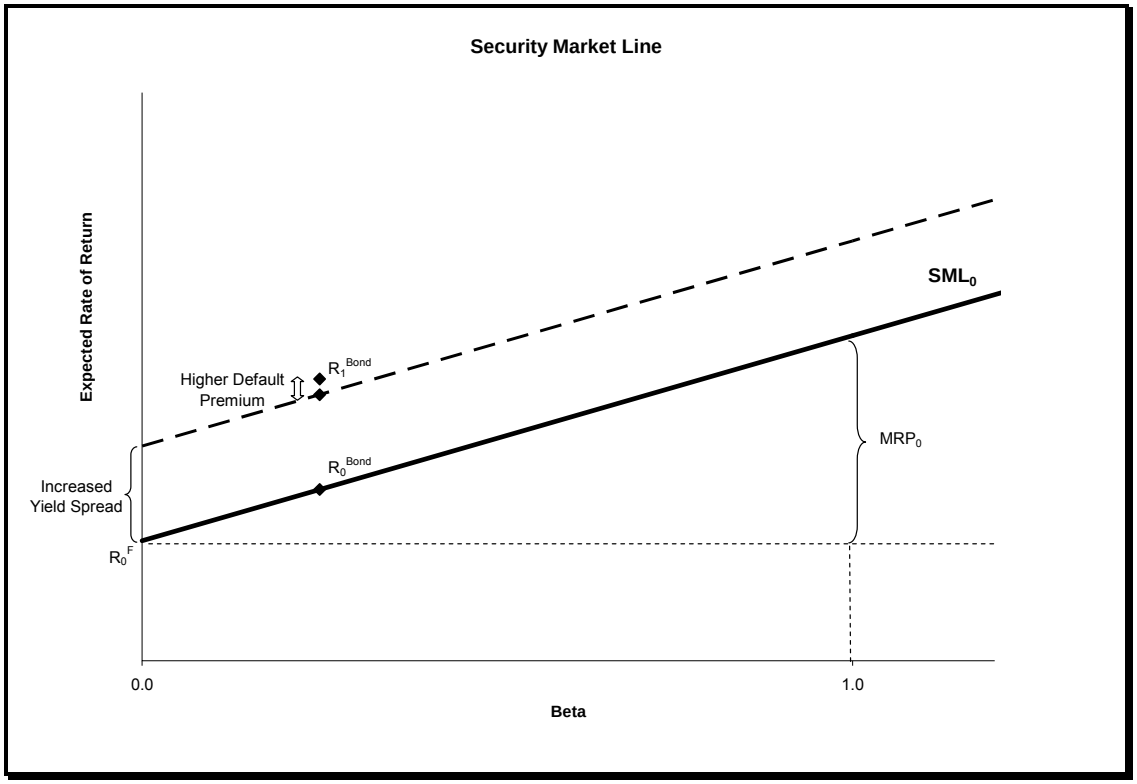


Figure 8

Figure 8 is a modification to Figure 1. Note that the beta of the market is always equal to 1.0 so the difference between the risk-free rate and the return on the market (beta = 1.0) is the market risk premium (MRP_0 in Figure 8). Recognizing the increased yield spread as an adjustment to the risk-free rate has the effect of moving the SML up without affecting the MRP. Note that I only consider the increase in the yield spread for A-rated utility bonds to avoid adding an increase in the default premium on BBB-rated utility bonds to the risk-free rate.

The effect of combining a yield spread adjustment and an increase in the MRP is illustrated in Figure 9 below.

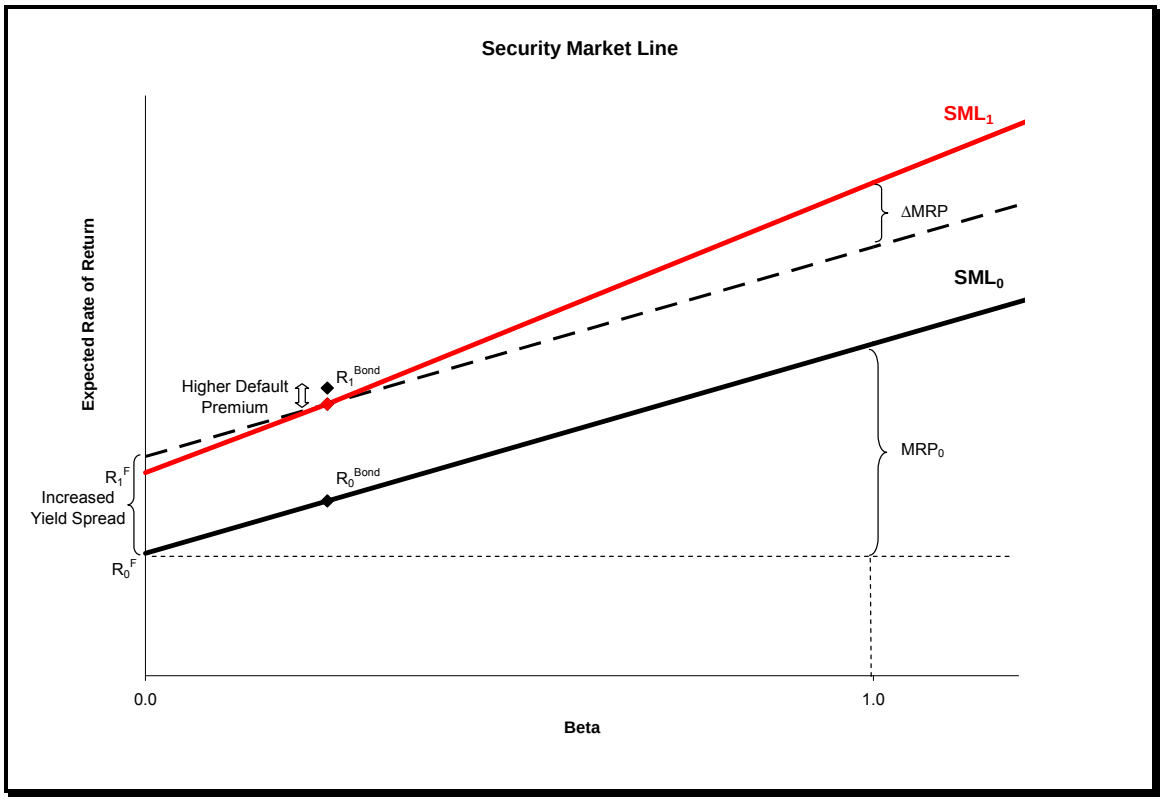


Figure 9

The effect of the MRP adder is to increase the slope of the SML. Note that the SML_1 is rotating through the estimated yield of the utility bond minus the estimate of the increase in default premium. Effectively, this step recognizes that there are three possible components to the increased yield spread: an increased default risk premium, an increased systematic risk premium and an increased premium over the risk-free rate not related to the other two categories. The default risk premium is the premium bond investors require to accept the risk that the bond issuer may default on interest payments and /or the repayment of the principal. The fact that the yield on lower rated bonds (e.g., BBB rated bonds) has increased more than the yield on higher rated bonds (e.g., AA or A rated bonds) indicates that investors are concerned about default risk. However, the increase in the default risk premium is likely to be small for highly (AA or A) rated utility bonds. The systematic risk premium bond investors receive is compensation for the risk they cannot diversify away. It is the bond's systematic risk in comparison to the

market as a whole and therefore measured by the so-called bond beta, which is similar to stock betas. A positive bond beta means that the intercept of the SML is lower than it would have been if there was no increase in the systematic risk premium in the increase in the yield spread. Bond betas are more difficult to estimate than stock betas because data are scarcer but bond betas are substantially lower than stock betas and .25 is likely to be in the upper range. The fraction of the increase that is not either an increase in the default risk premium or related to the bond beta is the unexplained increase.

IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES

Q45. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A45. 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.

A. Preliminary Decisions

Q46. WHAT PRELIMINARY DECISIONS ARE NEEDED TO IMPLEMENT THE ABOVE PRINCIPLES?

A46. 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

Q47. WHY DO YOU USE TWO SAMPLES?

A47. 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.[22] "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 sample of "water" utility companies in the U.S. is relatively small and has data deficiencies. See *Section IV.0.1* for a description of these 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*.[23] 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*), or lack of a bond rating, 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

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

[23] 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.*

Southwest Water which recently cut dividends and as of May 25, 2009 had yet to file its 2008 form 10-K with the Securities and Exchange Commission.[24]

Q48. WHAT DO YOU DO TO OVERCOME THE WEAKNESSES OF THE WATER UTILITY SAMPLE?

A48. 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 check for the results of the water sample. 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. Additional details of the sample selection process for each sample and subsample are described below as well as in Appendix B.

Q49. 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?

A49. 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.

[24] The only company followed by *Value Line* that I do not include is Sun Hydraulics. This company's main

Q50. PLEASE ELABORATE ON THE WAY TWO SAMPLES WITH DIFFERENT BUSINESS AND FINANCIAL RISKS CAN BE COMPARED.

A50. 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.

Q51. PLEASE COMPARE THE CHARACTERISTICS OF THE WATER UTILITY SAMPLE AND THE GAS LDC SAMPLE.

A51. 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. However, it appears that the gas LDC sample's systematic risk has been affected more by the financial crisis than has the water utility sample in the sense that while the measures of systematic risk,

line of business is the production of industrial equipment, not the water utility business.

beta, has remained relatively constant for water utilities, it has dropped for gas LDC companies. It is difficult to determine whether the decline in gas LDC betas is due to the financial crisis or to industry specific factors as other utility sectors have not seen the same decline in beta estimates.[25] At the same time, the gas LDC has fewer of the data and estimation issues identified above for the water sample. Please refer to Appendix B for additional details on the two samples.

2. Market-Value Capital Structure

Q52. WHAT CAPITAL STRUCTURE INFORMATION DO YOU REQUIRE?

A52. 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.

Q53. PLEASE DESCRIBE HOW YOU CALCULATE THE MARKET VALUES OF COMMON EQUITY, PREFERRED EQUITY AND DEBT.

A53. 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

[25] According to *Value Line*, gas LDC companies have seen a larger decline in beta than has water utilities, electric utilities, or pipelines.

growth rate forecasts utilized.[26] 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.[27] The market value of preferred stock for the samples is set equal to its book value.[28,29]

3. Market Costs of Debt and Preferred Equity

Q54. HOW DO YOU ESTIMATE THE CURRENT MARKET COST OF DEBT?

A54. 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 38.45 percent.

Q55. HOW DO YOU ESTIMATE THE MARKET COST OF PREFERRED EQUITY?

[26] BEst is Bloomberg's name for its earnings growth rate information. BEst growth rate forecasts are as of May 18, 2009.

[27] The book value of debt from Bloomberg includes all interest-bearing financial obligations that are not current and includes capitalized leases and mandatory redeemable preferred and trust preferred securities in accordance with FASB 150 effective June 2003. See Bloomberg's definition of long-term debt for additional details.

[28] 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.

[29] 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.

A55. 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.[30]

B. Cost-of-Equity Estimation Methods

Q56. HOW DO YOU ESTIMATE THE COST OF EQUITY FOR YOUR SAMPLE COMPANIES?

A56. 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 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.

Q57. HOW DOES THE ABOVE DEFINITION HELP YOU ESTIMATE THE COST OF CAPITAL?

A57. 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

[30] 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

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

Q58. PLEASE EXPLAIN THE RISK-POSITIONING METHOD.

A58. 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

revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

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:

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

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.

Q59. HOW ARE THE "MORE FORMAL" APPLICATIONS OF THE RISK-POSITIONING APPROACH IMPLEMENTED?

A59. 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

Q60. WHAT BENCHMARKS ARE USED TO DETERMINE THE LOCATION OF THE SECURITY MARKET LINE?

A60. 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.

Q61. WHAT BENCHMARK DO YOU USE FOR THE MRP?

A61. 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 to zero and at times even below zero.[31] I also report several sensitivity analyses that take into account the increase in the MRP as discussed above in *Section III.*

Q62. HOW DO YOU ESTIMATE THE BASELINE MRP?

A62. 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.[32] Morningstar data from 1926 to 2008, the longest period reported, show an MRP average premium of stocks of 7.9 percent over Treasury bills and 6.5 percent over long-term Government bonds. The publication reports a premium of stocks over bonds of 7.6 percent for the period 1947 to 2008.[33] At the same time, Dimson, Marsh and Stauton (2008) estimate the arithmetic market risk premium for the U.S. over the 1900 to 2007 period at 6.5 percent over bonds.[34] 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.[35]

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[31] See, for example, "Treasury Bills Trade at Negative Rates as Haven Demand Surges", by Daniel Kruger and Cordell Eddings, *Bloomberg*, December 9, 2008.

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

[33] Morningstar, *Ibbotson SBBI Valuation Yearbook 2009*, Appendix A, Tables A-1 and A-3.

[34] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

[35] *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 relative conservative estimate of the historical average risk-premium in that it is equal to 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.

Q63. HOW DO YOU DETERMINE THE RISK-FREE RATE YOU USE?

A63. 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.[36] As of May 15, 2009 this spread stood at 219 to 239 basis points and had increased by 114 to 145 basis points over the period 1991 to 2007 if I look to Moody's data and by 124 to 174 basis points if I look to Bloomberg's data.[37] As 125 basis points is in the lower end of the range, I conservatively choose to add this to the current estimate of the long-term risk-free rate.

b) Relative Risk

Q64. WHAT MEASURE OF RELATIVE RISK DO YOU USE?

A64. 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.

[36] 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.

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

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.

Q65. WHAT DOES A PARTICULAR VALUE OF BETA MEAN?

A65. 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.

Q66. HOW DO YOU ESTIMATE BETA?

A66. I use beta estimates reported in the *Value Line* for the sample companies.

c) Cost of Equity Capital Calculation

Q67. HOW DO YOU COMBINE THE PRECEDING STEPS TO ESTIMATE THE COST OF EQUITY?

A67. 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

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad \textbf{(3)}$$

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.

Q68. WHY IS IT APPROPRIATE TO USE THE ECAPM MODEL?

A68. 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.

Q69. IS THE USE OF THE ECAPM EQUIVALENT TO ADJUSTING THE ESTIMATED BETAS FOR THE SAMPLE COMPANIES?

A69. 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.[38] Even if the beta of the sample companies were 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

Q70. PLEASE DESCRIBE THE DISCOUNTED CASH FLOW APPROACH.

A70. 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:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad \textbf{(4)}$$

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

[38] 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 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.

stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k - g)} \quad \textbf{(5)}$$

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:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \quad \textbf{(6)}$$

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.

Q71. CAN YOU ILLUSTRATE THE DCF MODEL?

A71. 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: $k = D_1 / P + g = 7.0\% + 5\% = 12\%$.

Q72. ARE THERE OTHER VERSIONS OF THE DCF MODELS BESIDES THE "SIMPLE" ONE?

A72. 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 results.)

Q73. WHAT ARE THE MERITS OF THE DCF APPROACH?

A73. 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.)

Q74. WHAT IS THE MOST DIFFICULT PART OF IMPLEMENTATING THE DCF APPROACH?

A74. 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.[39] 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.

Q75. HOW DO YOU ESTIMATE THE GROWTH RATES YOU USE IN YOUR DCF ANALYSIS?

A75. 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 has been documented and confirmed extensively in academic research. Please see Section I in Appendix D for a detailed discussion on this issue.

Q76. ARE YOU AWARE THAT SOME REGULATORY COMMISSIONS RELY ON BOTH HISTORICAL AND FORECAST GROWTH RATES IN THEIR IMPLEMENTATION OF THE DCF MODEL?

A76. 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

[39] 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.

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.

Q77. ARE YOU AWARE OF EVIDENCE THAT ANALYSTS'FORECAST OF EARNINGS GROWTH HAVE HISTORICALLY OVERESTIMATED EARNINGS AND DIVIDEND GROWTH?

A77. Yes. Although analyst forecasts have historically been too optimistic, this problem is less acute for regulated companies.[40] 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 also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[41]

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.

Q78. 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?

A78. The requisite conditions for the sample companies are not fully met at this time, particularly for the water sample. 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

[40] 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.

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

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 nine companies in the water sample, six do not have earnings forecasts from *Value Line* and three do not have *BEst* growth rates. *A*s a result three companies have no forecasted earnings growth and two companies have only one analyst's estimate.[42] The average long-term earnings forecasts from vary from a low of -6.0 percent[43] to a high of 15 percent. The lack of sufficient number of analysts following the sample companies and the large variation in growth forecasts indicate that these forecasts are less reliable than ideal. The growth rates for gas LDC sample vary less from 2.1 to 6.6 percent, and are more consistent with the GDP growth forecast of 4.9 percent. Of the 11 companies in the gas LDC sample, 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 to comply with EPA water purification rules, maintain or replace old infrastructure, and deal with increased threats towards the water systems.[44] The American Society of Civil Engineers estimated in 2009 that "drinking water systems face an annual shortfall of at

[42] See Table BV-5 for details.

[43] The negative 6 percent pertains to Southwest Water which recently cut dividends.

[44] See, for example, *Value Line*, Water Utility Industry, April 25, 2008.

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 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

[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.

[47] *Ibid*., Arizona. (http://www.infrastructurereportcard.org/state-page/arizona)

the past, I submit DCF evidence in this case. DCF estimates also serve as a check on the values provided by the risk-positioning methods.

In this proceeding, I give no weight to the water sample's DCF estimates, but use the gas LDC DCF estimates as a 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 makes them very unreliable at this point in time. For example, a year ago, Southwest Water's growth rate from BEst was 9.7 percent, but it is now negative 6.0 percent and York Water had a growth rate of only .6 percent a year ago while it now has a growth rate of 7.0 percent.[48] 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. For example, Southwest Water's 5-year historical earnings growth was negative 2.5 percent while the company's 10-year historical earnings growth was 8.0 percent. 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

Q79. EARLIER YOU SAID THAT THE SAMPLE OF WATER UTILITIES HAD SERIOUS DATA WEAKNESSES. PLEASE ELABORATE ON THESE WEAKNESSES.

A79. In attempting to apply the DCF model to the sample, six companies had no *Value Line* 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 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. recently cut dividends and has delayed the issuance of its 2008 10-K. Dividend cuts are usually a sign of financial distress or unusual circumstances. I therefore report my results for both the full sample and for a subsample of companies that does not include Southwest Water Co.[49]

It is because of these weaknesses in the water sample that I also utilize a sample of natural gas LDCs. However, I believe the comparability of the water utilities and the gas LDC companies is lower than it has been in the recent past because the gas LDC sample's systematic risk measures have diverted not only from those of water utilities but also from those of other utilities. The selection procedure for this sample was summarized earlier and details are provided in Appendix B.

[48] Table No. BV- 5 uses data as of May 18, 2009 and my testimony in W-01303A-08-0227 used data as of February 7, 2008.

[49] Further, Southwest Water Co. has an unusual negative growth rate and a very high beta.

2. Risk-Positioning Cost-of-Capital Estimates

Q80. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A80. 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

Q81. HOW DID YOU DETERMINE THE EXPECTED RISK-FREE INTEREST RATE?

A81. I reviewed current constant maturity U.S. Government bond yield data available from the St. Louis Federal Reserve Bank. For the period April 27 to May 15, 2009, the average yield on long-term government bonds was 4.10 percent. To that figure I added 125 basis points in the baseline case as an adjustment for the increase in yield spread.[50] I note that in the sensitivity analyses, I reduce the adjustment for yield spread by 25 basis 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

Q82. WHAT BETA ESTIMATES DID YOU USE IN YOUR ANALYSIS FOR THE SAMPLES?

A82. I rely upon the most recent betas estimated by *Value Line* for both the water sample and for the gas LDC sample.

Q83. ARE THE BETA VALUES REPORTED BY *VALUE LINE* ADJUSTED BETAS?

A83. Yes. *Value Line* reports betas that are adjusted towards one. For this proceeding, I reverse the *Value Line* adjustment for water utilities. This is intended to ensure my

[50] See Table No. BV-9.

estimates for the water sample are conservative.[51] *Value Line* and many investment firms adjust the estimated betas. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that the CAPM tends to overestimate the sensitivity of the cost of capital to beta. For this proceeding I use unadjusted betas as I have previously for water and wastewater utilities and as reported *Value Line* estimates for the gas LDC sample.

Q84. PLEASE SUMMARIZE THE BETA ESTIMATES YOU RELY ON.

A84. After reversing the *Value Line* adjustment procedure, the average estimated *Value Line* beta for the water sample is about 0.70. The average of the *Value Line* betas for the gas LDC sample is about 0.68. These beta estimates are reported in Workpaper #1 to Tables No. BV-10 and BV-21.[52]

Q85. PLEASE EXPLAIN THE METHOD TO ADJUST FOR DIFFERENCES IN CAPITAL STRUCTURE.

A85. 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.[53] 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.

[51] In some prior proceedings I also reversed the gas LDC companies' beta estimates, but the sharp decline in these betas and the divergence from water utility betas indicate that unadjusted betas are too conservative as a measure of water utility risk.

[52] The beta estimates for both the water sample and the gas LDC sample are about .15 lower than the estimates relied upon in my most recent testimony before this Commission in Docket No. W-01303A-08-0227.

[53] 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.

c) Risk-Positioning Results

Q86. WHAT ARE THE COST-OF-EQUITY ESTIMATES DERIVED FROM THE RISK-POSITIONING APPROACH FOR THE WATER AND GAS LDC SAMPLE?

A86. 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. Panel A of Table No. BV-12 shows the cost of equity and ATWACC value for all water sample companies, while Panel B shows the results for the subsample of companies without Southwest Water that recently cut dividend and whose revenue from regulated water utility activities constitute a lower percentage than for other companies. Similar results for the gas LDC sample are shown in Table No. BV-23. The baseline cost-of-equity results are summarized below in Table 5 for the water sample and subsample and in Table 6 for the gas LDC sample.

Table 5: Baseline Cost-of-Equity Estimates for the Water Sample and Subsample

Regulatory Capital Structure:	*45.2% Equity / 0.0% Preferred / 54.8% Debt*				*Tax Rate: 38.6%*
	METHODS				
	RISK POSITIONING (using Long-Term Risk-Free Rate)			DCF	
Water Sample	CAPM	α = 0.5%	α = 1.5%	Simple	Multi-stage
Cost of Equity	12.8%	13.0%	13.5%	16.5%	11.6%
Average ATWACC	8.0%	8.1%	8.3%	9.6%	7.4%
Sub-Sample					
Cost of Equity	12.3%	12.6%	13.1%	16.5%	11.6%
Average ATWACC	7.8%	7.9%	8.1%	9.6%	7.4%

Risk Positioning Security Market Line Parameters:		Multi-Stage DCF Parameter:	
Long-Term			
Risk Free Rate Estimate:	5.35% (4.1% plus 1.25%)	GDP Growth Estimate:	4.9%
Estimated MRP:	6.5% .		

Table 6: Baseline Cost-of-Equity Estimates for the Gas LDC Sample

Regulatory Capital Structure:	*45.2% Equity / 0.0% Preferred / 54.8% Debt*				*Tax Rate: 38.6%*
	METHODS				
	RISK POSITIONING (using Long-Term Risk-Free Rate)			DCF	
Gas LDC Sample*	CAPM	α = 0.5%	α = 1.5%	Simple	Multi-stage
Cost of Equity	12.2%	12.5%	12.9%	12.2%	12.1%
Average ATWACC	7.7%	7.8%	8.0%	7.7%	7.7%
Risk Positioning Security Market Line Parameters:					
Long-Term					
Risk Free Rate Estimate:	5.4%			GDP Growth	
Estimated MRP:	6.5%			Estimate:	4.9%

Varying the MRP / risk-free rate over the range 6.5 percent / 5.35 percent to 8.5 percent / 4.85 percent, I obtain the estimated displayed in Tables 7-A, 7-B and 8 below.

Table 7-A: Summary RoE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.8%	13.5%	13.8%	14.1%
ECAPM (α = 0.5%)	13.0%	13.7%	14.0%	14.4%
ECAPM (α = 1.5%)	13.5%	14.1%	14.5%	14.8%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1% plus 1.25%,
MRP is 6.50%
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Table 7-B. Water Subsample: Summary of ROE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.3%	12.9%	13.2%	13.5%
ECAPM (α = 0.5%)	12.6%	13.2%	13.5%	13.8%
ECAPM (α = 1.5%)	13.1%	13.7%	14.0%	14.3%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1% plus 1.25%,
MRP is 6.50%
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Table 8: Gas LDC Sample: Summary of ROE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.2%	12.8%	13.1%	13.4%
ECAPM (α = 0.5%)	12.5%	13.1%	13.4%	13.6%
ECAPM (α = 1.5%)	12.9%	13.5%	13.8%	14.1%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1 plus 1.25%
MRP is 6.50%.
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Q87. PLEASE SUMMARIZE YOUR FINDINGS FROM THE RISK-POSITIONING MODEL.

A87. Focusing on the middle ECAPM (α = .50%) for the long-term risk-positioning model, I find that the water subsample's cost of equity of about 12.6 percent for the baseline case with a range of 12.3 to 13.1 percent. If a modest MRP adjustment of 1 percent is applied the midpoint estimate increases to 13.2 percent. Looking at the gas LDC sample, the midpoint for the baseline scenario is very similar at 12.5 percent with a range of 12.2 to

12.9 percent. However, it is more correct to say that the water subsample and the gas LDC sample indicate a baseline range of 12 to 13 percent. If I consider the modest adjustment of 1 percent to the MRP the upper bound increases to 13½ percent. I do not report results from the short-term model in this proceeding as the Treasury bill rate has been driven to zero. This is consistent with, for example, a recent decision by the Surface Transportation Board that decided to rely on the CAPM using 20-year Treasury bonds for the risk-free rate, 5-year weekly beta estimates, and Ibbotson's reported long-term market risk premium when determining railroads' cost of equity.[54]

The best point estimate for the risk positioning model for both the water subsample and the gas LDC sample is 12½ percent in the baseline case with a range of 12 to above 13 percent. I discuss the assessment of Arizona-American Water's cost of equity in the concluding section.

3. The DCF Cost-of-Capital Estimates

Q88. WHAT STEPS DO YOU TAKE IN YOUR DCF ANALYSES?

A88. 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

Q89. WHAT GROWTH RATE INFORMATION DO YOU USE?

A89. 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

[54] *STB Ex Parte No. 664*, Issued January 17, 2008.

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 2012-2014 horizon, representing an average of about four years from the current earning forecasts available for 2009. 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

Q90. WHAT VALUES DO YOU USE FOR DIVIDENDS AND STOCK PRICES?

A90. Dividends are either for the first or the second quarter of 2009, depending on the most recent dividend information available at the time of estimation for each company.[55] 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.

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.

[55] The dividend information was obtained from Bloomberg.

c) DCF Results

Q91. WHAT ARE THE DCF ESTIMATES FOR THE SAMPLES?

A91. 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 5 above. There is a very large difference between the simple and multi-stage DCF results for the water sample (16.5 versus 11.6 percent), confirming the conclusion drawn above that the water industry is not in a stable equilibrium. As a result, DCF results from the water sample are unreliable, and I therefore do not put any weight on them in arriving at my final estimate. However, for the gas LDC sample both DCF models yields very similar results (12.2 versus 12.1 percent, suggesting that the gas LDC sample is indeed more homogeneous than the water sample at this time. In addition, DCF estimates for the gas LDC sample are not too different from risk-positioning results, albeit on average lower than them. It is noteworthy that the DCF estimates have increased since I last filed testimony in this jurisdiction. This indicates that the cost of capital has increased for the gas LDC and water samples.

V. ARIZONA-AMERICAN WATER'S COST OF EQUITY

Q92. 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?

A92. For the gas LDC sample, the estimated costs of equity from the risk-positioning model and from the DCF model are reasonably in line. For the water sample subsample, estimates vary significantly between different methods, and the DCF results are particularly variable. Although I do not rely upon the DCF model results for the water sample or subsample, I believe that DCF cost-of-capital estimates from the gas LDC sample provide a useful check on the risk-positioning results. The relative consistency of the multi-stage DCF and the risk-positioning cost-of-equity estimates for the gas LDC sample indicate that those estimates are reasonable.

Q93. DO YOU HAVE ANY COMMENTS REGARDING THE RESULTS OF THE RISK-POSITIONING MODELS?

A93. The estimated cost of equity displayed in Panel B of Table No. BV-12 compared to Table No. BV-23 is significantly higher on average for the water sample. The risk-positioning results are summarized above in Tables 5 and 6 with sensitivity analyses presented in Tables 7 and 8. The CAPM values deserve the least weight, because this method does not adjust for the empirical finding that the cost of capital is less sensitive to beta than predicted by the CAPM (which my testimony considers by using the ECAPM). Conversely, the ECAPM numbers deserve the most weight, because this method adjusts for the empirical findings. Based on the facts discussed in *Section III* as well as the increase in DCF estimates for both samples, it is clear that the cost of capital has increased over the last year. It is more difficult to assess exactly by how much. Therefore, I rely primarily on my baseline case which is a conservative estimate of the cost of capital for Arizona-American Water.

Q94. DID YOU CONSIDER ANY OTHER EVIDENCE IN DETERMINING WHETHER ARIZONA-AMERICAN'S REQUESTED RETURN ON EQUITY WAS REASONABLE?

A94. 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.

Q95. PLEASE EXPLAIN YOUR COMPARISON TO RECENT COMMISSION DECISIONS.

A95. I obtained data on 20 recent Arizona decisions on water and wastewater utilities.[56] The data is summarized in Table 9 below.

[56] The first 17 decisions were provided by Arizona-American and the last three were obtained from the Commission's website (E-dockets).

Table 9: Summary of Recent Commission Water and Wastewater Decisions

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%
Arizona-American Water Co. (Formerly 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%
Arizona-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%
Arizona-American Water Co. (Mohave W&WW)	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	2/17/2008	100.0%	10.0%
Arizona -American (Sun City Wastewater)	70209	3/20/2008	38.5%	10.6%
Arizona-American (Anthem)	70372	6/13/2008	39.2%	8.8%

Arizona-American Water's requested capital structure contains only 45.2 percent equity which is lower than that of any company in Table 9 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 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 10 below shows the after-tax weighted-average cost of capital inherent in each decision listed in Table 9 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 10: Comparing Recent Commission Decisions at 45.15% 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%	11.8%
Clearwater Utilities	66782	100.0%	9.1%	0.0%	n/a	9.1%	15.6%
Arizona Water Company [f]	66849	70.1%	9.2%	29.9%	8.5%	8.0%	13.2%
AZ-American Water Co. (Citizens)	67093	39.9%	9.0%	60.1%	4.8%	5.4%	7.3%
Rio Rico Utilities	67279	100.0%	8.7%	0.0%	n/a	8.7%	14.7%
Las Quintas Serenas Water Co.	67455	100.0%	8.1%	0.0%	n/a	8.1%	13.4%
Forest Highlands	67983	100.0%	8.1%	0.0%	n/a	8.1%	13.4%
Pineview Water Co.	67989	51.0%	8.9%	49.0%	5.4%	6.2%	9.1%
Chaparral City Water	68176	58.8%	9.3%	41.2%	5.1%	6.8%	10.4%
Arizona Water Company	68302	73.4%	9.1%	26.6%	8.4%	8.1%	13.3%
AZ-American Water Co. (PV)	68858	36.7%	10.4%	63.3%	5.4%	5.9%	8.6%
Black Mountain Sewer	69164	100.0%	9.6%	0.0%	n/a	9.6%	16.7%
Far West Water & Sewer Co.	69335	56.0%	9.3%	44.0%	5.8%	6.8%	10.5%
Goodman Water Co.	69404	100.0%	9.3%	0.0%	n/a	9.3%	16.0%
AZ-American Water Co. (Mohave)	69440	40.0%	10.7%	60.0%	5.7%	6.4%	9.6%
Gold Canyon Sewer Company	69664	100.0%	9.2%	0.0%	n/a	9.2%	15.8%
Utility Source	70140	100.0%	8.9%	0.0%	n/a	8.9%	15.2%
Cordes Lakes Water Company	70710	100.0%	10.0%	0.0%	n/a	10.0%	17.6%
AZ -American (Sun City Wastewater)	70209	38.5%	10.6%	61.5%	5.5%	6.2%	9.1%
AZ-American (Anthem)	70372	39.2%	8.8%	60.8%	5.4%	5.5%	7.6%
Average		73.6%	9.3%	26.4%	6.0%	7.7%	12.4%
Averge without AZ-Am		85.2%	9.1%	14.8%	6.5%	8.3%	13.8%
Average without AZ-Am and Companies with 100% Equity		62.9%	9.2%	37.1%	6.5%	7.2%	11.4%

As can be seen from Table 10 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 12.4 percent for all companies which is very comparable to the Company's current request. Excluding Arizona-American Water from the average increases the comparable cost of equity to 13.8 percent and an exclusion of both Arizona-American Water and companies that are 100 percent equity financed decreases the comparable cost of equity to 11.4 percent. 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 comparable to that requested by the Company, prior Commission decisions are consistent with Arizona-American Water's request in this proceeding.

Q96. BASED ON THE EVIDENCE WHAT IS YOUR CONCLUSION REGARDING ARIZONA-AMERICAN WATER'S REQUESTED 12.25 PERCENT RETURN ON EQUITY?

A96. Based on the results from my cost-of-capital estimation procedures, I conclude that 12.25 percent return on equity is very reasonable and a conservative request. It is included in both the risk positioning and DCF ranges and near the lower end of the water subsample and gas LDC sample's risk positioning estimates using the baseline scenario which relies on a lower MRP than what I believe currently prevail. It is also comparable to the overall returns the Commission has allowed other water and wastewater utilities to earn in the past. As a result, the empirical analysis of market data and the study of the Commission's past decisions indicate that the requested return on equity is consistent with both market data and past Commission decisions.

Q97. DOES THIS CONCLUDE YOUR TESTIMONY?

A97. Yes.

APPENDIX A

RESUME OF DR. BENTE VILLADSEN

Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused cost of capital, credit issues in the utility industry as well the impact of regulatory initiatives such as energy efficiency and de-coupling. Other recent work has included damage estimation, accounting disclosure and principles including impairment testing, leases, mark-to-market accounting, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. She has testified on cost of capital, accounting issues, and damages.

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.

REPRESENTATIVE EXPERIENCE

ENERGY AND PUBLIC UTILITY FINANCE

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

- She has considerable experience in estimating 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 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.

- For a large integrated utility in the U.S., Dr. Villadsen participated in all aspects of the company's rate filing, including the company's cost of capital, incentive based rates, and certain regulatory accounting issues.

- 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 international arbitration matter, she testified on the allocation of corporate overhead costs and damages in the form of lost profit.

- Dr. Villadsen has provided expert reports and testimony on several accounting issues in international and domestic arbitrations or court proceedings. In a recent international arbitration, she testified on the proper application of US GAAP in determining shareholders' equity. Among other topics, she testified regarding impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.

- In a U.S. arbitration, 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.

- 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.

- 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.

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

- For a large multi-national company, Dr. Villadsen estimated the cost of capital for the company's segments. As part of the assignment, she evaluated the company's decision methods and assessed the country-specific investment risk of projects under consideration.

- She has worked on accounting issues in connection with several tax shelter cases. 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.

- Dr. Villadsen has modeled the cash flows of several companies to estimate the impact of specific (energy) contracts or to determine the impact of specific loans.

- 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.

- 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 commercial litigation, Dr. Villadsen estimated the cost of capital for companies in the chemical industry and for companies in the cement industry.

RECENT PUBLICATIONS

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

"Building Sustainable Efficiency Businesses: Volume I – Approaches and Models," (with Joe Wharton and Peter Fox-Penner, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, forthcoming, Spring 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.

REPRESENTATIVE PRESENTATIONS

"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

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*)

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

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, and 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. (Joint with Carlos Lapuerta, *Confidential*)

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.

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, 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 listed by *Value Line Investment Survey - Plus Edition.* I then eliminated Sun Hydraulics because, although listed as a water utility, its operations consist mainly of producing industrial equipment.[1] I also eliminated American Water Works as it only started trading in 2008 and therefore insufficient data available for *Value Line* to estimate its beta or other key figures.[2]

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 2008,[3] 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 (2004 to today). However, applying these procedures to the nine 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. This results in the use of all nine companies to form a full sample, as well as the use of eight companies to form a subsample. The nine regulated companies that form the full sample of water utilities are American States Water Co., Aqua America Inc., California Water Service Group, Connecticut Water Service Inc.,

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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] See *Value Line Investment Survey*, American Water, April 24, 2009.

[3] Table No. BV-2 and its associated workpapers report the share of operating revenues from different lines of business in 2007 for these companies. (Table No. BV-1 provides an index to the other tables.)

Middlesex Water Co., Pennichuck Corp., SJW Corp., Southwest Water Co., and York Water Co. I eliminate Southwest Water from the subsample because the company recently cut dividend and as of May 25, 2009 had yet to file its 2008 10-K with the Securities and Exchange Commission ("SEC"). 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 nine water utilities with sufficient data for analysis that *Value Line* follows, four companies (Connecticut Water, Middlesex Water, Pennichuck, and York Water) have 2008 revenues below $100 million. The stocks of small companies frequently exhibit "thin trading" which means that their stock trades infrequently. Indeed, during the period January 2007 through June 3, 2009, two companies (Pennichuck Corp., and York Water Co.) traded an average of less than 20,000 shares per trading day with York Water trading less than 0.15 percent of its shares outstanding. By contrast, each of the gas LDC sample companies had an average trading volume of at least 160,000 shares per day, which in percentage terms represented more than 0.55 percent of shares outstanding for each company. Greater trading volume gives the expert more confidence in estimates relying on market data since there is less likelihood of a delay between the release of important information and the time that this information is reflected in prices.

[4] For example, Southwest Water has a negative growth rate which could not be sustained forever and which would lead to a negative cost of capital. At the same time, *Value Line* estimates a beta above one for Southwest Water indicating a higher than average cost of capital.

Second, six companies lack long-term earnings forecasts from *Value Line*, and three companies lacks a BEst growth rate forecasts. In addition, the existing growth rates estimates are highly variable, ranging from a low of -6.0 percent to a high of 15 percent. Such highly variable growth 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 "aggressive acquisition strategy" of Aqua America[5] has impacted the market perception and hence risk measures of the company. Similarly, Southwest Water's recent dividend cut and the fact that its 2008 financial report has yet to be issued due to mistakes in prior years' depreciation rates likely has impacted its stock price, growth rate, and systematic risk.[6]

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.

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.*[7] This resulted in an initial group of 18 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.

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[5] *Value Line Investment Survey*, Water Utility Industry, April 24, 2009.

[6] *Value Line Investment Survey*, Southwest Water Co., April 24, 2009.

[7] *Value Line Investment Survey*, Plus Edition, March 13, 2009.

Q5. What are the selection criteria you applied?

A5. I eliminated all companies whose regulated assets are not greater than 50 percent of their total assets as reported in each company's 2008 10-K form, because one goal for this sample was for the companies to be primarily engaged in regulated activities. I also eliminated companies whose bond rating was less than BBB- as rated by S&P, and companies that had a large merger during the period May 2004 to May 2009.[8] Merger activity is obtained from Bloomberg, which provides a history of past acquisitions and divestitures for each company, and also the size of each transaction, if such information is available.[9] To guard against measurement bias caused by "thin trading,"[10] I also restricted the sample to companies with total operating revenues greater than $300 million in 2008.

Finally, I required that the companies have historical data available from Bloomberg and that they had no dividend cuts or restatement of financial statements in the past five years, since this can be signs of financial distress.

The final sample consists of eleven gas LDC companies: AGL Resources Inc., Atmos Energy Corp., Laclede Group Inc., New Jersey Resources, Nicor Inc., NiSource Inc., Northwest Natural Gas Co., Piedmont Natural Gas Co., South Jersey Industries Inc., Southwest Gas Corp., and WGL Holdings Inc.[11]

Q6. What companies did you eliminate before arriving at the final sample?

A6. First, I eliminated three companies for a combination of having no or a non-investment grade bond rating and revenues below $300 million (Chesapeake Utilities Corp., Energy

[8] One company included in the sample (Atmos Energy Corp.) did undertake an acquisition in 2004. The merger was announced in June 2004 and completed October 1, 2004, so the announcement date is very close to the cut-off data. I therefore decided to keep the company in the sample. See, *Kansas City Business Journal*, "Atmos, TXU Gas will merge," June 17, 2004 and *Dallas Business Journal*, "Atmos, TXU close on gas transaction," October 1, 2004.

[9] For purposes of sample selection, a sizeable merger is defined to be one which would exceed 30 percent of the total capitalization of the company at the time of the merger announcement.

[10] As noted above, all the gas LDC companies that I include have traded in excess of 160,000 shares per day on average since 2007.

[11] NiSource is a relative new addition to *Value Line Investment Survey*.

West Inc., and RGC Resources Inc.), one company for not having a bond rating (UGI Corp.), and three companies were eliminated due to the lack of a bond rating or a below investment bond rating and for being primarily involved in the sale of propane or heating oil (Amerigas Partners LP, Ferrellgas Partners LP, and Star Gas Partners LP).

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. 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. The water subsample excludes Southwest Water which recently cut dividends and as of May 25, 2009 had yet to file its 2009 form 10-K. All nine companies in the water sample had at least 80 percent regulated assets. Among the gas LDC companies, only one company in the gas LDC sample had less than 2/3 of its assets devoted to regulated activities and the average percentage was about 85 percent. (See Tables No. BV-2 and Table No. BV-14).[12] All companies in the water utility sample and the 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. However, gas LDC companies only rarely develop their commodity (gas), water utilities usually do. Looking at stock market perceptions, gas LDCs have seen their beta measure decline in recent months while water utilities generally have experienced little movement

[12] Water utilities often do not report the percentage of assets subject to regulatory activities, while gas LDCs do. Both measures are likely to be good indicators of the relative magnitude of regulated activities, which is relevant to gauge the risk of the entities. Therefore, Table No. BV-2 and its associated workpapers report the share of operating revenues from different lines of business in 2007 for water utilities while Table No. BV-13 reports the share of regulated assets for gas LDC companies. (Table No. BV-1 provides an index to the other tables.)

in their beta measure. Therefore, it appears that capital markets' viewed the two utility industries a bit differently during the financial crisis. I continue to believe that gas LDC companies constitute a good check on the estimates provided by the water utility sample.

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 I 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.[13]

[13] See Panels A through I 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.

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 (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 2004 – 2008. 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 2004 through 2008, 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 April 2009. In general, the average amount of preferred equity in the sample companies' capital structures is very small and zero for most companies. No company in either sample has more than one percent preferred equity (see Tables BV-4 and BV-16).

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 by *Value Line* to estimate company betas. The current S&P debt ratings were obtained from Bloomberg.[14]

The yield on Moody's A-rated Utility bonds was 6.49 percent as of May 15, 2009, and 7.80 percent on Moody's BBB-rated Utility bonds. (See Panel A of Workpaper #2 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 38.45 percent. Calculation of the after-tax cost of debt uses the marginal tax rate 38.45 percent.

[14] 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 EMPIRICAL 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 ongoing 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 Pedro M. Chaves in Docket No. WS-01303A-06-0491, Schedule PMC-2.

[2] See, for example, Morningstar, *Ibbotson IBBS Valuation Yearbook 2009*, p. 59.

between 5 to 8 percent is reasonable for the U.S.[3] At the same time, Dimson, Marsh, and Staunton (2008) estimate that the average arithmetic risk premium of stocks *over bonds* in the U.S. was 6.5% for the period 1900 to 2007.[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 the recent literature on the MRP and the conclusions you draw from it.

A8. Some recent 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. as much as is claimed in some of the literature.

First, despite eye-catching claims like "equity risk premium as low as three percent,"[6] and "the death of the risk premium,"[7] not all recent research arrives at the same conclusion. In his presidential address to the American Finance Association in 2001,

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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] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

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

[6] 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.

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

Professor Constantinides seeks to estimate the unconditional equity premium based on average historical stock returns.[8] (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.[9] 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."[10]

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[11] by Prof. Welch reported only a 5.5 percent MRP.[12] In 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

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

[9] 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.

[10] 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.

[11] 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.

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

years, a period with low realized equity premia."[13] However, in the most recent survey,[14] 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,[15] 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 permanently. Conversely, the long-run MRP may remain the same even if expected market returns in the short-term are smaller.

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[13] *Ibid*, p. 8.

[14] 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.

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

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.[16] 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?"[17]

To sum up the above, I cite two passages from Profs. Mehra and Prescott's review of the theoretical literature on equity premium puzzle:[18]

> 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.

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

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[16] 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.

[17] 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

[18] *Ibid*, p. 926.

Forecasts: An Empirical Analysis."[19] 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.[20] 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 2009. The data provided cover the period 1926 through 2008. The results are discussed below.

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

A11. From 1926 to 2008, the full period reported, Morningstar's data show that the average premium of stocks over Treasury bills is 7.9 percent. I also examine the "post-War" period. The risk premium for 1947-2007 is 7.6 percent.[21] (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 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 6.5 percent for the 1926 to 2008 period.

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

[20] *Ibid*, p. 1082.

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 it is highly likely that the MRP currently exceeds the average of realized returns because of increased risk aversion among investors.

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.[22] To the extent that there has been an adverse shock to risk aversion of investors, the MRP is likely to have increased.

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

[21] Morningstar, *Ibbotson SBBI Valuation Yearbook 2009*, Appendix A, Table A-3.

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

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.[23] (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.[24] 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.[25]

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 stocks over short-term bonds because stocks perform poorly in recessions, when the investor is most likely to be laid off.[26]

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

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

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

[26] *Ibid*, p. 353.

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson (2004)[27] 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.[28]

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.[29] 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 an increase in the MRP even in the absence of any shock to the risk aversion parameter.

Gabaix (2009) provides an alternative explanation for a time-varying risk premium in his newly circulated working paper.[30] The argument is that the MRP is 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 experiencing an economic downturn of a magnitude not seen since the times of the Great Depression, the argument presented

[27] 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.

[28] *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.

[29] 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.

in this paper is supportive of the idea that the MRP is currently higher than it would be under more normal conditions.

The facts that financial markets are in turmoil and stock market volatility has increased dramatically mean that equity investors face increased uncertainty. Increased uncertainty leads investors to seek lower risk investments or to demand a higher expected rate of return before they are willing to invest their money. In part, this is an explanation of why market prices have fallen. The financial market distress means that the current MRP is *higher* than it would otherwise be. Dimson, Marsh, and Staunton (2008) appear to agree as they note

> Although credit spreads widened, credit fundamentals as measured by low default rates remained at historically strong levels. This may indicate higher defaults to come, an increase in risk aversion, a bigger premium for liquidity, or all three.[31]

As shown in Figure 5 in my direct testimony, the market volatility, measured by the Chicago Board Options Exchange ("CBOE") Volatility Index (also know as *VIX*), was until recently in the 10-20 percent range, but it spiked 80 percent in late 2008. Although volatility has decreased somewhat over the last couple of months, it is still significantly higher than the average value for the first half of 2008 (prior to the crisis). As investors' risk aversion also increases during times of financial distress, there can be little doubt that the MRP is currently higher than in the recent past.

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.

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[30] Gabaix, X. (2009), "Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro Finance", *Working Paper*, *New York University Stern School of Business* and *NBER*.

[31] Elroy Dimson, Paul Marsh, and Mike Staunton, 2008, *Global Investment Returns Yearbook 2008*, p. 25.

Therefore, I report the sensitivity of the results to an upward adjustment of 1, 1½ and 2 percent in Tables 7 and 8 of my direct testimony.

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 Merrill Lynch's quarterly Security Risk Evaluation, 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.[32] 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 May 15, 2009. To this figure I add 125 basis points to account for the substantial increase in the spread between investment-grade utility bond yields and government bond yields. Workpaper

[32] 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.

#1 to Table No. BV-9 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.

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 particular 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.

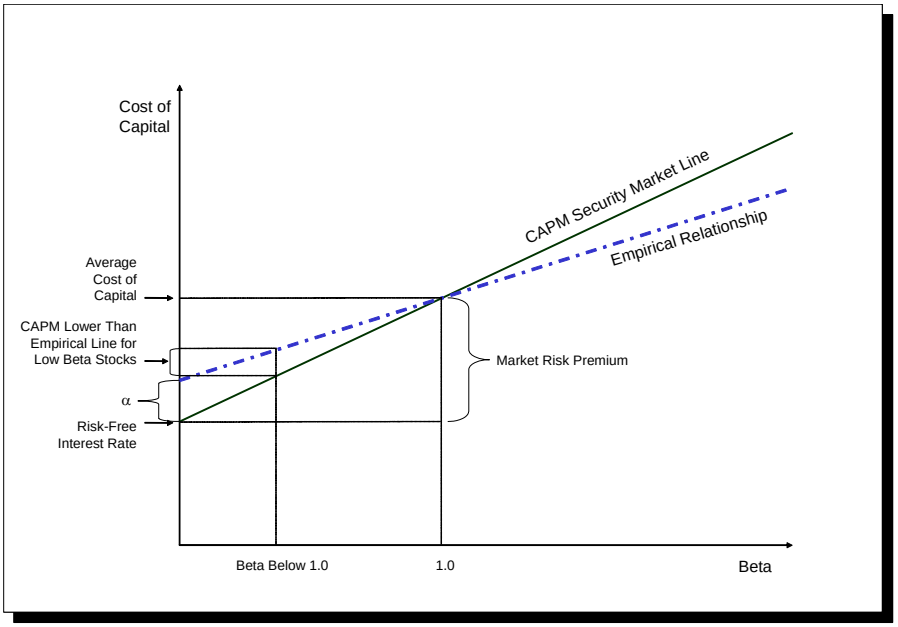

Figure BV-C1: The Empirical Security Market Line

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 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 5.35 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. This value was determined as of May 15, 2009.

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 the *Value Line Investment Survey* for the sample companies.[33]

Q31. How does *Value Line* estimate the reported betas?

A31. *Value Line* estimates the reported betas using weekly data for a five year period. As a market index, *Value Line* uses the New York Stock Exchange. Also *Value Line* reports so-called adjusted betas, i.e. the betas reported by *Value Line* are calculated as follows:

$$\beta_{Value\ Line} = .67 \times \beta + 0.35 \qquad \textbf{(C-3)}$$

where β is the standard beta estimate. As a conservative measure of the systematic risk of the comparable water utilities, I reverse the adjustment for the water utility companies. I specifically choose to not reverse the estimates for the gas LDC sample as they are substantially below those of the water utility industry which is the focus of this

[33] For each sample I used the *Value Line* beta estimates most recently available. For the water sample, estimates are as of April 24, 2009, while for the gas LDC sample estimates are as of March 13, 2009.

proceeding. Also, the gas LDC companies do not suffer from the data issues as the water utility sample does.

Q32. Please summarize the beta estimates you rely on.

A32. The unadjusted *Value Line* adjustment betas range from .37 to 1.19 for the full water sample and from .37 to .97 for the water subsample. The gas LDC companies' betas fall in a much narrower range from .60 to .80. The beta estimates for individual sample companies are reported in Workpaper #1 to Tables No. BV-10 and BV-21, respectively.

2. Market Risk Premium Estimation

Q33. Given all of the evidence, what MRP do you use in your analysis?

A33. 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 three alternative sensitivity analyses with an MRP of 7.5, 8.0, and 8.5 percent, respectively.

C. COST OF CAPITAL ESTIMATES

Q34. 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?

A34. 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.

Q35. What does the water market data imply about the sample's cost of equity at the proposed 46.75 percent equity ratio for Arizona-American Water?

A35. 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. ,

Q36. What are the implications of the risk positioning results for Arizona-American's estimated cost of equity?

A36. 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:

DETAILED PRINCIPLES 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

[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 — cause me to view the DCF method as *inherently* less reliable than equity risk premium approach, the other approach I use.

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 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.

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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.

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 *Value Line* 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 2009 and 2012-2014 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 first quarter of 2014 and on the long-term GDP forecast from the second quarter of 2019 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 BEst growth forecast for Southwest Water is negative percent while the BEst growth rate for SJW Corp. is 15 percent.[10] While the differences between BEst and *Value Line* forecasts are lower for the gas LDC sample, there is still significant

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[7] The BEst growth rates were downloaded from Bloomberg on May 18, 2009. *Value Line* estimates are from the most recent report available, dated April 24, 2009 for the water sample utilities, and March 13, 2009 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, 2009).

[10] See Table No. BV-5.

variation.[11] Also, for some companies, the five-year growth rate forecasts are significantly above or below the long-term GDP growth rate forecast, indicating lack of stability in growth rates. Overall, the growth rates indicate that some companies and maybe the industries have yet to reach a stable equilibrium which is required for the correct application of the DCF method.

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

A17. The requisite conditions for the sample companies are not fully met at this time; especially for the Water utility sample where the growth rates vary widely from company to company or across time.[12] 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 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.

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 expected spending (including the American Recovery and Reinvestment act) is $146.4

[11] See table No. BV-17.

[12] For example, in February 2008, the BEst estimate of York Water's growth rate was 0.6 percent whereas it now stands at 7.0 percent. See Table No. BV-5 in this filing as well as in Docket No. W-01303A-08-0227.

for a shortfall of about $108.6 billion.[13] 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 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 first quarter 2009 dividend, but for some it is the 2nd quarter 2009. 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.

Stock prices are the average of the closing stock prices for the 15 trading days ending on the day the BEst forecasts were released (May 18, 2009). Using these dates ensures that

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

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 46.75 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 taxed less heavily than interest, also, under current tax law.[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 equal for risk-free debt and risk-free equity.[7] Therefore, the pre-personal-tax risk-free

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[5] The current maximum personal tax rate on dividend income was extended to the end of 2010 on May 17, 2006. It is uncertain what the rate on dividend come will be set at after that.

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

[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.

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

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[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, $t_N = \{[0.35+0.077\underline{0}.\underline{4}(0.35 \square 0.077)] / (1.\underline{0}0.077)\} = 0.0/0.923 = 0$.

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]

[10] See, for example, Section 18.3 of Brealey, Myers and Allen, 2006, *Principles of Corporate Finance*, 8th Edition, McGraw-Hill/Irwin, 2006.

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.

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

[11] Carl Kester (1986), "Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Concerns," *Financial Management*, 15:5-16.

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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[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.

[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]

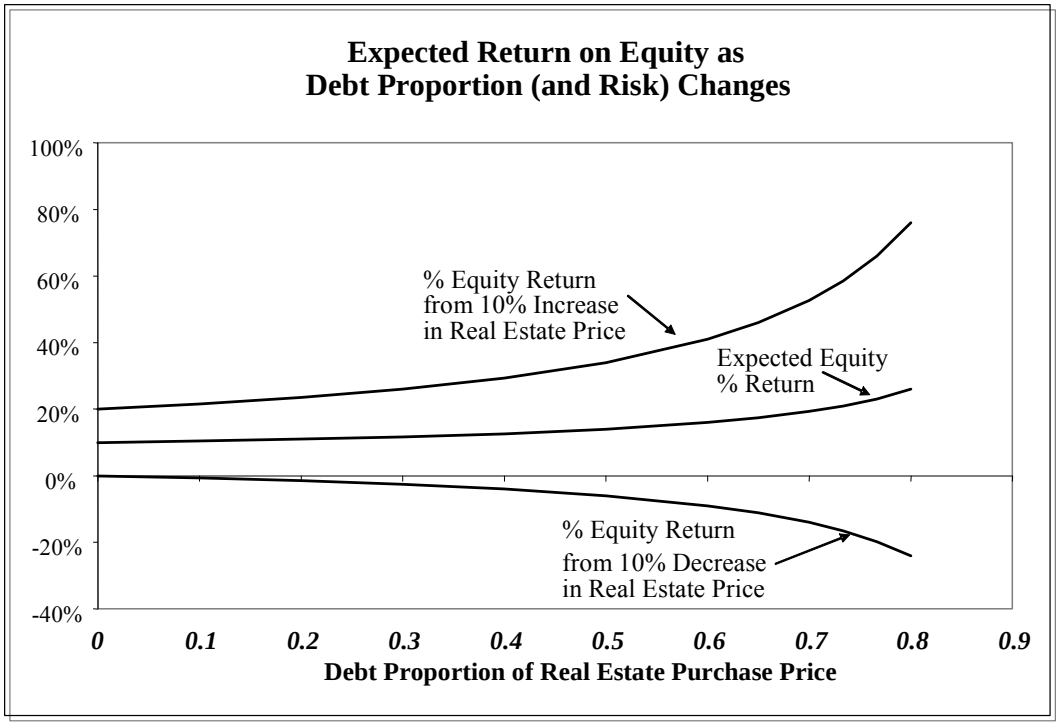

Figure E-1

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.

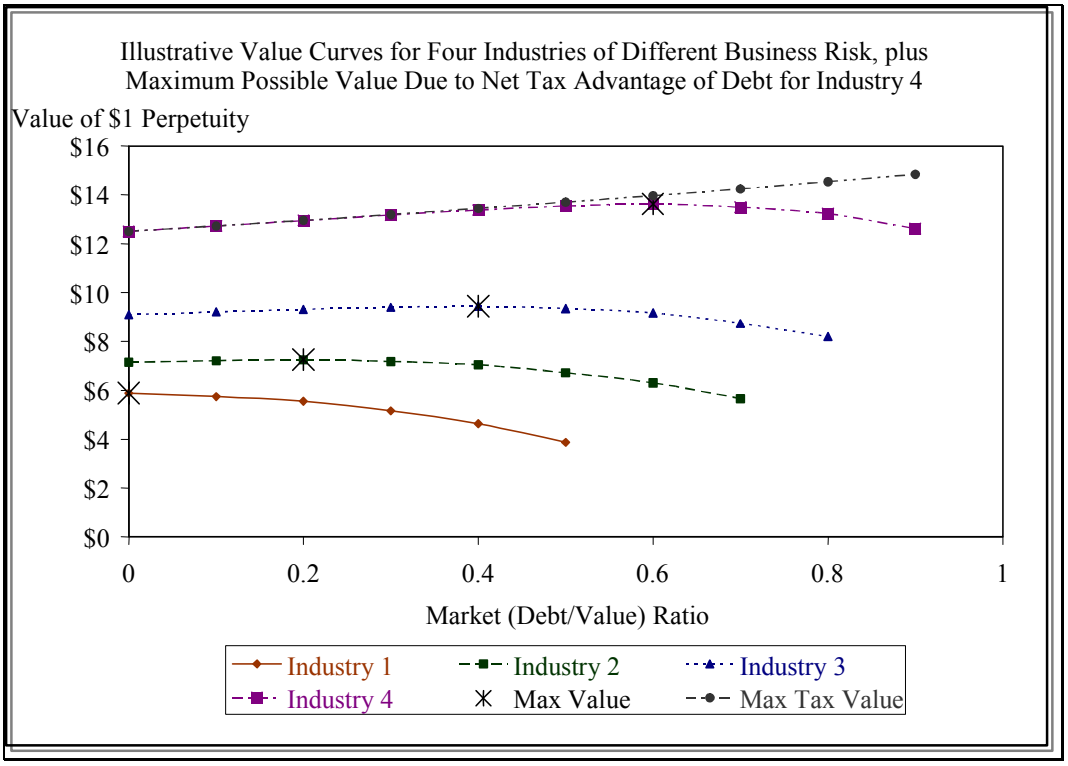

Figure E-2

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.

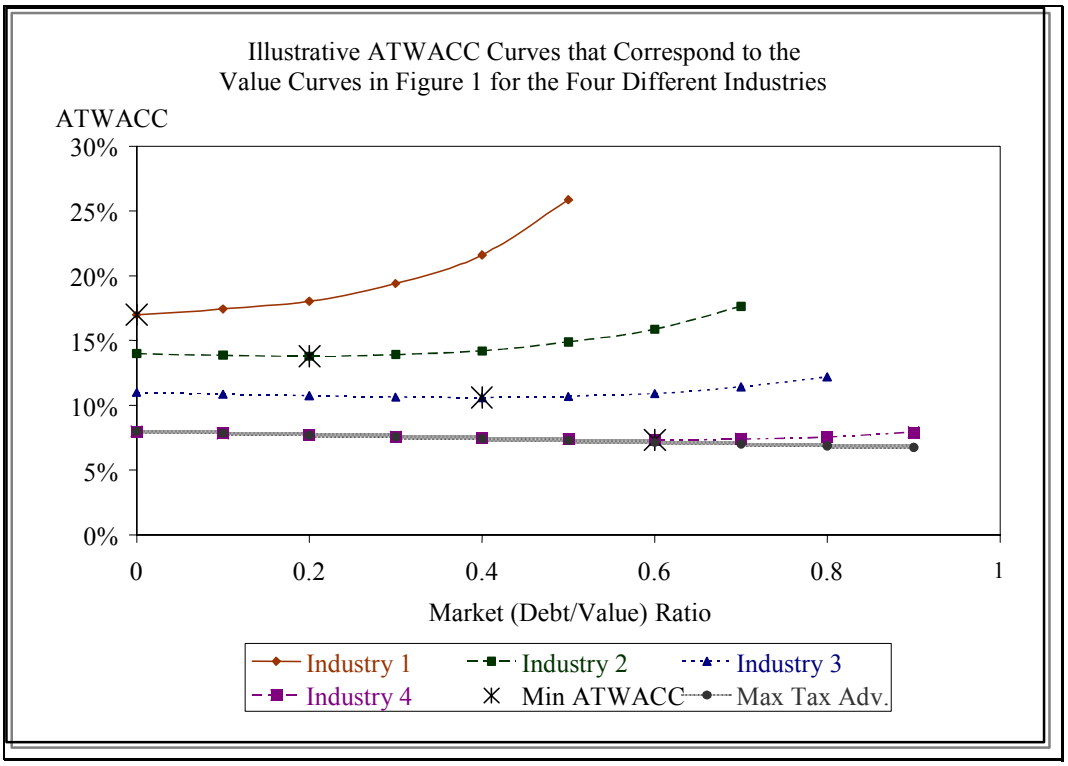

Figure E-3

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.