

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

JEFF HATCH-MILLER, CHAIRMAN
WILLIAM A. MUNDELL
MARC SPITZER
MIKE GLEASON
KRISTIN K. MAYES

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 SUN CITY
WASTEWATER AND SUN CITY WEST
WASTEWATER DISTRICTS

DOCKET NO. WS-01303A-06-_____

**DIRECT TESTIMONY
OF
BENTE VILLADSEN
ON BEHALF OF
ARIZONA-AMERICAN WATER COMPANY**

July 21, 2006

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
<u>EXECUTIVE SUMMARY</u>	1
<u>I. INTRODUCTION AND SUMMARY</u>	2
<u>II. THE COST OF CAPITAL AND RISK</u>	7
<u>III. THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY</u>	10
<u>IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES</u>	18
A. PRELIMINARY DECISIONS	19
1. The Samples: Water Utilities and Gas Local Distribution Companies	19
2. Market-Value Capital Structure	24
3. Market Costs of Debt and Preferred	25
B. COST OF EQUITY ESTIMATION METHODS	26
1. The Risk Positioning Approach	28
a. Security Market Line Benchmarks	29
b. Relative Risk	32
c. Cost of Equity Capital Calculation	33
2. Discounted Cash Flow Method	36
C. THE SAMPLES AND RESULTS	44
1. The Water Utility Sample	44
2. Risk Positioning Cost of Capital Estimates	46
a. Interest Rate Forecasts	47
b. Betas and the Market Risk Premium	47
c. Risk Positioning Results	50
3. The DCF Cost of Capital Estimates	54
a. Growth Rates	54
b. Dividend and Price Inputs	56
c. DCF Results	56
 APPENDIX A: QUALIFICATIONS OF BENTE VILLADSEN	
 APPENDIX B: RISK POSITIONING APPROACH METHODOLOGY: DETAILED PRINCIPLES AND RESULTS	

DOCKET NO. WS-01303A-06-_____
Arizona-American Water Company
Direct Testimony of Bente Villadsen
Page ii of ii

APPENDIX C: DISCOUNTED CASH FLOW METHODOLOGY:
DETAILED PRINCIPLES AND RESULTS

APPENDIX D: THE IMPACT OF CAPITAL STRUCTURE ON COST OF EQUITY

1 **EXECUTIVE SUMMARY**

2 Dr. Bente Villadsen, a senior associate at *The Brattle Group*, files testimony on the
3 cost of capital for Sun City Wastewater and Sun City West Wastewater districts
4 (collectively, “Sun City”).

5 Dr. Villadsen selects two benchmark samples, water utilities and gas LDC
6 companies. She estimates the sample companies’ cost of equity, associated after-tax
7 weighted-average cost of capital, and the corresponding cost of equity at 40 percent equity.
8 She also reviews recent Arizona water and wastewater decisions. In undertaking her
9 analysis, Dr. Villadsen notes that the overall cost of capital is constant within a broad middle
10 range of capital structures although the distribution of costs and risks among debt and equity
11 holders is not. Because Sun City’s requested target of 40 percent equity is lower than the
12 percentage equity among many utilities, its financial risk is higher and the return required
13 by investors increases with the level of risk they carry.

14 Based on the evidence from the samples, Dr. Villadsen estimates a cost of equity for
15 the benchmark samples to be in the range of 11¼ to 12¾ percent. In reviewing the samples’
16 cost of equity estimates, Dr. Villadsen determined that the best midpoint estimate for Sun
17 City is between 11¾ and 12 percent. Dr. Villadsen also reviewed recent Arizona decision
18 and found that the decisions when applied to an entity with 40 percent equity corresponds
19 to a cost of equity of approximately 12¼ percent. She therefore finds that Sun City’s request
20 for 11.75 percent return on equity at 40 percent equity is reasonable and fully supported by
21 her analysis.

1 I. INTRODUCTION AND SUMMARY

2 **Q1. Please state your name and address.**

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

5 **Q2. Please describe your job and your educational experience.**

6 A2. I am a Senior Associate of *The Brattle Group*, (“Brattle”), an economic, environmental and
7 management consulting firm with offices in Cambridge, Washington, San Francisco, London
8 and Brussels. My work concentrates on regulatory finance and accounting. I hold a B.S.
9 and M.S. from University of Aarhus, Denmark and a Ph.D. from Yale University’s School
10 of Management.

11 **Q3. What is the purpose of your testimony in this proceeding?**

12 A3. I have been asked by Arizona-American Water Company (“Arizona-American” or the
13 “Company”) to estimate the cost of equity that the Arizona Corporation Commission
14 (“ACC” or the “Commission”) should allow Sun City Wastewater and Sun City West
15 Wastewater districts (collectively “Sun City”) an opportunity to earn on the equity financed
16 portion of its rate base.

17 To determine the cost of equity for Sun City, I first estimate the overall cost of capital
18 for two samples of regulated companies using several versions of the discounted cash flow
19 (“DCF”) and risk positioning models. Second, I determine the cost of equity that the

1 estimated overall cost of capital gives rise to at Sun City's requested capital structure
2 consisting of 40% equity. Third, I evaluate the relative risk of Sun City and the sample
3 companies to determine the recommended cost of equity for Sun City.

4 **Q4. Please summarize any parts of your background and experience that are particularly**
5 **relevant to your testimony on these matters.**

6 A4. Brattle's specialties include financial economics, regulatory economics, and the utility
7 industry. I have worked extensively on cost of capital matters for electric, natural gas
8 distribution, pipeline and water utilities in both state and federal jurisdictions. I have
9 previously filed cost of capital testimony before the Arizona Corporation Commission.
10 Additionally, I have significant experience in other areas of rate regulation, credit risk in the
11 utilities industry, energy contracts, and accounting issues. I have filed direct and rebuttal
12 testimony on the equity method of accounting, the classification of debt versus equity, and
13 the distinction between categories of liabilities. Appendix A contains more information on
14 my professional qualifications.

15 **Q5. Please summarize your approach to estimating the cost of capital for Sun City.**

16 A5. To assess the cost of capital for Sun City, I select two benchmark samples, regulated water
17 utilities and natural gas local distribution companies ("LDC"). These samples are selected
18 to have risks characteristics comparable to those of Sun City. I give the results from the
19 water sample the most weight, but because the water sample suffers from numerous data

1 issues, I use the gas LDC sample as a check on the results from the water sample. For each
2 sample, I estimate the sample companies cost of equity using several versions of the DCF
3 method and of the risk positioning model. Based on data availability and the current state of
4 the water and gas distribution industries I assign the most weight to the risk positioning
5 models.

6 Given the cost of equity estimates for each company and the company market costs
7 of debt and preferred stock, I calculate each firm's overall cost of capital, i.e., its after-tax
8 weighted-average cost of capital ("ATWACC"), using the company market value capital
9 structure. I report the samples' average ATWACC and the cost of equity for a capital
10 structure with 40 percent equity. Thus, I present the cost of equity that is consistent with
11 the samples' market information and Sun City's regulatory capital structure. (By "regulatory
12 capital structure," I mean the capital structure that Sun City proposes in its application.)

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

16 **Q6. Please summarize your conclusions regarding Sun City's cost of equity.**

17 A6. The range for the water utility sample is 12 to 13 percent at 40 percent equity using the long-
18 term risk positioning method. The gas LDC sample has a wider range from 11¼ to 12½
19 percent with a midpoint of 12¼ and 11½ for the sample and subsample, respectively. The
20 corresponding overall after-tax weighted average cost of capital corresponding to the best

1 point estimate is a bit above 7 percent for a range of $6\frac{3}{4}$ to $7\frac{1}{4}$ percent for the water utility
2 sample. For the gas LDC sample the after-tax weighted average cost of capital falls in the
3 range of $6\frac{1}{2}$ to $7\frac{1}{2}$ percent. I specify a minimum of plus or minus $\frac{1}{4}$ percent range for the
4 cost of equity because I do not believe that it is possible to estimate the cost of capital or
5 equity more precisely than that. The cost of equity estimates from the multi-stage
6 discounted cash flow method are a bit lower for the water sample which has a midpoint of
7 about $11\frac{3}{4}$ percent while the midpoint for the gas LDC sample is about 12 and 13 percent
8 for the subsample and full sample, respectively. The company's request for return on equity
9 of 11.75 is within the range of my risk positioning estimates using the long-term risk
10 positioning model, near the midpoint for the gas LDC sample, and supported by the DCF
11 analysis. In my opinion, the request for 11.75 percent return on equity is therefore very
12 reasonable.

13 **Q7. Are your conclusions for Sun City based on the same evidence as prior testimony filed**
14 **before the Arizona Corporation Commission?**

15 A7. Yes. These conclusions are similar to those I recently submitted for Anthem Water district
16 and Anthem Aqua/Fria Wastewater district in Docket No. WS-01303A-06-0403. I submit
17 the same numerical evidence in the two proceedings because the matters are filing close in
18 time and pertain to companies with the same capital structure and parent company. In

1 addition, while interest rates have increased slightly,¹ general economic conditions have not
2 changed substantially and I have no reason to believe the risk characteristics of the entities
3 differ.

4 **Q8. Why do you need to consider Sun City's regulatory capital structure?**

5 A8. A firm's cost of equity is a function of both its business risk and its financial risk. The more
6 leveraged a company is the higher its risk. Investors in companies with higher risk require
7 a higher rate of return, so *as a company adds debt, the cost of equity goes up at an ever*
8 *increasing rate*. The higher cost of equity offsets the lower cost of debt, so that the after-tax
9 weighted-average overall cost of capital remains constant over a broad range.

10 That is, the associated capital structure affects an estimated cost of equity estimate
11 just as a life insurance applicant's age affects the required life insurance premium. It is
12 therefore necessary to calculate the cost of equity the sample companies would have had at
13 Sun City's regulatory capital structure to report accurately the market evidence on the cost
14 of equity.

15 **Q9. How is the rest of your testimony organized?**

16 A9. *Section II* defines the cost of capital and discusses the principles relating the cost of capital
17 and capital structure for a business. *Section III* summarizes the effects of leverage on the

¹ For example, on June 29, 2006, the Federal Reserve again raised interest rates by 1/4 percent (Federal Reserve Press Release, June 29, 2006).

1 cost of equity. *Section IV* presents the methods used to estimate the cost of capital for the
2 benchmark samples and the associated numerical analyses. This section also explains the
3 basis of my conclusions for the benchmark samples' returns on equity and overall costs of
4 capital. *Section V* summarizes the analysis and discusses the recommendation for Sun City.
5 Appendix A lists my qualifications. Appendices B and C support *Section IV* while Appendix
6 D supports *Section III*. Appendices B and C provide details on the risk positioning and DCF
7 approaches, respectively, including the details underlying the numerical analyses. Appendix
8 D discusses the impact of leverage on the cost of capital in more detail. Note that portions
9 of the testimony are repeated in the appendices in order to give the reader the context of the
10 issues before additional technical detail and further discussion are presented.

11 **II. THE COST OF CAPITAL AND RISK**

12 **Q10. Please formally define the “cost of capital.”**

13 A10. The *cost of capital* is the *expected rate of return in capital markets on alternative*
14 *investments of equivalent risk*. In other words, it is the rate of return investors require based
15 on the risk-return alternatives available in competitive capital markets. The cost of capital
16 is a type of opportunity cost: it represents the rate of return that investors could expect to
17 earn elsewhere without bearing more risk.²

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.

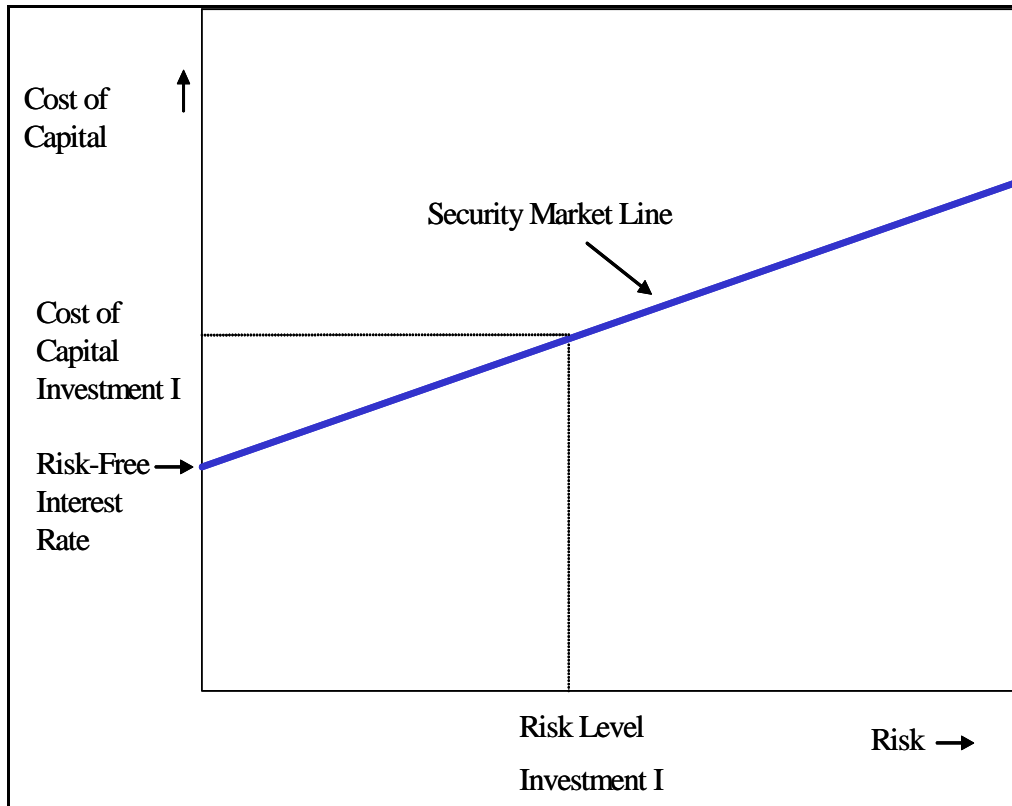


Figure 1

1 The definition of the cost of capital recognizes a tradeoff between risk and return that
2 is known as the “security market risk-return line,” or “security market line” for short. This
3 line is depicted in Figure 1. The higher the risk, the higher the cost of capital. A version of
4 Figure 1 applies for all investments. However, for different types of securities, the location
5 of the line may depend on corporate and personal tax rates.

6 **Q11. Why is the cost of capital relevant in rate regulation?**

1 A11. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility
2 investment.³ From an economic perspective, rate levels that give investors a fair opportunity
3 to earn the cost of capital are the lowest levels that compensate investors for the risks they
4 bear. Over the long run, an expected return below the cost of capital makes customers
5 underpay for service and shortchanges investors. In the long run, such a return denies the
6 company the ability to attract capital, to maintain its financial integrity, and to expect a
7 return commensurate with that of other enterprises attended by corresponding risks and
8 uncertainties. The failure to give investors a fair opportunity to earn the cost of capital can
9 have significant adverse consequences for the utility as well as for customers.

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

³ To the best of my knowledge, the first paper formally to link 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).

1 **III. THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF**
2 **EQUITY**

3 **Q12. Please explain why it is necessary to report the cost of equity adjusted for capital**
4 **structure.**

5 A12. In most jurisdictions in North America, rate regulation focuses on the components of the
6 rates. In other words, the focus of cost of capital estimation is usually to determine the
7 “right” cost of equity and to a lesser degree setting the allowed capital structure. While the
8 overall cost of capital depends primarily on the company’s line of business, the distribution
9 of the cost of capital among debt and equity depends on their share in total revenues. Debt
10 holders’ share is usually a fixed amount (except in situations of default) while equity holders
11 are residual claimants. Because a company’s financial risk depends on its capital structure,
12 the risk shareholders carry increases with the leverage of the company. As shareholders
13 expect to be compensated for increased risk, the required rate of return increases with the
14 company’s leverage. The increased risk is caused by the fact that debt has a senior claim on
15 a specified portion of earnings and in bankruptcy on assets. As common equity is the most
16 junior security, it gets what’s left after everyone else has been paid. In other words, common
17 equity holders carry all residual risk. However, as explained in more detail in Appendix D,
18 the overall cost of capital is constant within a broad middle range of capital structures
19 although the distribution of costs and risks among debt and equity holders is not.

20 **Q13. Please provide an example on how debt adds risk to equity.**

1 A13. As a simple example, think of an investor who takes money out of his savings account and
2 invests \$100,000 in real estate. The future value of the real estate is uncertain. If the real
3 estate market booms, he wins. If the real estate market goes down, he loses. Figure 2 below
4 illustrates this.

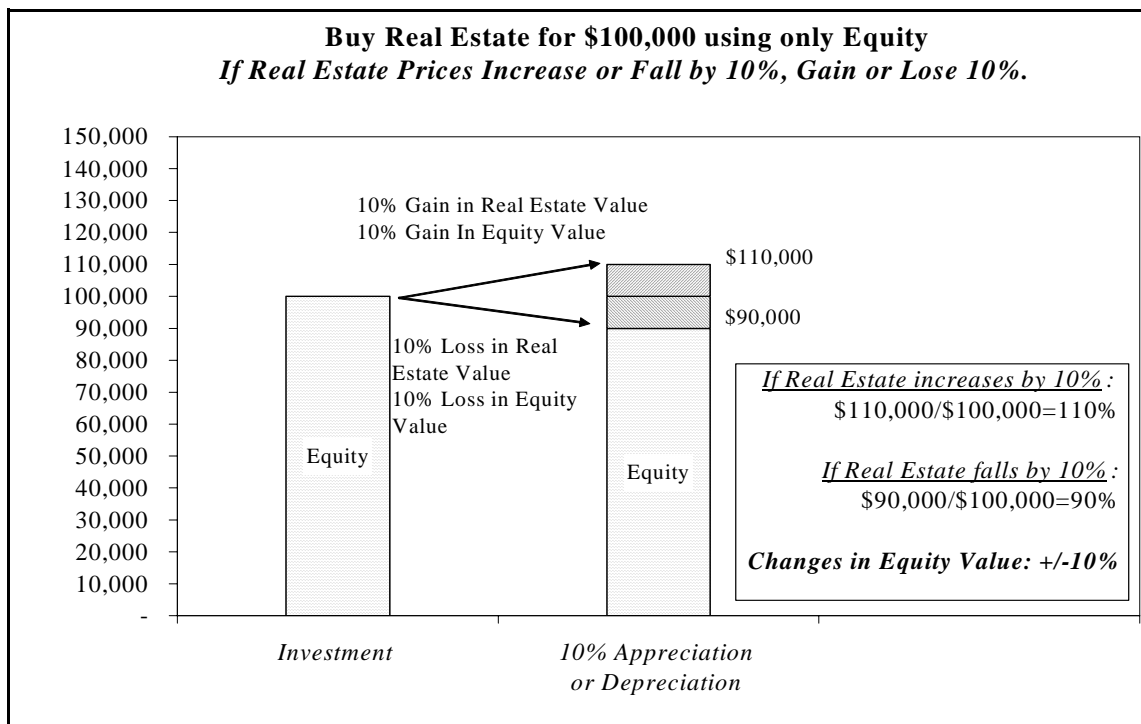


Figure 2

6 In the scenario above, the investor financed his real estate purchase through 100 percent
7 equity. Suppose instead that the investor had financed 50 percent of his real estate
8 investment with a mortgage of \$50,000. The mortgage lender does not expect to share in any
9 benefits from increases in real estate values. Neither does the mortgage lender expect to

1 share in any losses from falling real estate values. I.e., the investor carries the entire risk of
 2 fluctuating real estate prices. Figure 3 illustrates this effect.

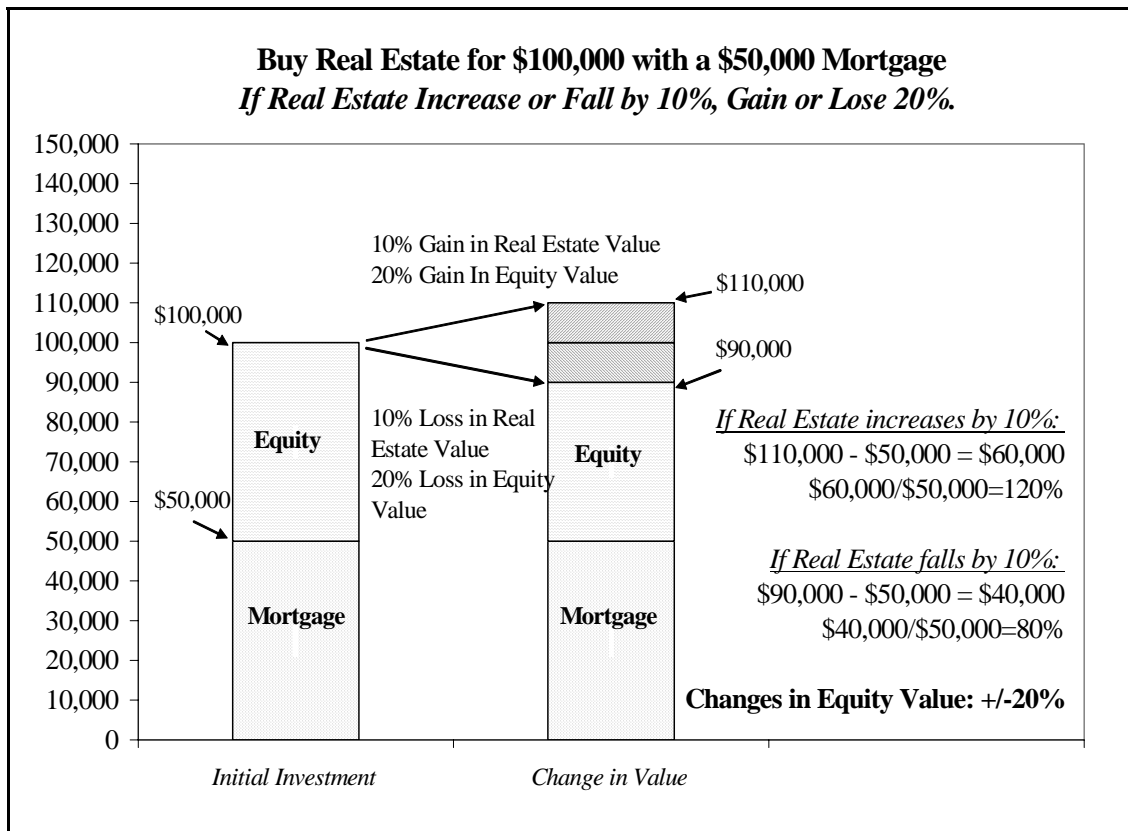


Figure 3

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

1 **Q14. Please explain the implications of the relationship between capital structure and the**
2 **cost of equity for rate regulation.**

3 A14. The risk equity holders carry, and therefore the cost of equity, depends on the capital
4 structure. As illustrated in the example above, as leverage increases, the market risk
5 increases and hence the required return on equity increases.

6 **Q15. To assess the magnitude of financial risk for a rate regulated company, should you use**
7 **the market-value or the book-value capital structure?**

8 A15. The market-value capital structure is the relevant quantity for analyzing the cost of equity
9 evidence, which is based on market information.⁴

10 **Q16. Please provide an example that illustrates why market values are relevant.**

11 A16. Suppose in the example from above that the investor has invested in real estate 10 years ago.
12 Further assume that depreciation has reduced the book value of the real estate from \$100,000
13 to \$75,000 and assume the investor has paid off 40 percent of his \$50,000 mortgage. Thus,

⁴ 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 8th ed. (2005) pp. 504-05. 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.

1 the investor has a remaining mortgage of \$30,000 (= 60% × \$50,000). The book value of
2 the investor's equity investment is therefore \$45,000 (= \$75,000 - \$30,000).

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

10 Net Worth = Market Value - Remaining Mortgage
11 Of Real Estate
12 = \$200,000 - \$30,000 = \$170,000

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

15

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%

16
17
18

1 **Q17. Please explain the implications for rate regulation and your testimony.**

2 A17. Because the market risk, and therefore the cost of equity, depends on the market-value
3 capital structures, one must base the estimation of the sample companies cost of capital on
4 market value capital structures. An approach that estimates the cost of equity for each of the
5 sample firms without explicit consideration of the market value capital structure underlying
6 those costs risks material errors. The costs of equity estimates of the sample companies at
7 their actual market-value capital structures is not necessarily reflected in the regulatory
8 capital structure. Therefore, it could lead to an incorrect rate of return. I avoid this problem
9 by calculating each sample company's ATWACC using its market value capital structure.
10 I then use the sample companies' average overall cost of capital to determine the
11 corresponding return on equity at Sun City's regulatory capital structure. This procedure
12 ensures that the capital structure and the estimated cost of equity are consistent.

13 In my analyses, I estimate the cost of equity for each of the sample firms using
14 traditional estimation methods (such as the DCF and Capital Asset Pricing Model
15 ("CAPM")). I use each company's estimated cost of equity along with Arizona-American's
16 marginal tax rate and each company's cost of debt and market-value capital structure to
17 estimate the sample companies' overall cost of capital. I then calculate the sample average
18 overall cost of capital for each equity estimation method for both of the samples. Using the
19 procedure discussed above, I then determine the cost of equity at Sun City's regulated capital
20 structure for each estimation method that is consistent with the sample's overall cost of
21 capital information.

1 **Q18. Is the use of market values to calculate the impact of capital structure on the risk of**
2 **equity incompatible with use of a book-value rate base for a regulated company?**

3 A18. No. Investors buy stock at market prices and expect a reasonable return on their investment.
4 Market-based cost of equity estimation methods, such as DCF or CAPM which are
5 frequently used in rate regulation, recognize this and rely on market data. That is, the cost
6 of capital is the fair rate of return on regulatory assets for both investors and customers.
7 Most regulatory jurisdictions in the U.S. measure the rate base using the net book value of
8 assets, not current replacement value or historical cost trended for inflation. But the
9 jurisdictions still apply market-derived measures of the cost of equity to that net book value
10 rate base.

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

16 **Q19. Please sum up the implications of this section.**

17 A19. The market risk, and therefore the cost, of equity depends directly on the market-value
18 capital structure of the company or asset in question. It therefore is impossible to compare
19 validly the measured costs of equity of different companies without taking capital structure
20 into account. Capital structure and the cost of equity are unbreakably linked, and any effort

1 to treat the two as separate and distinct questions violates both everyday experience (e.g.,
2 with home mortgages) and basic financial principles.

3 **Q20. How should a cost of capital analyst implement this principle?**

4 A20. As discussed further in Appendix D, there has been a great deal of financial research on the
5 effects of capital structure on the value of the firm. One of the key conclusions that result
6 from the research is that no narrowly defined optimal capital structure exists within
7 industries, although the typical range of capital structures does vary among industries.⁵
8 Instead, there is a relatively wide range of capital structures within any industry in which
9 fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to
10 its overall after-tax cost of capital.

11 Accordingly, analysts should treat the market-value weighted average of the cost of
12 equity and the after-tax current cost of debt, or the “ATWACC” for short,⁶ as constant.
13 Sample evidence should be analyzed to determine the sample’s average ATWACC, which
14 can be compared across different firms or industries. The economically appropriate cost of
15 equity for a regulated firm is the quantity that, when applied to the *regulatory* capital

⁵ An exception is very high-risk industries that should avoid debt entirely, which makes their optimal capital structure zero percent debt.

⁶ This quantity typically is called the “weighted-average cost of capital” or “WACC” in finance textbooks. 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. Accordingly, in regulatory settings it’s useful to refer to the textbook WACC as the “ATWACC,” or “after-tax weighted-average cost of capital.” I follow that practice here.

1 structure, produces the same ATWACC. That value is the cost of equity that the sample
2 would have had, estimation problems aside, if the sample's market-value capital structure
3 had been equal to the regulatory capital structure in question.

4 **Q21. How do you calculate the cost of equity consistent with the market-determined estimate**
5 **of the sample's average cost fo capital?**

6 A21. For simplicity assume that all sample companies have only common stock and debt. Then
7 the ATWACC is calculated as

$$8 \quad ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \quad (1)$$

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

15 **IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES**

16 **Q22. How is this section of your testimony organized?**

17 A22. As noted in *Section II*, I estimate the cost of capital using two samples of comparable risk
18 companies. This section first covers matters such as sample selection, market-value capital
19 structure determination, and the sample companies' costs of debt. It then covers estimation

1 of the cost of equity for the sample companies and the resulting estimates of the sample's
2 overall after-tax cost of capital. Next, it analyzes these data to reach a conclusion on the
3 overall cost of capital and the corresponding cost of equity at Sun City's regulatory capital
4 structure for both of the benchmark samples.

5 **A. PRELIMINARY DECISIONS**

6 **Q23. What preliminary decisions are needed to implement the above principles?**

7 A23. I must select the benchmark samples, calculate the sample companies' market-value capital
8 structures, and determine the sample companies' market costs of debt and preferred equity.

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

10 **Q24. Why do you use two samples?**

11 A24. The overall cost of capital for a part of a company depends on the risk of the business in
12 which the *part* is engaged, *not* on the overall risk of the parent company on a consolidated
13 basis.

14 Estimating the cost of capital for Sun City's regulated assets is the subject of this
15 proceeding. The ideal sample would be a number of companies that are publicly traded
16 "pure plays" in the water production, storage, treatment, transmission, distribution and
17 wastewater lines of business.⁷ "Pure play" is an investment term referring to companies with
18 operations only in one line of business. Publicly traded firms, firms whose shares are freely

⁷ Most of the water utilities in *Value Line* have operations in the water as well as wastewater business.

1 traded on stock exchanges, are ideal because the best way to infer the cost of capital is to
2 examine evidence from capital markets on companies in the given line of business.

3 Therefore, for this case, a sample of companies whose operations are concentrated
4 solely in the regulated portion of the water industry would be ideal. Unfortunately, the
5 available sample of “water” utility companies in the U.S. is relatively small and has serious
6 data deficiencies. See *Section IV.C.1* for a description of these deficiencies.

7 To select my sample of comparable water and gas LDC companies, I start with those
8 companies that are listed as a water utility or natural gas (distribution) company in *Value*
9 *Line*.⁸ Usually, I would apply several selection criteria to delete companies with unusual
10 circumstances that may bias the cost of capital estimation and companies whose risk
11 characteristics differ from those of the filing entity. However, the application of such criteria
12 would eliminate almost all the water utilities listed in *Value Line*. Therefore, I do not apply
13 selection criteria to the water utility sample although I do apply my standard criteria to the
14 gas LDC sample. Specifically, if I eliminate all water utilities with annual revenues below
15 \$200 million, less than 60 percent regulated revenues, lack of growth rates (from *IBES* or
16 *Value Line*), or lack of a bond rating, I would be left with at most two companies (American
17 States Water and California Water Services). A two company sample is simply too small
18 to provide reliable results. Therefore, I keep all water utilities with data in my water utility

⁸ To select the water utility sample I include both the Standard and the Small and Mid-Cap Editions of *Value Line Investment Survey and Value Line Investment Survey - Plus Edition*. To select the gas LDC sample I include only the Standard Edition of *Value Line Investment Survey*.

1 sample, but I do report results for a sub sample that earn a large percentage of revenues from
2 regulated activities.

3 **Q25. What do you do to overcome the weaknesses of the water utility sample?**

4 A25. To overcome the weaknesses of the water sample, I select a second sample of regulated
5 utilities: gas LDC companies. Gas LDC companies, like water utilities, are regulated by
6 state regulatory bodies, have large distribution investments, and serve a mix of residential,
7 industrial, and commercial customers.

8 For the gas LDC sample, I start with *Value Line*'s universe of natural gas distribution
9 companies but in this sample, I only include companies with an investment grade bond
10 rating, no recent mergers or acquisitions, no recent dividend cuts, at least 60 percent
11 percentage revenues from regulated operations, and no other activity that could cause the
12 estimation parameters to be biased. Additionally, I require the companies to have necessary
13 data available.

14 **Q26. What is the specific sample selection procedure for the gas local distribution
15 companies?**

16 A26. One reason for using the gas LDC sample is to generate a sample of regulated companies
17 whose primary source of revenues is in the regulated portion of the natural gas industry to
18 provide a check for the results of the water sample. Therefore, I started with the universe
19 of publicly traded natural gas distribution utilities covered by *Value Line Investment Survey*,

1 and eliminated those companies whose revenues from regulated natural gas distribution
2 operations was less than 60 percent. The final sample includes seven companies. I also
3 report results for a subsample of companies characterized by having generated more than 75
4 percent of their revenue from regulated activities. The subsample consists of three
5 companies.⁹ Additional details of the sample selection process for each sample and
6 subsample are described below as well as in Appendix B.

7 **Q27. If the business risk of the gas LDC sample differs from the water sample, can you still**
8 **rely on the cost of equity estimated for the gas LDC sample?**

9 A27. Yes. If the business and financial risk of the two samples differ, then a cost of capital analyst
10 can still make use of the information from the more reliable sample to evaluate the reliability
11 of the estimates from the water sample. The inference would be based on information about
12 the relative risk of the two industries.

13 **Q28. Please elaborate on the way two samples with different business and financial risks can**
14 **be compared.**

15 A28. As mentioned above, the overall cost of capital for a part of a company depends on the risk
16 of the business in which the *part* is engaged, *not* on the overall risk of the parent company

⁹ Compared to my earlier testimony filed with the Arizona Corporation Commission, the gas LDC sample has been reduced from eight to seven companies as KeySpan has announced merger plans.

1 on a consolidated basis. According to financial economics, the overall risk of a diversified
2 company equals the market value weighted-average of the risks of its components.

3 Calculating the overall after-tax weighted average cost of capital for each sample
4 company as described above allows the analyst to estimate the average overall cost of capital
5 for the sample. The ATWACC captures both the business risk and the financial risk of the
6 sample companies in one number. This allows comparison of the cost of capital between
7 two samples on a much more informed basis. If the alternative (more reliable) sample is
8 judged to have slightly different risk than the water sample, but the results show wide
9 differences in the ATWACC estimates, the analyst should carefully consider the validity of
10 the water sample estimates, whether they are materially higher or lower than the alternative
11 sample's estimates. Of course, the alternative sample could be the source of the error, but
12 that is less likely because the alternative sample has been selected precisely because of its
13 expected reliability.

14 **Q29. Please compare the characteristics of the water utility sample and the gas LDC sample.**

15 A29. The two samples differ primarily in that they operate in two different (regulated) industries,
16 but they are very similar in terms of the percentage of revenues from regulated operations
17 and the customers they serve. On average, both samples earn a large percentage of their
18 revenue from regulated activities and serve a mix of residential, industrial, and other
19 customers. In addition, both industries are characterized by large capital investment and
20 both operating a large distribution system. However, the gas LDC sample has fewer of the

1 data and estimation issues identified above for the water sample. Please refer to Appendix
2 B for addition details comparing the two samples.

3 2. Market-Value Capital Structure

4 **Q30. What capital structure information do you require?**

5 A30. For reasons discussed below and in Appendix D, explicit evaluation of the market-value
6 capital structures of the sample companies is vital for a correct interpretation of the market
7 evidence on the return on equity. This requires estimates of the market values of common
8 equity, preferred equity and debt, and the current market costs of preferred equity and debt.

9 **Q31. Please describe how you calculate the market values of common equity, preferred 10 equity and debt.**

11 A31. I estimate the capital structure for each sample company by estimating the market values of
12 common equity, preferred equity and debt from the most recent publicly available data. The
13 details are in Appendix B.

14 Briefly, the market value of common equity is the price per share times the number
15 of shares outstanding. For the risk positioning approach, I use the last five trading days of
16 each year to calculate the market value of equity for the year. I then calculate the average
17 capital structure over the corresponding five-year period used to estimate the “beta” risk
18 measures for the sample companies. This procedure matches the estimated beta to the
19 degree of financial risk present during its estimation period. In the DCF analyses, I use the

1 average stock price over 15 trading days ending on the release date of the *IBES* growth rate
2 forecasts utilized.¹⁰

3 The market value of debt is estimated at its book value. Because debt instruments
4 generally are callable in the U.S., I do not expect the market and book value of debt to differ
5 much. The market value of preferred stock for the samples is also set equal to its book
6 value.

7 3. Market Costs of Debt and Preferred

8 **Q32. How do you estimate the current market cost of debt?**

9 A32. The market cost of debt for each company in the DCF analysis is the current yield reported
10 in the Mergent Bond Record for an index of public utility company bonds with the same
11 rating as the sample company.¹¹ Bond rating information was obtained from Compustat
12 which reports Standard & Poor's bond ratings.¹² Calculation of the after-tax cost of debt
13 uses the Company's estimated marginal income tax rate of 38.6 percent.

¹⁰ *IBES* growth rates were as of March 31, 2006 for all companies except Aqua America whose *IBES* estimate is as of October 17, 2005.

¹¹ In the DCF analysis, the companies' current bond rating was used whereas the average bond rating over the past five years was used in the risk positioning models.

¹² For some companies in the water utility sample bond ratings were obtained from Moody's (www.moody.com) or from Standard & Poor's webpage (www.standardandpoors.com). Details are in Workpaper #1 to Table No. BV-10.

1 **Q33. How do you estimate the market cost of preferred equity?**

2 A33. For all sample companies, the preferred rating was assumed equal to the company's bond
3 rating. The cost of a company's preferred equity was set equal to the yield on an index of
4 preferred utility stock with the same rating. The data were obtained from Mergent Bond
5 Record.

6 **B. COST OF EQUITY ESTIMATION METHODS**

7 **Q34. How do you estimate the cost of equity for your sample companies?**

8 A34. Recall that the cost of capital is the expected rate of return in capital markets on alternative
9 investments of equivalent risk. This definition leads me to address three key points in my
10 estimation procedures. First, the cost of capital is an *expected* rate of return, it cannot be
11 directly observed, but must be inferred from available evidence. Second, the cost of capital
12 is determined *in capital markets* (such as the New York Stock Exchange). Therefore, capital
13 market data provide the best evidence from which to draw inferences. Third, the cost of
14 capital depends on the return offered by alternative investments *of equivalent risk*.
15 Consequently, measures of risk that matter in capital markets are part of the evidence that
16 I need to examine.

1 **Q35. How does the above definition help you estimate the cost of capital?**

2 A35. The definition of the cost of capital recognizes a tradeoff between risk and expected return;
3 This is the security market line plotted above in Figure 1 above. Cost of capital estimation
4 methods usually take one of two approaches: (1) they establish the location of the security
5 market line and estimate the relative risk of the security, which jointly determine the cost of
6 capital or (2) they try to identify a comparable-risk sample of companies and estimate the
7 cost of capital directly. Looking at Figure 1, the first approach focuses directly on the
8 vertical axis, while the second focuses both on the security's position on the horizontal axis
9 and on the position of the security market line.

10 The first type of approach is more direct, but ignores the wealth of information
11 available on securities not thought to be of precisely comparable risk. The "discounted cash
12 flow" or "DCF" model is an example. The second type of approach, sometimes known as
13 "equity risk premium approach," requires an extra step - - positioning the security market
14 line. Using the second approach allows me to use information from all traded securities
15 rather than just those included in my sample. The capital asset pricing model ("CAPM") is
16 an example. While both approaches can work equally well if conditions are right, one may
17 be preferable to the other under certain circumstances. In particular, approaches that rely on
18 the entire security market line are less sensitive to deviations from the assumptions that
19 underlie the model, all else equal. In this case, I examine both DCF and risk positioning
20 approach evidence for the water utility and gas LDC sample.

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

3 *Section I* of Appendix B to this testimony provides more detail on the principles that
4 underlie the risk positioning approach. *Section II* of Appendix B provides the details of the
5 risk positioning approach empirical estimates I obtain.

6 **Q37. How are the “more formal” applications of the risk positioning approach**
7 **implemented?**

8 A37. The first step is to specify the current values of the benchmarks that determine the security
9 market line. The second is to determine the security’s, or investment’s, relative risk. The
10 third is to specify exactly how the benchmarks combine to produce the security market line,
11 so the company’s cost of capital can be calculated based on its relative risk.

12 **a. Security Market Line Benchmarks**

13 **Q38. What benchmarks are used to determine the location of the security market line?**

14 A38. The essential benchmarks that determine the security market line are the risk-free interest
15 rate and the premium that a security of average risk commands over the risk-free rate. This
16 premium is commonly referred to as the “market risk premium” (“MRP”), *i.e.*, the excess
17 of the expected return on the average common stock over the risk-free interest rate. In the
18 risk positioning approach, the risk-free interest rate and MRP are common to all securities.
19 A security-specific measure of relative risk (beta) is estimated separately and combined with

1 the MRP to obtain the company-specific risk premium.

2 **Q39. What benchmark do you use for the MRP?**

3 A39. I estimate two versions of the risk positioning model. The first version measures the market
4 risk premium as the risk premium of average-risk common stocks over long-term
5 Government bonds. The second version measures the market risk premium over short-term
6 Treasury bills, which is the usual measure of the MRP used in capital market theories. To
7 determine the cost of capital in a regulatory proceeding, the market risk premium should be
8 used with a *forecast* of the same interest rate (*i.e.*, the short-term or long-term Government
9 bond rate).

10 **Q40. How do you estimate the MRP?**

11 A40. Appendix B summarizes academic and empirical research on the MRP. However, as
12 discussed in the appendix, there is currently little consensus on the “best practice” for
13 estimating the MRP. (Note: this is not the same thing as saying that all practices are equally
14 good). For example, the leading graduate textbook in corporate finance, expresses the view
15 that a range between 5 to 8 percent is reasonable for the U.S.¹⁴ Ibbotson Associates data from
16 1926 to 2005, the longest period reported, show an MRP average premium of stocks over

¹⁴ Richard A. Brealey, Stewart C. Myers and Franklin Allen, *Principles of Corporate Finance*, 8th ed., New York: McGraw-Hill/Irwin (2005), pp. 151-154.

1 Treasury bills is 8.5 percent.¹⁵

2 My testimony considers both the historical evidence and the results of scholarly
3 studies of the factors that affect the risk premium for average-risk stocks in order to estimate
4 the benchmark risk premium investors currently expect. In particular, I rely on historical
5 differences between the S&P 500 Index ("S&P 500") and the risk-free rate.

6 Considering all the evidence, I conclude that S&P 500 stocks of average risk today
7 command a premium of 8.0 percent over the short-term risk-free rate and 6.5 percent over
8 the long-term Government rate. The estimation of the MRP is discussed in greater detail in
9 Appendix B.

10 **Q41. How do you determine the risk-free rate you use?**

11 A41. Ideally, the risk-free rate is the estimated risk-free rate over the period where rates will be
12 in effect. For this proceeding, I use the current yield on long-term Government bonds and
13 30-day T-bills as an estimate for the long-term and short-term risk-free rate, respectively.
14 Using an average of 15 trading days ending April 25, 2006, I obtain a short-term risk-free
15 rate of 4.60% and a long-term risk-free rate of 5.21%, respectively.¹⁶ The yields on both
16 short-term and long-term government securities have increased by more than 50 basis points

¹⁵ Ibbotson Associates, "S&P 500: Valuation Edition 2006 Yearbook."

¹⁶ See Workpaper #2 to Table No. BV-9.

1 since the start of 2006.¹⁷ Therefore, I believe my risk-free rates, are more likely to
2 underestimate than overestimate the risk-free rate going forward.

3 **b. Relative Risk**

4 **Q42. What measure of relative risk do you use?**

5 A42. I examine the “beta” of the stocks in question. Beta is a measure of the “systematic” risk of
6 a stock — the extent to which a stock’s value fluctuates more or less than average when the
7 market fluctuates.

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

12 **Q43. What does a particular value of beta mean?**

13 A43. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up
14 or down by 10 percent on average when the market goes up or down by 10 percent. Stocks
15 with betas above 1.0 exaggerate the swings in the market: stocks with betas of 2.0 tend to
16 fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0
17 are less volatile than the market. A stock with a beta of 0.5 will tend to rise 5 percent when

¹⁷ The Federal Reserve raised interest rates on May 10, 2006 when the Federal Reserve stated that “further policy firming may yet be needed to address inflation risks”.(Federal Reserve, Press Release, May 10, 2006)

1 the market rises 10 percent.

2 **Q44. How do you estimate beta?**

3 A44. For both samples, I use betas reported by *Value Line* for reasons discussed below.

4 **c. Cost of Equity Capital Calculation**

5 **Q45. How do you combine the preceding steps to estimate the cost of equity?**

6 A45. The most widely used approach to combine a risk measure with the benchmark market risk
7 premium on common stocks to find a risk premium for a particular firm or industry is the
8 Capital Asset Pricing Model. However, the CAPM is only one risk positioning technique.

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

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

1 is

$$k = r_F + \alpha + \beta \times (MRP - \alpha) \quad (3)$$

2
3 where as before k is the cost of capital, r_F is the risk-free interest rate, MRP is the market risk
4 premium, β is the measure of relative risk, and α is the empirical adjustment factor.

5 Research supports values for α of from one to seven percent when using a short-term
6 interest rate. I use baseline values of α of 2 percent for the short-term risk-free rate and 0.5
7 percent for the long-term risk-free rate. I also conduct sensitivity tests for different values
8 of α . For the short-term risk-free rate I use values for α of 1, 2 and 3 percent. For the long-
9 term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Appendix B for a more
10 detailed discussion of the ECAPM model and Table B-1 for a summary of the empirical
11 evidence on the size of the required adjustment.

12 **Q46. Why is it appropriate to use the ECAPM model?**

13 A46. Empirical tests of the CAPM have repeatedly shown that an investment's return is related
14 to systematic risk, but that the increase in return for an increase in risk is *less* than is
15 predicted. The empirical tests have also shown that the theoretical intercept, as measured
16 by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests
17 indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical
18 data support the ECAPM. The ECAPM recognizes the consistent empirical observation that
19 the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The
20 ECAPM corrects the predictions of the CAPM to more closely match the results of the

1 empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of
2 capital that is likely to be less accurate than is possible.

3 **Q47. Is the use of the ECAPM equivalent to adjusting the estimated betas for the sample**
4 **companies?**

5 A47. No. Fundamentally, this is *not* an adjustment (increase) in beta. This can easily be seen by
6 the fact that the expected return on high beta stocks is lower with the ECAPM than when
7 estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the
8 risk-return tradeoff is flatter than predicted and the intercept higher based upon repeated
9 empirical tests of the model.¹⁸ Even if the beta of the sample companies were estimated
10 accurately, the CAPM would still underestimate the required return for low beta stocks.
11 Even if the ECAPM were used, the costs of equity would be underestimated if the betas were
12 underestimated.

¹⁸ Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment which adjusts betas 1/3 towards one. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for empirical fact that CAPM tend to overestimate the sensitivity of the cost of capital to beta. See Appendix B for a more detailed explanation.

1
2

$$P_0 = \frac{D_1}{(k - g)} \quad (5)$$

3 where “ D_1 ” is the dividend expected at the end of the first period, “ g ” is the perpetual growth
4 rate, and “ P_0 ” and “ k ” are the market price and the cost of capital, as before. Equation (5)
5 is a simplified version of Equation (4) that can be solved to yield the well known “DCF
6 formula” for the cost of capital:

7
8

$$k = \frac{D_1}{P_0} + g = \frac{D_0 \times (1+g)}{P_0} + g \quad (6)$$

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

15 **Q49. Are there other versions of the DCF models besides the “simple” one?**

16 A49. Yes. There are many variations on the DCF models that may rely on less strong assumptions
17 in that they allow growth rates to vary over time. I consider a variant of the DCF model that
18 uses the companies’ individual growth rates during the first five years, converges to a
19 perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual

1 growth rate after year 10 for all companies. This is a variant of the “multi-stage” DCF
2 method. The DCF models are described in detail in *Section I* of Appendix C. (*Section II* of
3 Appendix C provides the details of my empirical DCF results.)

4 **Q50. What are the merits of the DCF approach?**

5 A50. The DCF approach is conceptually sound if its assumptions are met, but can run into
6 difficulty in practice because those assumptions are so strong, and hence so unlikely to
7 correspond to reality. Two conditions are well known to be necessary for the DCF approach
8 to yield a reliable estimate of the cost of capital: the variant of the present value formula that
9 is used must actually match the variations in investor expectations for the dividend growth
10 path; and the growth rate(s) used in that formula must match current investor expectations.
11 Less frequently noted conditions may also create problems. (See Appendix C for details.)

12 **Q51. Do you agree that estimating the right growth rate is the most difficult part for the**
13 **implementation of the DCF approach?**

14 A51. Yes. Finding the right growth rate(s) is the usual “hard part” of a DCF application. The
15 original approach to estimation of g relied on average historical growth rates in observable
16 variables, such as dividends or earnings, or on the “sustainable growth” approach, which
17 estimates g as the average book rate of return times the fraction of earnings retained within
18 the firm. But it is highly unlikely that these historical averages over periods with widely
19 varying rates of inflation and costs of capital will equal current growth rate expectations.

1 This is particularly true for the water sample as many companies in the industry are engaged
2 in merger, acquisition or other restructuring activities.

3 Moreover, the constant growth rate DCF model *requires* that dividends and earnings
4 grow at the same rate for companies that earn their cost of capital on average.¹⁹ It is
5 inconsistent with the theory on which the model is based to have different growth rates in
6 earnings and dividends over the period when growth is assumed to be constant. If the
7 growth in dividends and earnings were expected to vary over some number of years before
8 settling down into a constant growth period, then it would be appropriate to estimate a
9 multistage DCF model. In the multistage model, earnings and dividends can grow at
10 different rates, but *must* grow at the same rate in the final, constant growth rate period. A
11 difference between forecasted dividend and earnings rates therefore is a signal that the facts
12 do not fit the assumptions of the simple DCF model.

13 **Q52. How do you estimate the growth rates you use in your DCF analysis?**

14 A52. I use earnings growth rate forecasts from *IBES* and *Value Line*. Analysts' forecasts are
15 superior to using single variables in time series forecasts based upon historical data as has
16 been documented and confirmed extensively in academic research. Please see *Section I* in

¹⁹ 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.

1 Appendix C for a detailed discussion on this issue.

2 **Q53. Are you aware that the Commission Staff typically relies on an average of historical**
3 **growth rates of earnings and dividends as well as forecasts of earnings and dividend**
4 **growth rates to estimate the growth rate for the DCF model?**

5 A53. Yes, but I do not believe that this is the best way to estimate the growth rate for use in the
6 DCF model for the following reasons. First, as mentioned above, the model requires that
7 dividends and earnings grow at the same rate at some point in the future in order to apply the
8 model. The data on historical growth rates do not confirm this condition. Second, analysts
9 have access to historical information and include that information in their forecast of
10 earnings growth rates. In other words, using historical data provides no additional
11 information to that captured in analyst forecasts.

12 Finally, averaging wildly different growth rate estimates in the hopes of having
13 the extremes cancel out calls into question whether the DCF model is applicable at this time
14 to the sample companies.

15 **Q54. What about the evidence that analyst earning growth forecasts have been optimistic**
16 **(over estimated earnings and dividend growth) in the past?**

17 A54. Although analyst forecasts have been optimistic on average in the past, this problem is less

1 acute for regulated companies.²⁰ In addition, the use of a two-stage DCF model that
2 substitutes the forecast growth of GDP mitigates analyst optimism by substituting the GDP
3 growth rate for the potentially optimistic (or pessimistic) earnings forecasts of analysts.

4 **Q55. How well are the constant-growth rate conditions necessary for the reliable application**
5 **of the DCF likely to be met for the sample companies at present?**

6 A55. The requisite conditions for the sample companies are not fully met at this time, particularly
7 for the water sample. Of particular concern for this proceeding is the uncertainty about what
8 investors truly expect the long-run outlook for the sample companies to be. The longest time
9 period available for growth rate forecasts of which I am aware is five years. The long-run
10 growth rate (*i.e.*, the growth rate after the water industry settles into a steady state, which
11 may be *beyond* the next five years for this industry) drives the actual results one gets with
12 the DCF model. Unfortunately, this implies that unless the company or industry in question
13 is stable, so there is little doubt as to the growth rate investors expect, DCF results in practice
14 can end up being driven by the subjective judgment of the analyst who performs the work.

15 Of the eight companies in the water sample, two have no current long-term *IBES*
16 growth rates, and only four companies have growth forecasts from both *IBES* and *Value*
17 *Line*.²¹ The average long-term earnings forecasts vary from a low of 3.5 percent to a high

²⁰ 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.

²¹ See Table BV-5 for details.

1 of 12.5 percent. Additionally, the analysts' forecast for individual companies range widely.
2 For example, the median *IBES* growth forecasts for Southwest Water Co is 7.3 percent while
3 the *Value Line* forecast is 28.3 percent. The lack of sufficient analysts following and the
4 large variation in growth forecasts indicate that these forecasts are less reliable than ideal.
5 The growth rates for gas LDC sample vary less from an average of 4.3 to 6.7 percent and
6 are more consistent with the GDP growth forecast of 5.2 percent. However, this sample also
7 includes companies for which analysts' forecasts vary widely. For example, the *IBES*
8 forecast for Cascade Natural Gas is 3.0 percent while the *Value Line* forecast is 10.5
9 percent.²² Of the seven companies in the gas LDC sample, one has no current *IBES* forecasts
10 and one has only one analyst providing a forecast. Thus, the available data are far from
11 being ideal. As discussed above, the two-stage DCF model adjusts for any over optimistic
12 (or pessimistic) growth rate forecasts by adjusting the 5-year growth rate forecasts of the
13 analysts toward the long-term GDP growth rate in the years after year 5. See Appendix C,
14 *Section I* for a discussion of the two-stage model.

15 The DCF growth rates whether estimated from historical data or from analyst
16 forecasts are likely to be affected by the fact that there has been a number of mergers and
17 acquisitions in the water industry in recent years, and the industry is showing signs of
18 becoming globalized.²³ Thus, the industry appears to be moving towards a larger degree of

²² See Table No. BV-15.

²³ Philadelphia Suburban (renamed Aqua America) completed the acquisition of AquaSource for about \$195 million in July 2003. During 2005 Aqua America integrated about 30 smaller entities and the company expects to add further entities in 2006. Additionally, American Water Works acquired National Enterprises,

1 consolidation – at least among the privately held water utilities. The consolidation of the
2 industry may well increase as the industry need significant infrastructure investments to
3 comply with EPA water purification rules, maintain or replace old infrastructure, and deal
4 with increased threats towards the water systems.²⁴ The uncertainty associated with these
5 factors increases the industry’s business risk. Additionally, environmental regulation that
6 impact the industry as standards for water quality evolve over time, and there is potential for
7 new safety and security requirements in the future. The industry has no federal regulator
8 (other than for environmental and health issues), and state public utility commissions
9 regulate most investor owned water utilities. Different regulatory bodies may lead to
10 differing regulatory requirements for companies operating in adjacent parts of the country.
11 Taken together, these factors mean that it may be some time before the water industry settles
12 into anything investors will see as a stable equilibrium necessary for the reliable application
13 of the DCF model.

14 Such circumstances imply that a commission may often be faced with a wide range
15 of DCF estimates, none of which can be well grounded in objective data on true long-run

Inc., Azurix, and the water and wastewater utility assets of Citizens Utilities. American Water Works, in turn, was acquired by RWE AG on January 10, 2003. Recently, the parent of American Water, RWE, has decided to sell American Water. Domestic energy companies have also invested in the water utility business, although presently many of those investments have or will be sold. Allele has sold its assets in Florida and North Carolina; Indianapolis Water Company was sold by NISource; Suez Lyonnaise des Eaux purchased the remaining shares of United Water Resource that it did not already own; and Thames Water purchased E’Town Corporation. (Sources: *Value Line Investment Survey*, January 30, 2004 and January 27, 2006, *The Business Journal* and company web sites)

²⁴ *Value Line Investment Survey* (January 27, 2006) expects infrastructure investments to run into hundreds of millions of dollars during the next decade or two.

1 growth expectations, *because no such objective data now exist*. DCF for firms or industries
2 in flux is *inherently* subjective with regard to the most important parameter, the long-run
3 growth rate, that drives the answer.

4 In short, the unavoidable questions about the DCF model's strong assumptions cause
5 me to view the DCF method as *inherently* less reliable than the risk positioning approach
6 described above. This is particularly true because of the data problems discussed above.
7 However, because the DCF method has been widely used in the past, I submit DCF evidence
8 in this case. DCF estimates also serve as a check on the values provided by the risk
9 positioning methods.

10 In this proceeding, I give little weight to the DCF results. However, I use the results
11 as a check on the reasonableness of my risk positioning estimates.

12 C. THE SAMPLES AND RESULTS

13 1. The Water Utility Sample

14 **Q56. Earlier you said that the sample of water utilities had serious data weaknesses. Please**
15 **elaborate on these weaknesses.**

16 A56. In attempting to apply the DCF model to the sample, two companies had no long-term
17 growth forecasts from *IBES* and among the remaining six companies, two had no *Value Line*
18 growth forecasts. The lack of data means that the discounted cash flow model only can be
19 applied to six companies. A similar lack of data exists when looking at the companies' bond

1 ratings. For two of the eight companies, neither a Moody's nor a Standard and Poor's
2 ("S&P") bond rating was found.²⁵

3 The size of the companies in the water sample also makes cost of capital estimation
4 difficult. Currently, only four companies have more than \$500 million in market value of
5 equity. More important, however, is the fact that the stock of these companies trades
6 relatively infrequently. For example, two of the eight water utilities traded less than 5
7 million shares in 2005 and only four companies traded in excess of 10 million shares in
8 2005.²⁶ This compares to an average annual trading volume of about 31 million shares for
9 companies in the gas LDC sample.²⁷ Low trading volume causes concern because there may
10 be a delay between the release of important information and the time that this information
11 is reflected in prices. Such delay is well known to cause beta estimates to be statistically
12 insignificant and possibly biased.

13 In addition to lack of data and the small size of the companies, there are firm-specific
14 events that render the water utility sample less reliable than would be ideal. First, Aqua

²⁵ For two of the six companies with a Moody's or Standard and Poor's bond rating, the bond rating was only found for some years during the most recent 5-year period. The rating for periods for which no bond rating was found was set equal to the rating for later periods. For companies without a bond rating, an A-rating is used in the analysis. The A-rating is consistent with the average for companies listed as water utilities in *Value Line* and followed by either Moody's or Standard and Poor's. Bond ratings were obtained from Compustat, www.standardandpoors.com, www.moodys.com, Mergent Bond Record, and S&P's Bond Rating books.

²⁶ Connecticut Water SVC Inc and York Water Co traded less than 5 million shares. American States Water Co, California Water Services GP, Aqua America Inc, and Southwest Water Co traded in excess of 10 million shares in 2005.

²⁷ Only Cascade Natural Gas has relative low trading volume at about 9 million shares in 2005.

1 America (the largest of the companies) has gone through several mergers and acquisitions
2 in recent years. Normally, I would not include companies with significant merger or
3 acquisition activity in a sample because the individual information about the progress of the
4 proposed merger is so much more important for the determination of the company's stock
5 price than day-to-day market fluctuations. In practice, beta estimates for such companies
6 tend to be too low. The growth rates for such companies may also be affected. Second,
7 Southwest Water Co. earns only approximately 40 percent of its revenue from regulated
8 activities. I therefore also report my results for the subsample of companies that do not
9 include Southwest Water Co.

10 It is because of these weaknesses in the water sample that I also utilize a sample of
11 natural gas LDCs. The selection procedure for this sample was summarized earlier and
12 details are provided in Appendix B.

13 2. Risk Positioning Cost of Capital Estimates

14 **Q57. How is your testimony on the risk positioning approach cost of capital estimates**
15 **organized?**

16 A57. This section first describes the input data used in the CAPM and ECAPM models, then
17 reports the resulting cost of equity estimates for the samples. The second section of
18 Appendix B details the empirical analysis.

1 **a. Interest Rate Forecasts**

2 **Q58. How did you determine the expected risk-free interest rate?**

3 A58. I reviewed current constant maturity U.S. Government bond yield data available from the
4 St. Louis Federal Reserve Bank. For the period April 4 to April 25, 2006, the average yield
5 on 30-day Treasury bills was 4.60 percent and the average yield on long-term government
6 bonds was 5.21 percent.²⁸ As discussed above, risk-free interest rates have increased by
7 almost 50 basis points since the beginning of the year and the Federal Reserve (“Fed”)
8 recently raised the federal funds rate to 5 percent. The press releases associated with the
9 increase, the Fed suggested that “further policy firming may yet be needed to address
10 inflation risks ...”²⁹ Thus, interest rates are, if anything, likely to increase.

11 **b. Betas and the Market Risk Premium**

12 **Q59. What beta estimates did you use in your analysis for the samples?**

13 A59. I rely upon the most recent betas estimated by *Value Line* for both the water sample and for
14 the gas LDC sample.

²⁸ See Workpaper #2 to Table No. BV-9.

²⁹ Federal Reserve Board, Press Release, May 10, 2006.

1 **Q60. Are the beta values reported by *Value Line* adjusted betas?**

2 A60. Yes. *Value Line* reports betas that are adjusted about 1/3 towards one. For this proceeding,
3 I reverse the *Value Line* adjustment. *Value Line* and many investment firms adjust the
4 estimated betas. This type of adjustment is intended to compensate for sampling errors in
5 the beta estimation, not for the empirical fact that the CAPM tends to overestimate the
6 sensitivity of the cost of capital to beta. I use adjusted betas when the sample companies
7 display statistically significant sensitivity to interest rate changes. Neither of the two
8 samples in this proceeding display such sensitivity at this time, so I reverse the adjustment
9 process to get “unadjusted” beta values. There are, however, evidence that betas are
10 increasing in the utility industry and not least in the water industry. I discuss this in
11 *Appendix B*, Section II.B.

12 **Q61. Please summarize the beta estimates you rely on.**

13 A61. After reversing the *Value Line* adjustment procedure, the average estimated *Value Line* beta
14 for the water sample is about .53 while the average for the gas LDC sample is about .63.
15 These beta estimates are reported in Workpaper #1 to Tables No. BV-9 and BV-19. During
16 the last few years betas estimates for both water utilities and gas LDC’s have increased
17 significantly indicating that the industry’s risk is increasing. As additional evidence that
18 betas are increasing and that the unadjusted *Value Line* betas likely underestimate the
19 industry’s risk going forward, I estimated 52-week betas for both samples. For both sample,
20 current 52-week betas are higher than are *Value Line* betas and both samples show an

1 increase in betas during the past few years. Graphs depicting the development in 52-week
2 betas are included in Appendix B.

3 **Q62. What value do you use for the market risk premium?**

4 A62. For the premium over the short-term risk-free interest rate I use 8.0 percent, while for the
5 premium over the long-term risk-free interest rate I use 6.5 percent, for the reasons discussed
6 before and in Appendix B.

7 **Q63. Please explain the method to adjust for differences in capital structure.**

8 A63. Starting with the ATWACC, the cost of equity for any capital structure within a broad range
9 of capital structures can be determined by the following formula:

10 Return on equity = $\frac{\text{ATWACC} - \text{Return on debt} \times \% \text{ debt in capital structure} \times (1 - \text{tax rate})}{\% \text{ equity in capital structure}}$
11

12 This is the calculation that is displayed in Tables No. BV-11 and BV-21. The tables display
13 the result of converting the sample average ATWACC to a return on equity for a specific
14 capital structure. It is straightforward to determine the cost of equity consistent with capital
15 structure utilizing this method.

1 **c. Risk Positioning Results**

2 **Q64. What are the cost of equity estimates derived from the risk positioning approach for**
3 **the water sample?**

4 A64. Using the long-term interest rate in the two risk positioning models (CAPM and ECAPM),
5 with two values of the ECAPM parameter (0.5% and 1.5%), I obtain three estimates of each
6 sample company's cost of equity (Tables No. BV-9 and BV-19). The cost of equity
7 estimates are combined with the estimates of the company's cost of debt and preferred to
8 calculate the company's ATWACC (Tables No. BV-10 and BV-20). Tables No. BV-11 and
9 BV-21 combines the sample average ATWACC with Sun City's capital structure, cost of
10 debt, and tax rate to obtain the cost of equity at Sun City's 40 percent equity. Panel A shows
11 the cost of equity and ATWACC value for all water sample companies, while Panel B shows
12 the results for the subsample of companies with significant revenue from regulated water
13 utility activities. The cost of equity results are shown below in Table 2 below. Comparable
14 ATWACC results are in Table B-2 at the end of Appendix B.

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Table 2: Panel A		
Risk Positioning Cost of Equity for All Companies in the Water Utility and Gas LDC Samples		
Using Long-Term Risk-Free Rate	Water Utility	Gas LDC
CAPM	12.2%	12.0%
ECAPM ($\alpha = 0.5\%$)	12.6%	12.3%
ECAPM ($\alpha = 1.5\%$)	13.4%	12.9%

Source: Tables No. BV-11 and BV-21, Panel A.

Table 2: Panel B		
Risk Positioning Cost of Equity for Companies with a High Percentage Regulated Revenue in the Water Utility and Gas LDC Samples		
Using Long-Term Risk-Free Rate	Water Utility	Gas LDC
CAPM	12.2%	11.3%
ECAPM ($\alpha = 0.5\%$)	12.6%	11.5%
ECAPM ($\alpha = 1.5\%$)	13.4%	12.0%

Source: Table No. BV-11 and BV-21, Panel B.

Using the short-term interest rate in the two risk positioning models (CAPM and ECAPM) and using different values for the ECAPM parameter, α , I obtain four estimates

1 of each sample companies' cost of equity. These estimates are also displayed in Tables No.
2 BV-11 and BV-21. As for the long-term interest rate, I summarize the cost of equity results
3 below in Table 3. ATWACC results are displayed in Table B-2 in Appendix B.

4 **Table 3: Panel A**
5
6 **Risk Positioning Cost of Equity**
7 **for All Companies**
8 **in the Water Utility and Gas LDC Samples**

9 Using Short-Term Risk-Free Rate	Water Utility	Gas LDC
10 CAPM	12.5%	12.5%
11 ECAPM ($\alpha = 1\%$)	13.3%	13.1%
12 ECAPM ($\alpha = 2\%$)	14.1%	13.6%
13 ECAPM ($\alpha = 3\%$)	14.9%	14.1%

14 Source: Tables No. BV-11 and BV-21, Panel A.

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Table 3: Panel B		
Risk Positioning Cost of Equity for Companies with a High Percentage Regulated Revenue in the Water Utility and Gas LDC Samples		
Using Short-Term Risk-Free Rate	Water Utility	Gas LDC
CAPM	12.5%	11.7%
ECAPM ($\alpha = 1\%$)	13.3%	12.2%
ECAPM ($\alpha = 2\%$)	14.1%	12.7%
ECAPM ($\alpha = 3\%$)	14.9%	13.2%

Source: Table No. BV-11 and BV-21, Panel B.

Q65. Please summarize your findings from the risk positioning model.

A65. Focusing on the middle ECAPM ($\alpha = .50\%$ for the long-term model) and $\alpha = 1\%$ for the short-term model), I find that the water sample's cost of equity of about $12\frac{1}{2}$ percent for the long-term model and about $13\frac{1}{4}$ percent for the short-term model. However, it is more correct to say that the sample results indicate a range of values from about 12 to 13 percent for the long-term model and a range of $12\frac{3}{4}$ to $13\frac{3}{4}$ percent using the short-term model. Looking at the gas LDC sample, the full sample and the subsample display some differences with the subsample's cost of equity estimates being 50 to 75 basis points lower than the estimates for the full sample. Reviewing the middle ECAPM estimates for the full sample the point estimate is about $12\frac{1}{4}$ percent while the point estimate for the subsample is about $11\frac{1}{2}$ percent. Thus, the range for the gas LDC sample is $11\frac{1}{4}$ to $12\frac{1}{2}$ percent. As for the

1 water utility sample, the short-term risk positioning estimates are consistently higher. The
2 gas LDC subsample's results are largely driven by one company (Southwest Gas). Because
3 short-term interest rates have been in significant flux in the past year, I assign the most
4 weight to the long-term model and therefore conclude that the risk-positioning model
5 provides cost of equity estimates in the range of 11¼ to 12¾ percent with a midpoint
6 between 11¾ and 12 percent for the gas LDC sample while the water utility sample
7 estimates are higher and have a midpoint at about 12½ percent. The results from the short-
8 term risk positioning model are consistently higher. I discuss the assessment of Sun City's
9 cost of equity in the concluding section.

10 3. The DCF Cost of Capital Estimates

11 Q66. What steps do you take in your DCF analyses?

12 A66. Given the above discussion of DCF principles, the steps are to collect the data, estimate the
13 sample companies' costs of equity at their current capital structures, and then to adjust the
14 sample's estimates to Sun City's 40 percent equity ratio.

15 a. Growth Rates

16 Q67. What growth rate information do you use?

17 A67. For reasons discussed above and in Appendix C, historical growth rates today are not as
18 relevant as forecasted of current investor expectations for these samples. I therefore use
19 rates forecast by security analysts.

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

11 Accordingly, the first step in my DCF analysis is to examine a sample of investment
12 analysts' forecasted earnings growth rates from *IBES* and *Value Line* to the degree such
13 forecasts are available. The details are in Appendix C. At present, *Value Line* data run
14 through a 2008-2010 horizon for the water utility companies and through a 2009-2011
15 horizon for the gas LDC companies. This represents an average of about four years for the
16 water utility sample and an average of about five years for the gas LDC sample (from Q1
17 2006 to Q4 2009 and 2010, respectively). *IBES* also provides a long-term earnings growth
18 rate estimates. The longest-horizon forecasted growth rates from these sources underlie the
19 simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF
20 formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only

1 go out four to five years, which is too short a period to make the DCF model completely
2 reliable.

3 **b. Dividend and Price Inputs**

4 **Q68. What values do you use for dividends and stock prices?**

5 A68. Dividends are for the 4th quarter of 2005, the most recent dividend information available at
6 the time of estimation.³⁰ This dividend is grown at the estimated growth rate and divided by
7 the price described below to estimate the dividend yield for the simple DCF model.

8 Stock prices are an average of closing stock prices for the 15-day trading period
9 ending on the day the *IBES* forecast is released. A 15-day stock price average is used to
10 guard against anomalous price changes in any single day.

11 **c. DCF Results**

12 **Q69. What are the DCF estimates for the samples?**

13 A69. The data are used in the two versions of the DCF method to get sample company estimates
14 at the sample company's capital structure. The resulting cost of equity at Sun City's 40
15 percent equity capital structure are shown in Table 4 below. The simple DCF model's cost
16 of equity estimates are higher on than the risk positioning approach results. However, the
17 multi-stage DCF's cost of equity estimates are a bit lower than the comparable risk
18 positioning estimates for the water utility sample at about 11¾ percent. The multi-stage

³⁰ The 4th quarter 2005 dividend information was obtained from Compustat.

1 DCF estimates for the gas LDC sample are comparable to the risk positioning estimates for
2 the full sample and a bit higher than the risk positioning estimates for the subsample.
3 Corresponding ATWACC figures are shown in Appendix B.

4 **Table 4: Panel A**
5 **Discounted Cash Flow Cost of Equity Estimates**
6 **for All Companies**
7 **in the Water Utility and Gas LDC Samples**

	Water Utility	Gas LDC
8 Simple DCF Method (Quarterly)	16.8%	13.4%
9 Multi-Stage DCF Using the Long-Term GDP 10 Forecast as the Perpetual Rate	11.7%	13.1%

11 Source: Tables No. BV-8 and BV-18.

12 **Table 4: Panel B**
13 **Discounted Cash Flow After-Tax Weighted-Average Cost of Capital Estimates**
14 **for Companies with a High Percentage Regulated Revenue**
15 **in the Water Utility and Gas LDC Samples**

	Water Utility	Gas LDC
16 Simple DCF Method (Quarterly)	17.3%	13.2%
17 Multi-Stage DCF Using the Long-Term GDP 18 Forecast as the Perpetual Rate	11.8%	12.2%

19 Source: Tables No. BV-8 and BV-18.

20 **Q70. Please summarize your findings from the DCF model.**

1 A70. The results from the multi-stage DCF model are in line with the results from the risk
2 positioning model whereas the simple DCF provides uniformly higher cost of equity
3 estimates. The cost of equity estimates from the multi-stage DCF model is in the range of
4 11½ to 12 percent for the water utility sample and in the range of 12 to 13 percent for the gas
5 LDC sample. As noted for the risk positioning model, there is a fairly large difference
6 between the full sample and the subsample estimates for the gas LDC sample. While growth
7 rates in both the water utility and the gas LDC industry have increased in recent months, the
8 GDP growth forecast from Blue Chip have decreased slightly.³¹ While I do not believe the
9 DCF results are fully reliable at this time for these industries, I view the estimates as a
10 confirmation that (1) the gas LDC sample provides more stable results than do the water
11 utility sample and (2) the risk positioning results are reasonable.

12 **V. SUN CITY'S COST OF EQUITY**

13 **Q71. What conclusions do you draw from the above data regarding each sample's cost of**
14 **equity at Sun City's 40 percent equity ratio?**

15 A71. The estimated costs of equity from the risk positioning model and from the multi-stage DCF
16 model are reasonably in line whereas the cost of equity estimates from the simple DCF
17 model are substantially higher. The simple DCF model that relies on company-specific

³¹ Blue Chip forecasted a long-term GDP growth of 5.5 percent in October 2005, but decreased this forecast to 5.2 percent in March 2006. At the same time *IBES* analysts increased the average growth rate for water utilities from 6.6 percent to 6.8 percent from October 2005 to March 2006. *Value Line* also increased its five-year growth forecasts for the water utility industry.

1 growth rate forecasts vary significantly among companies and are less reliable because the
2 long-run growth rate forecast drives the results, and there are *no* objective data on the long-
3 run growth rate investors truly expect, *nor* on when the industry is expected to settle down
4 into some sort of stable-growth equilibrium.

5 Although I do not rely upon the DCF model results for the water sample, I believe
6 that DCF cost of capital estimates provide a useful check on the risk positioning results for
7 the gas LDC sample. The consistency of the multi-stage DCF and the risk-positioning cost
8 of equity estimates for (especially the full) gas LDC sample indicate that those estimates are
9 reasonable.

10 **Q72. Do you have any comments regarding the results of the risk positioning models?**

11 A72. Yes. The relative risk measure, beta, used in the models is derived from 260 weeks (5 years)
12 of historical data. Ordinarily, using historical data to estimate beta is not a serious problem
13 because the overall business risk of an industry probably does not change rapidly. For an
14 industry undergoing major changes, however, the beta estimates based upon the historical
15 data may not capture the full changes in risk in the industry. This is true even though
16 information on the probability and provisions of industry changes have been available some
17 months ago. However, as explained in Appendix B, such “decoupling” of beta from the
18 market appears to be a common feature of industries undergoing structural changes. This
19 factor also suggests that the risk positioning estimates may be downward biased and is
20 consistent with the information from the DCF models.

1 **Q73. Given your view of the current value of the DCF method for this industry, what**
2 **conclusions do you draw from the risk positioning results?**

3 A73. The risk positioning results are summarized above in Tables 2 and 3. Of those results, the
4 CAPM values deserve the least weight, because this method does not adjust for the empirical
5 finding that the cost of capital is less sensitive to beta than predicted by the CAPM (which
6 my testimony considers by using the ECAPM). Conversely, the ECAPM numbers deserve
7 the most weight, because this method adjusts for the empirical findings. Using the long-term
8 model, the cost of equity estimates at a 40 percent equity thickness range from 12.2 to 13.4
9 percent for the water sample and subsample and from 11.3 to 12.9 percent for the gas LDC
10 sample and subsample.

11 Focusing on the middle ECAPM ($\alpha = .50\%$ for the long-term model and $\alpha = 1\%$ for
12 the short-term model), I find that the cost of equity estimates for the water sample are 12.6
13 and 13.3 percent for the long-term and short-term estimate, respectively. For the gas LDC
14 sample's the estimates from the full sample and the subsample differ. Focusing on the full
15 sample, the cost of equity estimates are 12.3 and 13.1 percent for the long-term and short-
16 term estimate, respectively. For the gas LDC subsample, the cost of equity estimates are
17 lower at 11.5 and 12.2 percent for the long-term and the short-term estimate, respectively.
18 However, it is more correct to say that the estimates fall in a range. Focusing on the long-
19 term estimates, a reasonable range is 12 to 13 percent for the water utility sample and $11\frac{1}{4}$
20 to $12\frac{1}{2}$ percent for the gas LDC sample. The midpoint of the corresponding ATWACC is

1 between 7 and 7¼ percent for the water utility sample. The range of reasonable estimates
2 is wider for the gas LDC sample which span 6¾ to 7¼ percent. Because the water sample
3 and water subsample have identical estimates while the gas LDC subsample has significantly
4 lower cost of equity estimates than do the full gas LDC sample, it is difficult to draw a
5 conclusion regarding the impact of having a higher percentage of regulatory revenues. This
6 is particularly so because the results from the gas LDC subsample are driven by one
7 company, Southwest Gas.

8 Based upon the evidence, the midpoint estimates for the cost of equity for the water
9 sample is above 12 percent while the point estimate for the gas LDC sample is between 11¾
10 and 12 percent. However, it is more accurate to say that the cost of equity range is best
11 approximated by a range of 11¼ to 12¾ percent. However, I observe that no risk positioning
12 estimate is below 11.3 percent and most estimates are a bit above 12 percent. Therefore, the
13 best point estimate is in the range of 11¾ to 12 percent which is consistent with the multi-
14 stage DCF cost of equity estimates for the water utility sample and a bit below the
15 comparable cost of equity estimates for the gas LDC sample.

16 As previously noted, in estimating the cost of equity I round to the nearest ¼ percent
17 (25 basis points) because I do not believe that cost of capital estimates can be made more
18 precisely than that. In this case I use a broader range than usual because the estimates fall in
19 a fairly broad range.

1 **Q74. Did you consider any other evidence when assessing the reasonableness of Sun City's**
2 **requested 11.75 percent return on equity?**

3 A74. Yes. I reviewed recent water utility decisions from the Arizona Corporation Commission
4 and compared the rates of return on equity and the capital structures to Sun City's regulatory
5 capital structure.

6 **Q75. Please explain this procedure.**

7 A75. I obtained data on ten recent Arizona decisions on water and wastewater utilities from the
8 Company. This data is summarized in Table 5 below.

Table 5
Capital Structure and Allowed Rate of Return on Equity
in Recent Arizona Water Decisions

	Decision	Date	Common Equity	Allowed Rate of Return
Arizona Water Company	66849	03/2004	66.2%	9.2%
Rio Rico Utilities	67279	10/2004	100.0%	8.7%
Las Quintas Serenas Water Co	67455	01/2005	100.0%	8.1%
Arizona Water Company	68302	11/2005	73.4%	9.1%
Clearwater Utilities	66782	02/2004	100.0%	9.1%
Arizona-American Water	67093	06/2004	39.9%	9.0%
Chaparral City Water	68176	09/2005	58.8%	9.3%
Forest Highlands	67983	07/2005	100.0%	8.1%
Pineview Water	67989	07/2005	51.0%	8.9%
Average			75.7%	8.8%
Average*			63.5%	9.1%

Source: Arizona-American Water.

* Excludes companies with 100 percent equity and Arizona-American Water.

Sun City's requested target regulatory capital structure consists of 40 percent equity which is significantly lower than that of all but one company in the table. Therefore, Sun City's equity has more financial risk than most of the companies listed in Table 5. Consequently, the allowed return on equity for Sun City needs to be higher. To determine exactly how much higher, I calculate the ATWACC that corresponds to the capital structures and cost of equity in Table 5 using Sun City's current cost of debt and tax rate. I then determine the cost

of equity that correspond to the calculated ATWACC at Sun City’s 40 percent equity.³² The result of this calculation is shown in Table 6 below.

Table 6
Rate of Return on Equity that Provides the Same Cost to Customers at Sun City’s 40% Equity Ratio as Allowed in Recent Arizona Water Decisions

Decision	Date	Common Equity	Allowed Rate of Return on Equity	Implied ATWACC	Implied Rate of Return at 40% Equity
66849	03/2004	66.2%	9.2%	7.2%	12.7%
67279	10/2004	100.0%	8.7%	8.7%	16.4%
67455	01/2005	100.0%	8.1%	8.1%	14.9%
68302	11/2005	73.4%	9.1%	7.6%	13.9%
66782	02/2004	100.0%	9.1%	9.1%	17.4%
67093	06/2004	39.9%	9.0%	5.7%	9.0%
68176	09/2005	58.8%	9.3%	6.9%	12.0%
67983	07/2005	100.0%	8.1%	8.1%	14.9%
67989	07/2005	51.0%	8.9%	6.3%	10.4%
Average		75.7%	8.9%	7.5%	13.5%
Average*		63.5%	9.1%	7.0%	12.2%

Sources: Columns 1 through 4: Arizona American. Column 5 was calculated using Sun City’s current cost of debt and tax rate. Column 6 was calculated using the ATWACC in Column 5 and Sun City’s regulatory capital structure, cost of debt, and tax rate.

*) Excludes companies with 100 percent equity and Decision 67093.

³² In performing this calculation, I assume that the rate base equals net book value. I understand that this is not true in Arizona but believe rates are calculated in a manner that produces similar results.

1 **Q76. What are the implications of Table 6?**

2 A76. Ignoring companies with no debt and Arizona-American Water, the average rate of return
3 on equity was 12.2 percent when measured at 40 percent equity. Therefore, if the
4 Commission believes that Sun City's overall business risk is similar to that of the companies
5 in Table 5, then Sun City's cost of equity is 12.2 percent.³³

6 **Q77. Based on the evidence what is your conclusion regarding Sun City's request for a 11.75**
7 **percent return on equity?**

8 A77. Based on the results from my cost of capital estimation procedures which are confirmed by
9 recent Arizona decisions on water utilities' cost of equity, I conclude that an 11.75 percent
10 return on equity is reasonable at 40 percent equity.

11 **Q78. Does this conclude your testimony?**

12 A78. Yes.

³³ I exclude companies with extreme capital structures from this analysis as I believe the ATWACC is flat only within a broad range of non-extreme capital structures. At extreme levels of debt or equity the ATWACC may be increasing/decreasing in the level of debt. I exclude Arizona-American to avoid comparing Sun City to its parent.

APPENDIX A: QUALIFICATIONS OF BENTE VILLADSEN

Bente Villadsen's work concentrates in the areas of finance and accounting. Her work has included analyses of the cost of capital, cost-of-service rate making, credit issues in the electric industry, valuations of power contracts, accounting disclosure, accounting principles, mark-to-market accounting, gain-of-sale accounting, and accounting for hybrid securities. Her recent work has included rate-regulated companies' allowed rates of return in the U.S. and Canada as well as mark-to-market valuation in the electric industry, a contract dispute in the petroleum industry and matters related to income tax disputes.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management. 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 and at Washington University in St. Louis. Dr. Villadsen also worked as a consultant for Risø National Laboratories in Denmark.

REPRESENTATIVE EXPERIENCE

Energy and Public Utility Finance

- Dr. Villadsen has filed testimony on cost of capital for regulated water utilities and has significant experience in estimating the cost of capital for U.S. and Canadian utilities and pipelines. The work has been used in connection with the companies' rate hearings for the Federal Energy Regulatory Commission, the Canadian National Energy Board, state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, and water utilities.

- For a large integrated utility in the U.S., Dr. Villadsen participated in all aspects of the company's rate filing; emphasizing the company's cost of capital, incentive based rates, and certain regulatory accounting issues.
- She was part of a team evaluating the capital structure and cost of capital for a Canadian crown corporation.
- Bente Villadsen is currently involved in the valuation of long-term power contracts in the electric industry and in evaluating the impact of assumptions and models on financial information.
- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluated 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 flow 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).
- Dr. Villadsen is evaluating the appropriate regulatory framework and rates a utility should be able to charge for providing access to its facilities to outside companies.

Accounting and Corporate Finance

- Dr. Villadsen filed testimony and rebuttal testimony in an arbitration proceeding between two major oil companies involved in a contract dispute. The testimony pertained to the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities.
- Currently, she is working on two 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 and the application of accounting principles.
- Dr. Villadsen 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 and the accounting treatment of security sales.
- She 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 has modeled the cash flow of several companies to estimate the impact of specific (energy) contracts or to determine the impact of specific loans and to assess the companies' viability going forward.
- 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 cost 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.

PUBLICATIONS

"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), published by the Edison Electric Institute (dated January 2005, issued April 2005).

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

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

PRESENTATIONS

"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, 2000.

“Computational Methods and Theoretical Accounting Research,” Big 10 Doctoral Consortium, 1999.

TESTIMONY

Direct Testimony before the Arizona Corporation Commission on Cost of Capital for Anthem Water district and Anthem/Agua Fria Wastewater district, a subsidiary of Arizona-American Water Company, Docket No. WS-01303A-06-0403, June 2006.

Direct Testimony before the Arizona Corporation Commission on Cost of Capital for Mohave Water and Mohave Wastewater district, a subsidiary of Arizona-American Water Company, Docket No. WS-01303A-06-0014, January 2006.

Affidavit and rebuttal affidavit in an arbitration proceeding on behalf of a major oil company regarding the equity method of accounting and classification of debt and equity, August and November, 2004.

**APPENDIX B: EQUITY RISK PREMIUM APPROACH METHODOLOGY:
DETAILED PRINCIPLES AND RESULTS**

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
<u>I. THE EQUITY RISK PREMIUM APPROACH</u>	1
A. THE EQUITY RISK PREMIUM MODEL	1
B. MARKET RISK PREMIUM	3
C. RELATIVE RISK	11
D. INTEREST RATE FORECAST	15
E. COST OF CAPITAL MODELS	16
<u>II. EMPIRICAL EQUITY RISK PREMIUM RESULTS</u>	19
A. PRELIMINARY MATTERS	19
1. WATER UTILITY SAMPLE	19
2. GAS LOCAL DISTRIBUTION COMPANY SAMPLE	23
3. OTHER PRELIMINARY MATTERS	26
B. BETAS AND THE MARKET RISK PREMIUM	29
1. BETA ESTIMATION PROCEDURES	29
2. MARKET RISK PREMIUM ESTIMATION	32
D. COST OF CAPITAL ESTIMATES	32
Table No. B-1	B-35
Table No. B-2	B-37

1 **Q1. What is the purpose of this appendix?**

2 A1. The appendix reviews the principles underlying the risk premium methodology and discusses
3 the estimation of parameters. It also provides information on sample selection, input
4 parameters, and the resulting cost of capital estimates.

5 **I. THE EQUITY RISK PREMIUM APPROACH**

6 **Q2. How do you organize this section of the appendix?**

7 A2. First, the appendix reviews the basics of the equity risk premium approach. Second, it
8 discusses the individual components of the model: the risk premium, the relative risk of the
9 company or line of business in question, the appropriate choice of interest rate, and the
10 combination of these elements in a particular equity risk premium model. The appendix
11 also provides details on the choice of parameters in the ECAPM model and details the
12 ATWACC results obtained from the application of the risk positioning methodology.

13 **A. THE EQUITY RISK PREMIUM MODEL**

14 **Q3. Please describe the equity risk premium model.**

15 A3. The equity risk premium approach estimates the cost of equity as the sum of a current or
16 forecast interest rate and a risk premium. (The model is sometimes referred to as the “risk
17 premium” or the “risk positioning” approach.)

18 Formal applications of the equity risk premium method implement theoretical finance
19 models of cost of capital. Such models use information on securities to identify the security
20 market line (Figure 1 in the body of the testimony) and derive the cost of capital for an

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

4 **Q4. How are the “theoretical finance models” implemented?**

5 A4. The key parameters that determine the security market line are the risk-free interest rate, the
6 premium that a security of average risk commands over the risk-free rate, and a measure of
7 the relative risk of the security being examined. The premium that a security of average risk
8 commands over the risk-free rate is commonly referred to as the “market risk premium”
9 (“MRP”). It is measured as the excess of the expected return on the average common stock
10 over the risk-free interest rate. In the equity risk premium approach the risk-free interest rate
11 and MRP are common to all securities. The security-specific measure of relative risk (beta)
12 is estimated separately and combined with the MRP to obtain the company-specific risk
13 premium.

14 In principle, there may be more than one factor affecting the expected stock return,
15 each with its own security-specific measure of relative risk and its own benchmark risk
16 premium. For example, “multi-factor” models and the “arbitrage pricing theory” are
17 common in the academic literature. These models estimate the cost of capital as the sum of
18 a risk-free rate and several security-specific risk premiums. However, none of these
19 alternative models has emerged as “the” improvement to use instead of the original,
20 single-factor model. Therefore, I use the traditional single-factor model in this testimony.

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

5 **B. MARKET RISK PREMIUM**

6 **Q5. Why is a risk premium necessary?**

7 A5. Experience (*e.g.*, the U.S. market's October Crash of 1987) demonstrates that shareholders,
8 even well diversified shareholders, are exposed to enormous risks. By investing in stocks
9 instead of risk-free Government bills, investors subject themselves not only to the risk of
10 earning a return well below those they expected in any year but also to the risk that they
11 might lose much of their initial capital. This is why investors demand a risk premium.

12 In regulatory proceedings, both a long-term and a short-term version of the Capital
13 Asset Pricing Model (“CAPM”) are often reported. The first version measures the market
14 risk premium as the risk premium of average risk common stocks over the long-term risk-
15 free rate. The second version measures the risk premium relative to a short-term risk-free
16 rate, which is the usual measure of the “market risk premium” used in capital market
17 theories.

18 **Q6. How do you estimate the MRP?**

19 A6. There is presently little consensus on “best practice” for estimating the MRP. For example,
20 the latest edition of the leading graduate textbook in corporate finance, after recommending

1 use of the arithmetic average realized excess return on the market for many years (which for
2 a while was noticeably over 9 percent), now reviews the current state of the research and
3 expresses the view that the a range between 5 to 8 percent is reasonable for the U.S.¹
4 Ibbotson Associates show an average MRP of stocks over Treasury bills of 8.5 percent.

5 For the period 1926 to 2005, the longest period for which data are available, Ibbotson
6 Associates show an average MRP of stocks over Treasury bills of 8.5 percent,² but most of
7 the recent scholarly research on the MRP suggests that the expected MRP is below the
8 historically realized MRP.

9 I consider both the historical evidence and the results of scholarly studies of the
10 factors that affect the risk premium for average-risk stocks in order to estimate the
11 benchmark risk premium investors currently expect.

12 **Q7. Please summarize the recent literature on the MRP and the conclusions you draw from**
13 **it?**

14 A7. The new research challenges the conventional wisdom of using the arithmetic average
15 historical excess returns to estimate the MRP. However, after reviewing the issues in the
16 debate, I remain skeptical for several reasons that the market risk premium has declined
17 substantially in the U.S.

¹ Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 8th edition, 2005, pp. 151-154.

² Ibbotson Associates, *SBBI: Valuation Edition*, 2006 Yearbook.

1 First, despite eye-catching claims like “equity risk premium as low as three percent,”³
2 and “the death of the risk premium,”⁴ not all recent research arrives at the same conclusion.
3 In his presidential address to the American Finance Association in 2001, Professor
4 Constantinides seeks to estimate the unconditional equity premium based on average
5 historical stock returns.⁵ (Note that this address was based upon evidence just before the
6 major fall in market value.) He adjusts the average returns downward by the change in
7 price-earnings ratio because he assumes no change in valuations in an unconditional state.
8 His estimates for 1926 to 2000 and 1951 to 2000 are 8.0 percent and 6.0 percent,
9 respectively, over the 3-month T-bill rate. In another published study in 2001, Professors
10 Harris and Marston use the DCF method to estimate the market risk premium for the U.S.
11 stocks.⁶ Using analysts’ forecasts as a proxy for investors’ expectation, they conclude that
12 over the period 1982-1998 the MRP **over the long-term risk-free rate** is 7.14 percent. As
13 yet another example, a paper by Drs. Ibbotson and Chen (2003) adopts a supply side
14 approach to estimate the forward looking long-term sustainable equity returns and equity risk
15 premium based upon economic fundamentals. Their equity risk premium **over the long-**
16 **term risk-free rate** is estimated to be 3.97% in geometric terms and 5.90% on an arithmetic

³ 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.

⁴ Arnott, R. and R. Ryan, (2001), “The Death of the Risk Premium,” *Journal of Portfolio Management* 27(3):61-84.

⁵ Constantinides, G.M. (2002), “Rational Asset Prices,” *Journal of Finance* 57:1567-1591.

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

1 basis. They conclude their paper by stating that their estimate of the equity risk premium
2 is “far closer to the historical premium than being zero or negative.”⁷

3 Second, Professor Ivo Welch surveyed a large group of financial economists in 1998
4 and 1999. The average of the estimated MRP was 7.1 percent in Prof. Welch’s first survey⁸
5 and 6.7 percent in his second survey which was based on a smaller number of individuals.
6 However, a more recent survey by Prof. Welch reported only a 5.5 percent MRP.⁹ In
7 characterizing these results Prof. Welch notes that “[T]he equity premium consensus forecast
8 of finance and economics professors seems to have dropped during the last 2 to 3 years, a
9 period with low realized equity premia.”¹⁰

10 The above quotation from Prof. Welch emphasizes the caution that must attend
11 survey data even from knowledgeable survey participants: the outcome is likely to change
12 quickly with changing market circumstances. I do not believe that regulatory commissions
13 should attempt to keep pace with such rapidly changing opinions.

14 Third, some of the evidence for negative or close to zero market risk premium simply
15 does not make sense. Despite the relatively high valuation levels, stock returns remain much
16 more volatile than Treasury bond returns. I am not aware of any empirical or theoretical

⁷ Ibbotson, R. and P. Chen (2003), “Long-Run Stock Returns: Participating in the Real Economy,” *Financial Analysts Journal*, 59(1):88-98. Cited figures are on p. 97.

⁸ 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.

⁹ Ivo Welch (2001), “The Equity Premium Consensus Forecast Revisited,” School of Management at Yale University working paper. The cited figure is in Table 2.

¹⁰ *Ibid.*, p. 8.

1 evidence showing that investors would rationally hold equities and not expect to earn a
2 positive risk premium for bearing the risk.

3 Fourth, I am unaware of a convincing theory for why the future MRP should have
4 substantially declined. At the height of the stock market bubble in the U.S., many claimed
5 that the only way to justify the high stock prices would be if the MRP had declined
6 dramatically,¹¹ but this argument is heard less frequently now that the market has declined
7 substantially. All else equal, a high valuation ratio such as price-earnings ratio implies a low
8 required rate of return, hence a low MRP. However, there is considerable debate about
9 whether the high level of stock prices (despite the burst of the internet bubble in the last few
10 years) represents the transition to a new economy or is simply an “irrational exuberance,”
11 which cannot be sustained for the long term. If the former case is true, then the MRP may
12 have decreased permanently. Conversely, the long-run MRP may remain the same even if
13 expected market returns in the short-term are smaller.

14 Another common argument for a lower expected MRP is that the U.S. experienced
15 very remarkable growth in the 20th century that was not anticipated at the start of the
16 century. As a result, the average realized excess return is overestimated meaning the
17 standard method of estimating the MRP would be biased upward. However, one recent
18 study by Profs. Jorion and Goetzmann¹² finds, under some simplifying assumptions, that the

¹¹ See Robert D. Arnott and Peter L. Bernstein (2002), “What Risk Premium is ‘Normal’?”, *Financial Analysts Journal* 58:64-85, for an example.

¹² Jorion, P., and W. Goetzmann (1999), “Global Stock Markets in the Twentieth Century,” *Journal of Finance* 54:953-980.

1 so-called “survivorship bias” is only 29 basis points.¹³ Furthermore, “[I]f investors have
2 overestimated the equity premium over the second half of the last century, Constantinides
3 (2002) argues that ‘we now have a bigger puzzle on our hands’” Why have investors
4 systematically biased their estimates over such a long horizon?¹⁴

5 A number of recent studies that argue that the MRP is variable and depends on a
6 broad set of economic circumstances. For example, Mayfield (2004) estimates the MRP in
7 a model that explicitly accounts for investment opportunities. He models the process that
8 governs market volatility and finds that the MRP varies with investment opportunities which
9 are linked to market volatility. Thus, the MRP varies with investment opportunities and
10 about half of the measured MRP is related to the risk of future investment opportunities.
11 Based on this approach Mayfield estimates the U.S. MRP to be 5.6 percent when measured
12 since 1940.¹⁵

13 To sum up the above, I cite two passages from Profs. Mehra and Prescott’s review
14 of the theoretical literature on equity premium puzzle:¹⁶

15 Even if the conditional equity premium given current market conditions is
16 small, and there appears to be general consensus that it is, this in itself does
17 not imply that it was obvious either that the historical premium was too high
18 or that the equity premium has diminished.

¹³ Dimson, Marsh, and Staunton (2003), “Global Evidence on the Equity Risk Premium,” *Journal of Applied Corporate Finance* 15, pp. 27-38, 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.

¹⁴ 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

¹⁵ E. Scott Mayfield (2004), “Estimating the Market Risk Premium,” *Journal fo Financial Economics* 73, pp. 465-496.

¹⁶ Mehra and Prescott, *op cit* p. 926.

1 In the absence of this [knowledge of the future], and based on what we
2 currently know, we can make the following claim: over the long horizon the
3 equity premium is likely to be similar to what it has been in the past and the
4 returns to investment in equity will continue to substantially dominate that
5 in T-bills for investors with a long planning horizon.

6 **Q8. Is there other scholarly discussion of the value of the MRP?**

7 A8. Yes. Another line of research was pursued by Steven N. Kaplan and Richard S. Ruback.
8 They estimate the market risk premium in their article, “The Valuation of Cash Flow
9 Forecasts: An Empirical Analysis.”¹⁷ Professors Kaplan and Ruback compare published
10 cash flow forecasts for management buyouts and leveraged recapitalization over the 1983
11 to 1989 period against the actual market values that resulted from these transactions. One
12 of their results is an estimate of the market risk premium over the long-term Treasury bond
13 yield that is based on careful analysis of actual major investment decisions, not realized
14 market returns. Their median estimate is 7.78 percent and their mean estimate is 7.97
15 percent.¹⁸ This is considerably higher than my estimate of 6.5 percent. Even if the maturity
16 premium of Treasury bonds over Treasury bills were only 1 percent, well below the best
17 estimate of 1.5 percent the resulting estimate of the market risk premium over Treasury bills
18 is higher than my estimate of 8.0 percent.

¹⁷ *Journal of Finance*, 50, September 1995, pp. 1059-1093.

¹⁸ *Ibid*, p. 1082.

1 **Q9. Do you consider evidence other than the academic articles discussed above?**

2 A9. Yes. As noted above, Ibbotson Associates reports long-run realized equity premiums. For
3 the longest period available, from 1926 to 2005, Ibbotson Associates data show that the
4 average premium of stocks over Treasury bills is 8.5 percent. For the “post-War” period,
5 1947-2005,¹⁹ the market risk premium was 8.4 percent. I exclude 1946 from the period
6 because its economic statistics are heavily influenced by the War years.²⁰ From an economic
7 perspective it was not really a “post-War” year. The average premium of stocks over the
8 income returns on long-term Government bonds is 7.1 percent for the 1926 to 2005 period
9 and 7.0 percent for the 1947 to 2005 period.

10 **Q10. What is your conclusion regarding the MRP?**

11 A10. Historically, realized returns over the Treasury bill was the standard method to estimate the
12 MRP. However, the estimation of the MRP is currently controversial. There is no
13 consensus on its value nor even how to estimate it. Given all of the information, I estimate
14 the risk premium for average risk stocks to be 8.0 percent over Treasury bills and 6.5 percent
15 over long-term Government bonds.
16

¹⁹ Ibbotson Associates SBBI Valuation Edition 2005 Yearbook, Appendix A.

²⁰ During this period, the annual inflation reached 18 percent.

1 **C. RELATIVE RISK**

2 **Q11. How do you measure relative risk?**

3 A11. The risk measure I examine is the “beta” of the stocks in question. Beta is a measure of the
4 “systematic” risk of a stock — the extent to which a stock's value fluctuates more or less
5 than average when the market fluctuates. It is the most commonly used measure of risk in
6 capital markets theories.

7 **Q12. Please explain beta in more detail.**

8 A12. The basic idea behind beta is that risks that cannot be diversified away in large portfolios
9 matter more than those that can be eliminated by diversification. Beta is a measure of the
10 risks that *cannot* be eliminated by diversification.

11 Diversification is a vital concept in the study of risk and return. (Harry Markowitz
12 won a Nobel Prize for work showing just how important it was.) Over the long run, the rate
13 of return on the stock market has a very high standard deviation, on the order of 15-20
14 percent per year since 1926.²¹ However, many individual stocks have much higher standard
15 deviations than this. The stock market's standard deviation is “only” about 15-20 percent
16 because when stocks are combined into portfolios, some of the risk of individual stocks is
17 eliminated by diversification. Some stocks go up when others go down, and the average
18 portfolio return — positive or negative — is usually less extreme than that of individual
19 stocks within it.

²¹ This compares to a standard deviation of about 3 percent per year on Treasury bills (again since 1926).

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

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

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

18 **Q13. Why not?**

19 A13. Well-diversified investors compete away any premium rates of return for diversifiable risk.
20 Suppose a stock were priced especially low because it had especially high diversifiable risk.
21 Then it would seem to be a bargain to well diversified investors. For example, suppose an

1 industry is subject to active competition, so there is a large risk of loss of market share.
2 Investors who held a portfolio of all companies in the industry would be immune to this risk,
3 because the loss on one company's stock would be offset by a gain on another's stock. (Of
4 course, the competition might make the whole industry more vulnerable to the business
5 cycle, but the issue here is the diversifiable risk of shifts in market share among firms.)

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

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

16 **Q14. What does a particular value of beta signify?**

17 A14. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up
18 or down by 10 percent on average when the market goes up or down by 10 percent. Stocks
19 with betas below 1.0 moderate the swings in the market: stocks with betas of .75 tend to fall
20 only 7.5 percent when the market falls 10 percent. Stocks with betas above 1.0 are more
21 volatile than the market.

1 **Q15. How is beta measured?**

2 A15. The usual approach to calculating beta is a statistical comparison of the sensitivity of a
3 stock's (or a portfolio's) return to the market's return. Several investment services report or
4 sell beta estimates, including *Value Line Investment Survey*. Betas are not always calculated
5 the same way, and therefore must be used with a degree of caution. However, the basic point
6 that a high beta indicates a risky stock remains valid and has long been widely accepted by
7 both financial theorists and investment professionals.

8 **Q16. Are there circumstances when the “usual approach” should not be used?**

9 A16. There are at least two cases where the standard estimate of beta should be viewed
10 skeptically.

11 First, companies in serious financial distress seem to “decouple” from their normal
12 sensitivity to the stock market. The stock prices of financially distressed companies tend to
13 change based more on individual news about their particular circumstances than upon overall
14 market movements. Thus, a risky stock could have a low estimated beta if the company was
15 in financial distress.

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

20 Other circumstances that may cause a company's stock to decouple include an
21 industry restructuring or major changes in a company's supply or output markets.

1 **Q17. How reliable is beta as a risk measure?**

2 A17. Scholarly studies have long confirmed the importance of beta for a stock's required rate of
3 return. It is widely regarded as the best single risk measure available. The merits of beta as
4 a single measure of risk have been challenged by widely publicized work by Professors
5 Eugene F. Fama and Kenneth R. French.²² However, despite the early press reports of their
6 work as signifying that “beta is dead,” it turns out that beta is still a potentially important
7 explanatory factor (albeit one of several) in their work. Thus, beta remains alive and well
8 as the best single measure of relative risk.

9 **D. INTEREST RATE FORECAST**

10 **Q18. What interest rates do your procedures require?**

11 A18. Modern capital market theories of risk and return use the short-term risk-free rate of return
12 as the starting benchmark. My measures of the MRP incorporate this approach, since they
13 represent the excess of the expected return on the market over the 30-day U.S. Treasury bill
14 rate and over the long-term U.S. Government bond rate. Accordingly, implementation of
15 my procedures requires use of a forecast of the 30-day Treasury bill rate and the long-term
16 Government bond rate. As a proxy for a forecasted risk-free rate, I use the average over the
17 most recent 15 trading days ending April 25, 2006. The result is 4.60 percent for the short-
18 term risk-free rate and 5.21 percent for the long-term risk-free rate. Interest rates have
19 increased significantly in recent months and the Federal Reserve raised interest rates as

²² See for example, “The Capital Asset Pricing Model: Theory and Evidence,” Eugene F. Fama and Kenneth R. French, *Journal of Economic Perspectives* 18, Summer 2004, pp. 25-46..

1 recent as May 10, 2006. In the associated press release, the Federal reserve indicated that
2 “further policy firming may yet be needed to address inflation risks”.²³ In addition, the
3 public debt is at an all time high and the trade deficit is by historical standards very high.²⁴
4 Therefore, I believe interest rates are more likely to increase than to decrease going forward.
5 (See Workpaper #2 to Table No. BV-9 for interest rate details)

6 E. COST OF CAPITAL MODELS

7 **Q19. How do you combine the above components into an estimate of the cost of capital?**

8 A19. By far the most widely used approach to estimation of the cost of capital is the “Capital
9 Asset Pricing Model,” and I do calculate CAPM estimates. However, the CAPM is only one
10 equity risk premium approach technique, and I also use another.

11 **Q20. Please start with the CAPM, by describing the model.**

12 A20. As noted above, the modern models of capital market equilibrium express the cost of equity
13 as the sum of a risk-free rate and a risk premium. The CAPM is the longest-standing and
14 most widely used of these theories. The CAPM states that the cost of capital for investment
15 I (e.g., a particular common stock) is given by the following equation:

$$16 \quad k_i = r_f + \beta_i \times \text{MRP} \quad (\text{B-1})$$

17 where k_i is the cost of capital for investment I , r_f is the risk-free interest rate, β_i is relative
18 risk measure for investment I , and MRP is the market risk premium. The CAPM relies on

²³ Federal Reserve, Press Release, May 10, 2006.

²⁴ See <http://www.publicdebt.treas.gov/opd/opdhisto4.htm> and the U.S. Census Bureau.

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

7 **Q21. What other equity risk premium approach model do you use?**

8 A21. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity
9 of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted
10 by the CAPM and high-beta stocks tend to have lower risk premia than predicted. A number
11 of variations on the original CAPM theory have been proposed to explain this finding. The
12 difference between the CAPM and the type of relationship identified in the empirical studies
13 is depicted in Figure B-1.

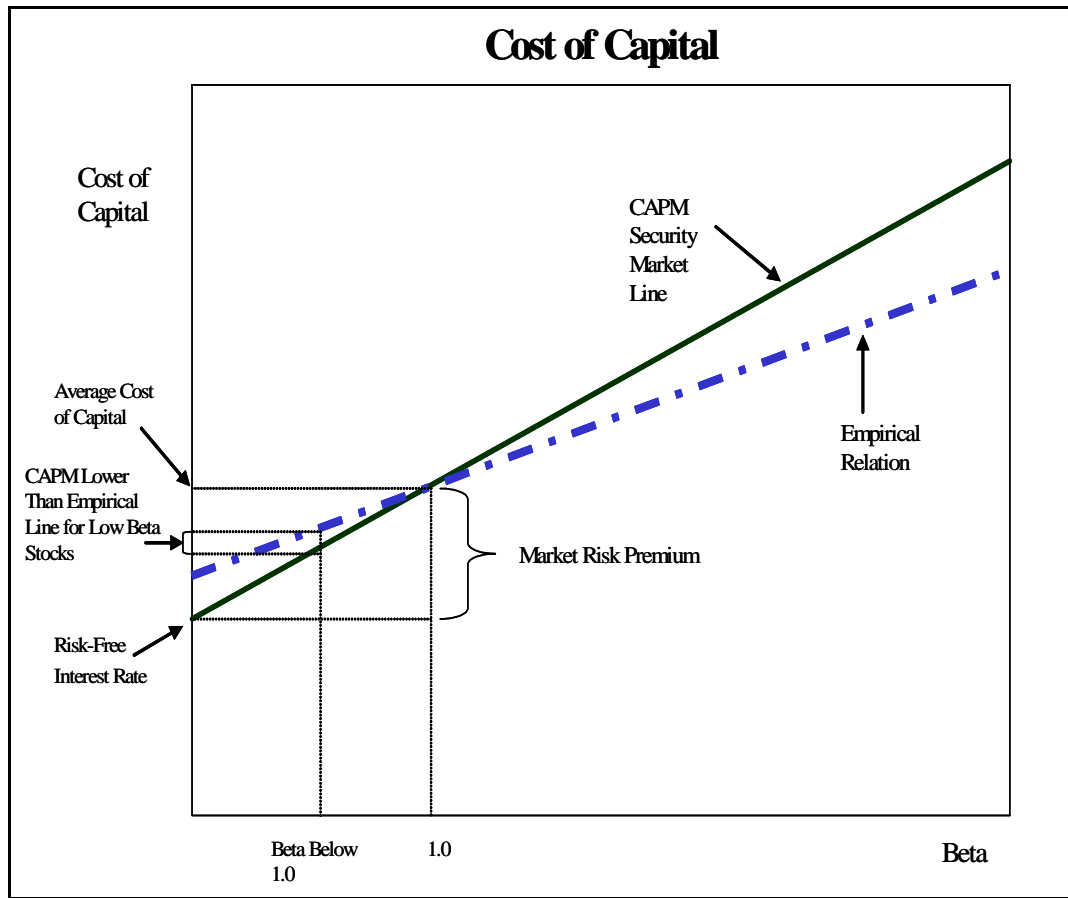


Figure B-1

1 The second model makes use of these empirical findings. It estimates the cost of capital
 2 using the equation

$$3 \quad k_i = r_f + \alpha + \beta_i \times (MRP - \alpha) \quad (B-2)$$

4 where as before, k_i is the cost of capital for investment I , r_f is the risk-free interest rate, α is
 5 the empirical adjustment factor, β_i is the measure of relative risk, and MRP is the market risk
 6 premium. I refer to the model in (B-2) as the Empirical CAPM or ECAPM.

7 Research supports values for α of from one to seven percent when using a short-term
 8 interest rate. I set alpha (α) equal to 1, 2, and 3 percent which are values somewhat lower

1 than that estimated empirically. For the long-term risk-free rate models, I set alpha equal
2 to both 0.5 percent and 1.5 percent, but I rely more heavily on the 0.5 percent results. The
3 use of a long-term risk-free rate incorporates some of the desired effect of using the ECAPM.
4 That is, the long-term risk-free rate version of the Security Market Line has a higher
5 intercept and a flatter slope than the short-term risk-free version which has been tested.
6 Thus, it is likely that a lesser adjustment is needed for the long-term risk-free rate than for
7 the short-term risk-free rate. A summary of the empirical evidence on the magnitude of
8 alpha is provided in Table B-1 at the end of this appendix.

9 **II. EMPIRICAL EQUITY RISK PREMIUM RESULTS**

10 **Q22. How is this part of the appendix organized?**

11 A22. This section presents the full details of my equity risk premium approach analyses, which
12 are summarized in the body of my testimony. This section discusses the sample selection
13 process, calculation of the market value capital structures, and the forecasts of the short-term
14 and the long-term risk-free interest rates. Next, it addresses the beta estimates, and the
15 estimates of the MRP used. Finally, it reports the CAPM and ECAPM results for the
16 samples' After-Tax Weighted-Average Cost of Capital (ATWACC), and describes the results
17 of adjusting for differences between the samples' and Sun City's capital structures.

18 **A. PRELIMINARY MATTERS**

19 **1. WATER UTILITY SAMPLE**

20 **Q23. How do you select your water utility sample companies?**

1 A23. The overall cost of capital for a part of a company depends on the risk of the business in
2 which the *part* is engaged, *not* on the overall risk of the parent company on a consolidated
3 basis. According to financial theory, the overall risk of a diversified company equals the
4 market value weighted-average of the risks of its components.

5 Estimating the cost of capital for Sun City’s regulated assets is the subject of this
6 proceeding. The ideal sample would be a number of companies that are publicly traded
7 “pure plays” in the water production, storage, treatment, transmission, distribution or waste
8 water line of business. “Pure play” is an investment term referring to companies with
9 operations only in one line of business. Publicly traded firms, firms whose shares are freely
10 traded on stock exchanges, are ideal because the best way to infer the cost of capital is to
11 examine evidence from capital markets on companies in the given line of business.

12 To construct a sample of comparable companies, I started with the universe of
13 companies classified as water utility companies in *Value Line*.²⁵ Normally, I would apply
14 several selection criteria to eliminate companies with unique circumstances that may affect
15 the cost of capital estimates. For example, in most industries, I would eliminate companies
16 with low annual revenues, no or non-investment grade bond ratings, lack of *IBES* or
17 Compustat data, all companies with announced dividend cuts, and companies involved in
18 significant merger, acquisition, or divesture activities over the last five years (2001 to today).

19 However, applying these procedures to the eight companies followed by *Value Line* would

²⁵ Including both the Standard and the Small and Mid-Cap Editions of *Value Line Investment Survey and Value Line Investment Survey - Plus Edition*.

1 result in a sample of at most two companies.²⁶ I therefore use all eight companies in my
2 analysis. I report results for both the full sample and for a subsample of companies that earn
3 a high percentage of revenues from regulated water activities. Southwest Water Company
4 earned less than 40 percent of its revenues from regulated water activities in 2005 and is
5 therefore not included in this “highly regulated” sample. Companies in the subsample
6 earned at least 89 percent of their revenue from regulated water utility activities in 2005.

7 Table No. BV-2 reports operating revenue shares from different lines of business in
8 2005 for these companies. (Table No. BV-1 provides an index to the other tables.)

9 **Q24. Why do you usually eliminate companies currently involved in a merger from your**
10 **samples?**

11 A24. The stock prices of companies involved in mergers are often more affected by news relating
12 to the merger than to movements in the stock market. In other words, the stock price
13 “decouples” from its normal relationship to the stock market (the economy) which is the
14 basis upon which a company’s relative risk is calculated. Instead the stock price of a merger
15 candidate is more affected by the latest speculation on the terms and probability of the
16 merger.

²⁶ All but California Water and American States Water would be eliminated for lack of revenues, trading volume, or data.

1 **Q25. What are the water sample's data problems?**

2 A25. First, of the eight companies followed by *Value Line*, three companies (Connecticut Water,
3 Middlesex Water, and York Water) have 2005 revenues below \$100 million. The stock of
4 small companies frequently exhibit "thin trading" which means that their stock trades
5 infrequently. This is confirmed as several of the water utilities have relative low trading
6 volume.²⁷ As a result, the measured beta is likely to be downward biased. Further, no bond
7 rating was found for two companies, SJW Corp and Southwest Water. (see Workpaper #1
8 to Table No. BV-10 for bond rating details).

9 Second, several companies lack long-term earnings forecasts. I do not include
10 Connecticut Water Service Inc. and SJW Corp. in the sample when applying the forward-
11 looking Discounted Cash Flow ("DCF") method because of a lack of recent earnings
12 forecasts. However, I do include both Connecticut Water and SJW Corp. in the risk
13 positioning method. To sum up, at most two companies have significant revenue, a bond
14 rating for five years and IBES long-term growth forecast.

15 Third, the water industry has seen substantial merger activity in recent years. For
16 example, Aqua America integrated about 30 smaller entities and the company expects to add
17 further entities in 2006. The company completed the acquisition of AquaSource for about
18 \$195 million in July 2003, and during 2004 Aqua America completed 29 acquisitions.
19 Additionally, American Water Works acquired National Enterprises, Inc., Azurix, and the
20 water and wastewater utility assets of Citizens Utilities. American Water Works, in turn,

²⁷ Connecticut Water Svc Inc and York Water Co traded less than 5 million shares. Only American States Water Co, California Water Services Gp, Aqua America Inc, and Southwest Water Co traded in excess of 10 million shares in 2005.

1 was acquired by the RWE AG on January 10, 2003. Recently, RWE announced plans to sell
2 American Water. Domestic energy companies have also invested in the water utility
3 business, although presently many of those investments have or will be sold. Allete has sold
4 its assets in Florida and North Carolina; Indianapolis Water Company was sold by NISource;
5 Suez Lyonnaise des Eaux purchased the remaining shares of United Water Resource that
6 it did not already own; and Thames Water purchased E'Town Corporation. California Water
7 Services purchased Ka'anpali Water Corporation in 2003 and Southwest Water Co. acquired
8 a Texas utility consisting of 86 water systems and 11 wastewater systems in 2004.²⁸

9 These factors may all potentially affect the cost of equity estimates in not completely
10 predictable ways. Because of the substantial data problems and lack of publicly traded water
11 utilities, I am forced to rely on a sample with significant data problems or a sample with at
12 most two companies (American States Water and California Water Services).

13 2. GAS LOCAL DISTRIBUTION COMPANY SAMPLE

14 Q26. How do you select your gas local distribution company sample?

15 A26. To select this sample, I started with the universe of publicly traded gas distribution utilities
16 covered by *Value Line*. This resulted in an initial group of 16 companies.²⁹ I then eliminated
17 companies by applying additional selection criteria designed to eliminate companies with
18 unique circumstances which may bias the cost of capital estimates. The final sample consists

²⁸ Sources: *Value Line Investment Survey*, January 30, 2004 and January 28, 2005, *The Business Journal*, <http://ir.calwatergroup.com>, and company web sites.

²⁹ The 16 companies are from *Value Line Investment Survey's* Standard Edition.

1 seven gas local distribution (“gas LDC”) companies. Table No. BV-12 reports operating
2 revenue shares from regulated activities for these companies for 2005.

3 **Q27. What are the selection criteria you applied?**

4 A27. I eliminated all companies whose regulated revenues are not greater than 60 percent of total
5 revenues because one goal for this sample was for the sample companies to derive the
6 majority of their revenues from regulated activities. I also eliminated all companies whose
7 Standard & Poor’s bond rating was less than BBB per Compustat and companies with large
8 mergers during the most recent five year period. The screen for merger activity is any
9 mention of merger activity in the analyst report section of *Value Line* or sizeable mergers
10 found during a search of the companies’ web pages.³⁰ To guard against measurement bias
11 caused by “thin trading,” I also restricted the sample to companies with total operating
12 revenues greater than \$300 million in 2005.³¹ Finally, I require that the companies have
13 historical monthly return data available from Compustat for the relevant period.

14 **Q28. What companies were eliminated from the gas LDC sample because their share of**
15 **revenue from distribution activities is not above 60 percent?**

16 A28. New Jersey Resources was eliminated from the sample because its revenue share from
17 natural gas distribution is not above 60%.

³⁰ For purposes of sample selection, a sizeable merger is defined to be one which would exceed 25 percent of the total capitalization of the company at the time of the merger announcement.

³¹ As reported by *Value Line* on March 17, 2006.

1 **Q29. Were any other companies eliminated?**

2 A29. Yes. AGL Resources, Atmos Energy, KeySpan, Piedmont Natural Gas and Southern Union
3 were eliminated for recent or current merger activities. SEMCO Energy was eliminated
4 because of dividend cuts and a low bond rating. Nicor Inc. was eliminated from the sample
5 because of its 2003 restatement of earnings for 1999-2001, and because Nicor settled
6 regulatory compliance issues with the Federal Energy Regulatory Commission (“FERC”)
7 in 2003.³² UGI Corp. was eliminated because it primarily sells propane which is non-
8 regulated.

9 **Q30. Do you report results for a subsample?**

10 A30. Yes. To ensure the results are not biased by companies earning substantial revenues from
11 non-regulated activities, I report results from a subsample of companies that earn at least 75
12 percent of their revenues from regulated gas activities. This subsample consists of three
13 companies: Cascade Natural Gas, Northwest Natural Gas, and Southwest Gas.

14 **Q31. Please compare the characteristics of the water utility sample and the gas LDC sample.**

15 A31. Both samples consists of companies with substantial capital investments in distribution
16 facilities. Also, both samples earned a large percentage of their revenue from regulated
17 activities and serve a mix of residential, industrial, and other customers. I.e., both samples
18 consists primarily of state regulated distribution companies with a comparable customer mix.

³² Nicor announced on Oct. 29, 2002 that its earnings for 1999-2001 would be revised downwards by \$15-35 million. On March 4, 2003, Nicor released its restated earnings for 1999-2001 along with 2002 earnings.

1 However, the gas LDC sample has fewer of the data and estimation issues identified above
2 for the water sample.

3 For both the water/wastewater industry and the gas distribution industry,
4 environmental compliance costs and infrastructure investments are of importance. Many gas
5 LDC companies discuss environmental clean-up requirements in their 10-K. Similarly,
6 regulatory requirements from federal and local authorities through, for example, the Clean
7 Water Act of 1974 and EPA enforcement will likely require the water and wastewater
8 industry to invest substantial amounts in environmental infrastructure going forward.³³

9 **Q32. What do you conclude from the comparison of the water utility and the gas LDC**
10 **samples?**

11 A32. The two samples differ primarily in that they operate in two different (regulated) industries,
12 but they are very similar in terms of the percentage of revenues from regulated operations
13 and the customers they serve. The gas LDC sample provides a reasonable comparison
14 sample for the water utility industry but without the substantial data issues.

15 **3. OTHER PRELIMINARY MATTERS**

16 **Q33. What capital structure information do you require?**

17 A33. For reasons discussed in my testimony and explained in detail in Appendix D, an explicit
18 evaluation of the market-value capital structures of the sample companies versus the capital

³³ According to *Value Line Investment Survey*, Water Utility Industry, January 28, 2005, updates to the infrastructure of water utilities are likely to grow into hundreds of millions of dollars over the next decade or two.

1 structure used for rate making is vital for a correct interpretation of the market evidence.
2 This requires estimates of the market values of common and preferred equity and debt, and
3 the current market costs of preferred equity and debt.

4 **Q34. How do you calculate the market-value capital structures of the sample companies?**

5 A34. I estimate the capital structure for each company by estimating the market values of common
6 equity, preferred equity and debt from publicly available data. The calculations are in Panels
7 A to H of Tables No. BV-3 and BV-13 for the water and gas LDC sample, respectively.

8 The market value of equity is straightforward: the price per share times the number
9 of shares outstanding. The market value of debt is set equal to its book value because debt
10 generally is callable in the U.S. The market value of preferred equity is also set equal to its
11 book value because preferred equity makes up a very small portion (less than 1 percent) of
12 the market value capital structures of the companies in the two samples.

13 For purposes of assessing financial risk to common shareholders, I add an adjustment
14 for short-term debt to the debt portion of the capital structure. This adjustment is used only
15 for those companies whose short-term (current) liabilities (net of the current portion of long-
16 term debt) exceed their short-term (current) assets. I add an amount equal to the minimum
17 of the difference between short-term liabilities and short-term assets or the amount of short-
18 term debt. The reason for this adjustment is to recognize that when current liabilities exceed
19 current assets, a portion of the companies long-term assets are being financed, in effect, by
20 short-term debt. The output of these schedules is the market debt-to-value and preferred
21 equity-to-value ratios. Table No. BV-3 and Table No. BV-13 report such calculations using

1 the values at year end for the years 2001 to 2005. The overall cost of capital calculation for
2 the risk positioning estimates rely on the average of the market value capital structure
3 computed for the years 2001 through 2005. The DCF capital structure uses stock prices as
4 of March 31, 2006 and balance sheet information for year-end 2005.

5 **Q35. How do you estimate the current market cost of debt?**

6 A35. I use the current yields on indices of comparably rated utility bonds. The cost of debt for
7 each company in the DCF analysis is the current yield reported by *Mergent Bond Record* for
8 an index of bonds rated carrying the same rating as the company in question.³⁴ For the risk
9 positioning method, the cost is the current yield corresponding to the five-year average debt
10 rating for each company. The debt ratings for the companies in both samples are obtained
11 from Compustat when available. If no rating was found in Compustat, S&P's website,
12 Moody's website, or S&P's Bond Guide was used. Calculation of the after-tax cost of debt
13 uses Sun City's estimated marginal income tax rate of 38.6 percent.

14 **Q36. How do you estimate the current market cost of preferred equity?**

15 A36. It is set equal to the yield on an index of comparably rated preferred stock. The sample
16 companies are assumed to have the same preferred and bond rating.

³⁴ For the purpose of assigning bond yields, I assume that S&P bond ratings are comparable to Moody's which underlies the yields reported in Mergent Bond Record.

1 **B. BETAS AND THE MARKET RISK PREMIUM**

2 **1. BETA ESTIMATION PROCEDURES**

3 **Q37. Which betas do you use in your risk positioning models?**

4 A37. I obtained beta estimates from Value Line Investment Survey.³⁵

5 **Q38. How does Value Line estimate the reported betas?**

6 A38. *Value Line* estimates the reported betas using weekly data for a five year period. As the
7 market index, *Value Line* uses the New York Stock Exchange. Also, Value Line reports so-
8 called adjusted betas. I.e., the betas reported by Value Line are calculated as follows:

9
$$\beta_{\text{Value Line}} = .67 \times \beta + .35 \qquad \qquad \qquad \text{(B-3)}$$

10 where β is the standard beta estimate. To obtain standard betas, I reverse *Value Line's*
11 adjustment to obtain standard betas, β . *Value Line's* and many investment firms adjust the
12 estimated betas using a procedure similar to the one described in equation (B-3). This type
13 of adjustment is intended to compensate for sampling errors in the beta estimation. It adjusts
14 betas below one upwards and betas above one downwards.

³⁵ For the water utility sample, *Value Line* betas as of January 27, 2006 were used. For the gas LDC sample, *Value Line* betas as of March 17, 2006.

1 **Q39. Please summarize the beta estimates you rely on.**

2 A39. After reversing the *Value Line* adjustment procedure, the average estimated *Value Line* beta
3 for the water sample is about .53 while the average for the gas LDC sample is about .63. The
4 beta estimates for the sample companies are reported in Workpaper #1 to Tables No. BV-9
5 and BV-19.

6 **Q40. Are there any problems with betas at this point in time?**

7 A40. Yes. Beta estimates are still impacted by the bubble in the stock market and tend to have
8 low statistical significance. Additionally, utility stock betas have been inclining rapidly in
9 recent months indicating that the industry is changing. This indicate the current betas
10 (relying on 260 weeks of data) likely are downward biased.³⁶ This is confirmed in Figure
11 B-2 below which shows rolling 52-week betas for the water utility and gas LDC samples.
12 These betas are “rolling betas” which means that each betas is based on the previous 52
13 weeks of return data. Specifically, the sample companies’ weekly returns were regressed on
14 the weekly S&P 500 return. In this way, the changes in the estimated betas can be tracked
15 through time. These betas were estimated over the period July, 2002 through April 2006.
16 The figure shows that both water utility and gas LDC betas have increased significantly over
17 the past few years and recently, the water utility sample’s betas have increased a great deal.
18 There likely are effects from (i) changes in the industry such as consolidation and increased
19 uncertainty regarding infrastructure investments, and (ii) low trading volumes which makes

³⁶ During the past year or so, Value Line has increased its beta estimates for the water utility and gas LDC samples by an average of .06 and .05, respectively.

1 the beta estimates less stable than in industries that have higher trading volumes. Regardless
2 of the reason, the figure shows that the risk of the industry is increasing.

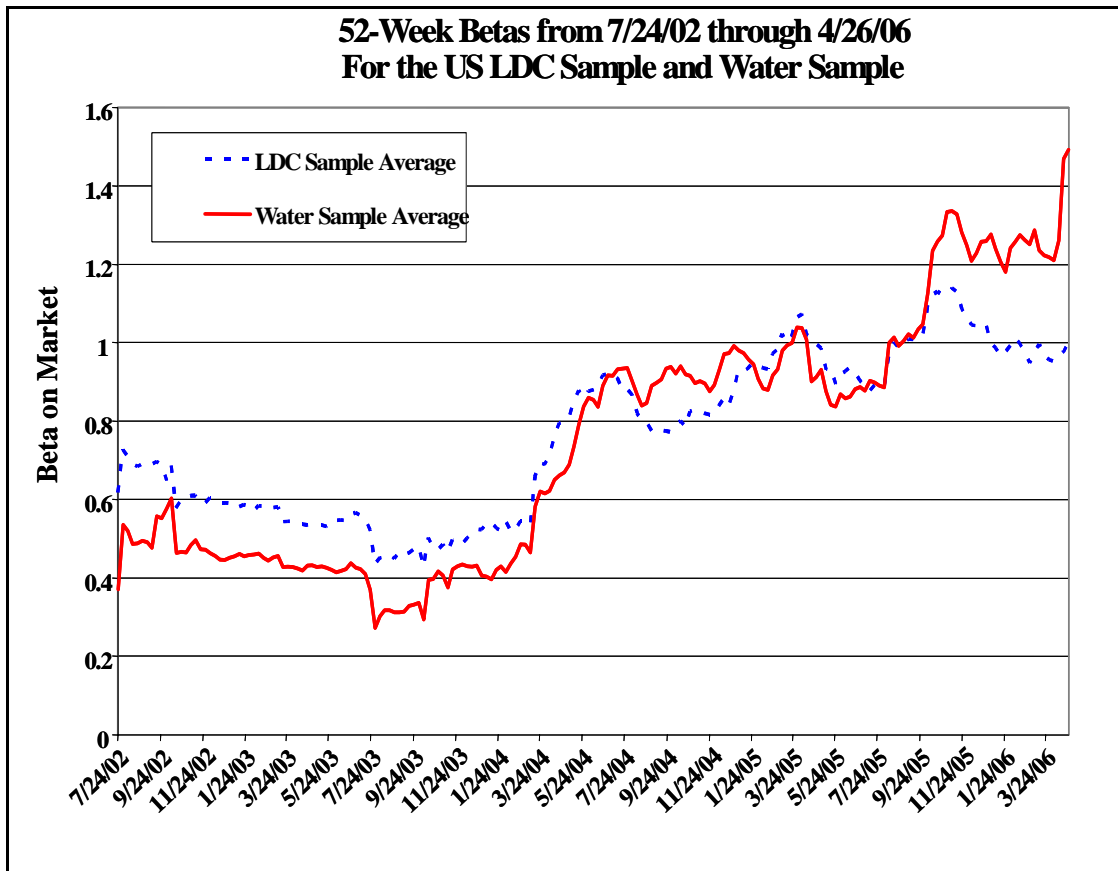


Figure B-2

3 Q41. What beta values do you use in your analysis?

4 A41. After reversing the adjustment process discussed above, the current estimated *Value Line*
5 betas range from 0.22 to 0.67 for the water sample and from 0.45 to 0.75 for the gas LDC
6 sample. The average is .53 and .63 for the water utility and gas LDC sample, respectively
7 (See Workpaper #1 to Tables No. BV-9 and No. BV-19).

1 **2. MARKET RISK PREMIUM ESTIMATION**

2 **Q42. Given all of the evidence, what MRP do you use in your analysis?**

3 A42. It is clear that market return information is volatile and difficult to interpret, but based on the
4 collective evidence, the MRP I use for the short-term risk-free rate is 8 percent and for the
5 long-term risk-free rate is 6.5 percent.

6
7 **D. COST OF CAPITAL ESTIMATES**

8 **Q43. Based on these data, what are the values you calculate for the overall cost of capital and**
9 **the corresponding cost of equity for the water utility sample?**

10 A43. Panels A and B of Table No. BV-9 present the cost of equity results using the equity risk
11 positioning method at the sample companies' market value capital structures. The table
12 contains two panels, Panel A for the long-term risk-free rate and Panel B for the short-term
13 risk-free rate.

14 **Q44. What does the water utility sample market data imply about cost of equity at Sun**
15 **City's 40 percent equity ratio?**

16 A44. The return on equity and the overall cost of capital for the various equity risk positioning
17 methods are reported in Table No. BV-10, Panels A to G. Panels A through C utilize the
18 long-term risk-free rate while Panels D through G use the short-term risk free rate. Panel
19 A reports the CAPM results using the long-term risk-free rate, while Panels B and C report
20 the ECAPM cost of equity results for the ECAPM parameters of 0.5 and 1.5 percent,
21 respectively. Panel D reports the CAPM estimates using the short-term risk free rate. Panels

1 E, F and G report ECAPM results using ECAPM parameters of 1, 2 and 3 respectively.
2 Focusing on the middle version of the ECAPM, Panel B of Table No. BV-10 (ECAPM with
3 $a = 0.5\%$) shows the results using the long-term risk-free rate version of the model. For this
4 table, the costs of equity estimates for the water sample companies range from 7.1 to 9.7
5 percent for capital structures that average 68 percent equity. The sample average ATWACC
6 is 7.2 percent for both the full sample and for the subsample.³⁷

7 In each panel, column eight reports the overall cost of capital for each company. The
8 last two rows of each panel report the sample averages. The first is for all companies in the
9 water sample (average [a]), and the second is for the subsample of companies with
10 significant revenue from regulated water activities (average [b]). The sample average
11 ATWACCs from each panel of Table No. BV-10 are reproduced in column one of Table No.
12 BV-11 which reports the cost of equity estimates for each of the risk positioning estimates
13 that is consistent with the sample information and the capital structure of Sun City. Panel
14 A of Table No. BV-11 reports the results for all sample companies. Panel B of the table
15 summarizes the results for the subsample of companies that have a large percentage of
16 revenues from regulated activities. The sample average ATWACCs are summarized in
17 Table B-2 at the end of this appendix. The costs of equity at a 40 percent equity ratio are
18 displayed in Tables 2 and 3 of my testimony.

³⁷ Note that these cost of equity estimates rely on unadjusted *Value Line* betas which are lower than current estimates based on weekly returns.

1 **Q45. What cost of equity values do you calculate for the gas LDC sample?**

2 A45. The cost of equity estimates for the gas LDC sample are displayed on Panels A and B of
3 Table No. BV-19. Panel A uses the long-term risk-free rate, and Panel B uses the short-term
4 risk-free rate.

5 **Q46. What does the gas LDC sample market data imply about the cost of equity at Sun**
6 **City's 40 percent equity ratio?**

7 A46. The cost of equity and the overall cost of capital for the various equity risk positioning
8 methods are reported in Table No. BV-20 for the gas LDC sample. Panels A through C
9 utilize the long-term risk-free rate. Panel A again reports the CAPM cost of equity results
10 while Panels B and C report the ECAPM cost of equity results for the 0.5 and 1.5 percent
11 adjustment factors, respectively. Panels D through G to Table BV-20 utilize the short-term
12 risk-free rate. Panel D report the CAPM cost of equity results, while Panels E, F and G
13 report the ECAPM overall cost of capital results using 1, 2 and 3 percent adjustment factors.
14 In each panel, column eight reports the overall cost of capital for each company. The last
15 two lines of each panel report the sample averages for the full sample and the subsample of
16 companies with an average of more than 75 percent of revenue for the last five years from
17 regulated activities. Panel B of Table No. BV-20 shows the estimates using the middle
18 version of the ECAPM ($\alpha = 0.5\%$) for the companies in the gas LDC sample. Using the long
19 -term risk-free rate, the model results in costs of equity of 8.4 to 10.2 percent for capital
20 structures that average about 59 percent equity for the full sample and 53 percent for the
21 subsample. The sample average ATWACC is 7.1 percent for the full sample and 6.8 percent

1 for the subsample. However, the subsample results is heavily influenced by one company,
2 Southwest Gas. If Southwest Gas was dropped from the subsample, the results would be
3 comparable to those from the full gas LDC sample.

4 The sample average ATWACC from each panel of Table No. BV-20 is reproduced
5 in column one of Table No. BV-21 which reports the cost of equity estimates for each of the
6 risk positioning estimates. Panel A reports the results for all sample companies. As with the
7 water sample, Panel B reports the averages using only those companies that have a large
8 percentage of revenue from regulated activities. The sample average ATWACCs and
9 corresponding costs of equity at a 40 percent equity ratio are displayed in Tables 2 and 3 of
10 my testimony. I discuss the implications of the equity risk positioning results in the main
11 body of my testimony.

Table No. B-1
Empirical Evidence on the Alpha (α) Factor in ECAPM^{*)}

Author	Alpha (α) Estimate	Period relied upon
Black (1993) ¹⁾	1% for betas between zero and .80	1931-1991
Black, Jensen and Scholes (1972) ²⁾	4.31%	1931-1965
Fama and McBeth (1973)	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 (unbiased, efficient, consistent). 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) Black, Jensen and Scholes 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 estimation results estimate alpha at 4.4%.

5) Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 to estimate the alpha parameter 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, "Beta and Return," *The Journal of Portfolio Management*, Fall 1993, 8-18.

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14 and Returns," *Journal of Financial and Quantitative Analysis*, Vol. 30, No. 1, March 1995, pp.
15 101-116.

**Table B-2: Risk Positioning After-Tax Weighted-Average Cost of Capital
 Panel A: for All Companies in the Water Utility and Gas LDC Samples**

	Water Utility	Gas LDC
Using Long-Term Risk-Free Rate		
CAPM	7.0%	7.0%
ECAPM ($\alpha = 0.5\%$)	7.2%	7.1%
ECAPM ($\alpha = 1.5\%$)	7.5%	7.3%
Using Short-Term Risk-Free Rate		
CAPM	7.1%	7.1%
ECAPM ($\alpha = 1\%$)	7.5%	7.4%
ECAPM ($\alpha = 2\%$)	7.8%	7.6%
ECAPM ($\alpha = 3\%$)	8.1%	7.8%

Source: Tables No. BV-11 and BV-21, Panel A.

**Table B-2: Risk Positioning After-Tax Weighted-Average Cost of Capital
 Panel B: for Companies with a High Percentage Regulated Revenue**

	Water Utility	Gas LDC
Using Long-Term Risk-Free Rate		
CAPM	7.0%	6.6%
ECAPM ($\alpha = 0.5\%$)	7.2%	6.7%
ECAPM ($\alpha = 1.5\%$)	7.5%	7.0%
Using Short-Term Risk-Free Rate		
CAPM	7.1%	6.8%
ECAPM ($\alpha = 1\%$)	7.5%	7.0%
ECAPM ($\alpha = 2\%$)	7.8%	7.2%
ECAPM ($\alpha = 3\%$)	8.1%	7.4%

Source: Tables No. BV-11 and BV-21, Panel B.

**APPENDIX C: DISCOUNTED CASH FLOW METHODOLOGY:
DETAILED PRINCIPLES AND RESULTS**

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
<u>I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES</u>	1
A. SIMPLE AND MULTI-STAGE DISCOUNTED CASH FLOW MODELS	1
B. CONCLUSIONS ABOUT DCF	9
<u>II. EMPIRICAL DCF RESULTS</u>	10
A. PRELIMINARY MATTERS	10
B. GROWTH RATES	11
C. DIVIDEND AND PRICE INPUTS	14
D. COMPANY-SPECIFIC DCF COST OF CAPITAL ESTIMATES	15
Table C-1	18

1 **Q1. What is the purpose of this appendix?**

2 A1. In this appendix, I review the principles underlying the discounted cash flow or “DCF”
3 methodology and discuss the estimation of parameters. I also provide information on any
4 differences between the samples used in the risk positioning method and in the DCF method,
5 and on the resulting cost of capital estimates. Parts of the appendix intentionally repeat parts
6 of the direct testimony to ensure the reader has a complete discussion in one place.

7 **I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES**

8 **Q2. How is this section of the appendix organized?**

9 A2. First, I discuss the general principles underlying the DCF approach. Second, I review the
10 strengths and weaknesses of the DCF model. Third, I discuss the methods applicability to
11 companies in the water and gas distribution industry at the current time.

12 **A. SIMPLE AND MULTI-STAGE DISCOUNTED CASH FLOW MODELS**

13 **Q3. Please summarize the DCF model.**

14 A3. The DCF model assumes that the current stock price is the discounted sum of future cash
15 payments that accrue to shareholders. The method also assumes that this present value can
16 be calculated by the standard formula for the present value of a cash flow stream:

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \dots + \frac{D_T}{(1+k)^T} \quad (C-1)$$

1 where “ P_0 ” is the current market price of the stock; “ D_t ” is the dividend cash flow expected
2 at the end of period t ; “ k ” is the cost of capital; and “ T ” is the last period in which a dividend
3 cash flow is to be received. The formula just says that the stock price is equal to the sum of
4 the expected future dividends, each discounted for the time and risk between now and the
5 time the dividend is expected to be received.

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

11 where “ D_1 ” is the dividend expected at the end of the first period, “ g ” is the perpetual growth
12 rate, and “ P_0 ” and “ k ” are the market price and the cost of capital, as before. Equation (C-3)
13 is a simplified version of Equation (C-2) that can be solved to yield the well known “DCF
14 formula” for the cost of capital:

$$k = \frac{D_1}{P_0} + g = \frac{D_0 \times (1 + g)}{P_0} + g \quad (\text{C-2})$$

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

21 **Q4. Are there other versions of the DCF models besides the “simple” one?**

1 A4. Yes. There are many variations on the DCF models that may rely on less strong assumptions
2 in that they allow growth rates to vary over time. I consider a variant of the DCF model that
3 uses the companies' individual growth rates during the first five years, converges to a
4 perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual
5 growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF
6 method. More formally, the "multi-stage" DCF approach solves the following equation for
7 k :

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \dots + \frac{D_T + P_{TERM}}{(1+k)^T} \quad (C-3)$$

8 The terminal price, P_{TERM} is estimated as

9 where T is the last of the periods in which a near term dividend forecast is made and g_{LT} is

$$P_{TERM} = \frac{D_{T+1}}{(k - g_{LT})} \quad (C-4)$$

10 the long-term growth rate. Thus, Equation (C-4) defers adoption of the very strong perpetual
11 growth assumptions that underlie Equation (C-2) — and hence the simple DCF formula,
12 Equation (C-3) — for as long as possible, and instead relies on near term knowledge to
13 improve the estimate of k . I examine both the simple and multi-stage DCF results.

14 **Q5. What are the merits of the DCF model?**

15 A5. The DCF approach is conceptually sound if its assumptions are met but can run into
16 difficulty in practice because those assumptions are so strong, and hence so unlikely to
17 correspond to reality. Two conditions are well-known to be necessary for the DCF approach
18 to yield a reliable estimate of the cost of capital: the variant of the present value formula,

1 Equation (C-1), that is used must actually match the variations in investor expectations for
2 the dividend growth path; and the growth rate(s) used in that formula must match current
3 investor expectations. Less frequently noted conditions may also create problems.

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

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

12 It is too early to throw out the standard formula, if for no other reasons than that the
13 evidence is still controversial and no one has offered a good replacement. But the evidence
14 suggests that it must be viewed with more caution than financial analysts have traditionally
15 applied. Simple models of stock prices may not be consistent with the available evidence
16 on stock market volatility.

17 **Q6. Do you agree that estimating the right growth rate is the most difficult part for the**
18 **implementation of the DCF approach?**

19 A6. Yes. Finding the right growth rate(s) is indeed the usual “hard part” of a DCF application.
20 The original approach to estimation of g relied on average historical growth rates in
21 observable variables, such as dividends or earnings, or on the “sustainable growth”
22 approach, which estimates g as the average book rate of return times the fraction of earnings

1 retained within the firm. But it is highly unlikely that historical averages over periods with
2 widely varying rates of inflation, interest rates and costs of capital, such as in the relatively
3 recent past, will equal current growth rate expectations. Moreover, the constant growth rate
4 DCF model *requires* that dividends and earnings grow at the same rate. It is inconsistent for
5 dividends to grow at a rate that differs from the growth in earnings because it would mean
6 that dividends are becoming an ever increasing or decreasing percentage of earnings.

7 Most cost of capital experts rely on earnings growth rates, not dividend growth rates,
8 for several reasons. First, although the model is derived from dividend growth rates, the
9 more fundamental parameter is earnings growth because dividends are paid from earnings.
10 Second, analyst forecasts of dividend growth rates are generally not available, but earnings
11 growth forecasts are. Third, a better approach than relying on historical information is to use
12 the growth rates currently expected by investment analysts, if an adequate sample of such
13 rates is available. Analysts' forecasts are superior to time series forecasts based upon single
14 variable historical data as has been documented and confirmed extensively in academic
15 research.¹

16 If this approach is feasible and if the person estimating the cost of capital is able to
17 select the appropriate version of the DCF formula, the DCF method should yield a
18 reasonable estimate of the cost of capital for companies not in financial distress and without
19 material option-pricing effects (always subject to recent concerns about the applicability of

¹ 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 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.

1 the basic present value formula to stock prices). However, for the DCF approach to work,
2 the basic stable-growth assumption must become reasonable and the underlying stable-
3 growth rate must become determinable *within the period for which forecasts are available*.

4 **Q7. What is the so called “optimism bias” in the earnings growth rate forecasts of security**
5 **analysts and what is its effect on the DCF analysis?**

6 A7. Optimism bias is related to the observed tendency for analysts to forecast earnings growth
7 rates that are higher than are actually achieved. This tendency to over estimate growth rates
8 is perhaps related to incentives faced by analysts that provide rewards not strictly based upon
9 the accuracy of the forecasts. To the extent optimism bias is present in the analysts’ earnings
10 forecasts, the cost of capital estimates from the DCF model would be too high.

11 **Q8. Does optimism bias mean that the DCF estimates based upon analysts’ earnings**
12 **forecasts are completely unreliable?**

13 A8. No. The effect of optimism bias is least likely to affect DCF estimates for large, rate
14 regulated companies in stable segments of an industry. Furthermore, the magnitude of the
15 optimism bias (if any) for regulated companies is not clear. Chan, Karceski, and Lakonishok
16 (2000)² sort companies on the basis of the size of the *IBES* forecasts to test the level of
17 optimism bias. Utilities constitute 25 percent of the companies in lowest quintile, and by one
18 measure the level of optimism bias is 4.0 percent. However, the 4.0 percent figure does not
19 represent the complete characterization of the results in the paper. Table IX of the paper
20 shows that the median *IBES* forecast for the first (lowest) quintile averages 6.0 percent. The

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

1 realized “Income before Extraordinary Items” is 2.0 percent (implying a four percent upward
2 bias in *IBES* forecasts), but the “Portfolio Income before Extraordinary Items” is 8.0 percent
3 (implying a two percent downward bias in *IBES* forecasts).

4 The difference between the “Income before Extraordinary Items” and “Portfolio
5 Income before Extraordinary Items” is whether individual firms or a portfolio are used in
6 estimating the realized returns. The first is a simple average of all firms in the quintile while
7 the second is a market value weighted-average. Although both measures of bias have their
8 own drawbacks according to the authors,³ the Portfolio Income measure gives more weight
9 to the larger firms in the quintile such as regulated utilities. In addition, the paper
10 demonstrates that “analysts’ forecasts as well as investors’ valuations reflect a wide-spread
11 belief in the investment community that many firms can achieve streaks of high growth in
12 earnings.”⁴ Therefore, it is not clear how severe the problem of optimism bias may be for
13 regulated utilities or even whether there is a problem at all.

14 Finally, the multi-stage DCF model also adjusts for any over optimistic (or
15 pessimistic) growth rate forecasts by substituting the long-term GDP growth rate for the 5-
16 year growth rate forecasts of the analysts in further out years.

17 **Q9. Please describe the multi-stage DCF model you use.**

18 A9. The multi-stage model I use is presented in equation (C-4) above and assumes that the long-
19 term perpetual growth rate for all companies in the two samples is the forecast long-term

³ Chan, Karceski, and Lakonishok, *op. cit.*, p. 675.

⁴ Chan, Karceski, and Lakonishok, *op. cit.*, p. 663.

1 growth rate of the GDP.⁵ This model allows growth rates to differ across companies during
2 the first ten years before settling down to a single long-term growth rate. The growth rate
3 for the first five years is the long-term growth rate provided in analysts' reports. After year
4 five, the growth rate is assumed to converge linearly to the GDP growth rate. In other
5 words, the growth rate in year 6 is adjusted by 1/6th of the difference between each
6 company's 5-year growth rate forecast and the GDP forecast. The growth rates in years 7
7 to 10 are adjusted by an additional 1/6th so that the earning growth rate pattern converges
8 on the long-term GDP growth rate forecast.

9 **Q10. Why do you assume that the long-term growth rate of the sample companies will**
10 **converge to the long-term growth rate of GDP?**

11 A10. Recall that the DCF model assumes that dividends grow at a constant rate literally forever.
12 If the growth rate of earnings (and therefore, dividends) were greater than (less than) the
13 long-term growth rate of the economy, mathematically it would mean that the company (and
14 the industry) would become an ever increasing (or decreasing) proportion of the economy.
15 Therefore, the most logical assumption is that the company's earnings grow at the same rate
16 as the economy on average over the long run.

17 **Q11. How well are the conditions needed for DCF reliability met at present?**

18 A11. The requisite conditions for the sample companies are not fully met at this time. Of
19 particular concern for this proceeding is the uncertainty about what investors truly expect
20 the long-run outlook for the sample companies to be. The longest time period available for

⁵ See Blue Chip Economic Indicators, March 10, 2006.

1 growth rate forecasts of which I am aware is five years. The long-run growth rate (*i.e.*, the
2 growth rate after an industry settles into a steady state) drives the actual results one gets with
3 the DCF model. Unfortunately, this implies that unless the company or industry in question
4 is stable, so there is little doubt as to the growth rate investors expect, DCF results in practice
5 can end up being driven by the subjective judgment of the analyst who performs the work.

6 Uncertainty in an industry implies that a commission may often be faced with a wide
7 range of DCF numbers, none of which can be well grounded in objective data on true long-
8 run growth expectations, *because no such objective data now exist*. DCF for firms or
9 industries in flux is *inherently* subjective with regard to a parameter (the long-run growth
10 rate) that drives the answer one gets.

11 In short, the unavoidable questions about the DCF model's strong assumptions cause
12 me to view the DCF method as *inherently* less reliable than risk positioning approach
13 described above. However, because the DCF method has been widely used in the past and
14 in other forums when the industry's economic conditions were different from today's, I
15 submit DCF evidence in this case. DCF estimates also serve as a check on the values
16 provided by the risk positioning approach methods.

17 **B. CONCLUSIONS ABOUT DCF**

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

19 A12. The unavoidable questions about the DCF model's strong assumptions — whether the basic
20 present value formula works for stocks, whether option pricing effects are important for the
21 company, whether the right variant of the basic formula has been found, and whether the true
22 growth rate expectations have been identified — cause me to view the DCF method as less

1 reliable than the equity risk premium approach.

2 **II. EMPIRICAL DCF RESULTS**

3 **Q13. How is this part of the appendix organized?**

4 A13. This section presents the details of my DCF analyses, which are summarized in my direct
5 testimony. The first part describes some preliminary matters, such as differences from the
6 samples used in the risk positioning method, calculation of sample capital structures, etc.
7 Then it turns to the details of the DCF estimates themselves.

8 In particular, implementation of the simple DCF models described above requires an
9 estimate of the current price, the dividend, and near-term and long-run growth rate forecasts.
10 The simple DCF model relies only on a single growth rate forecast, while the multi-stage
11 DCF model employs both near-term and long-run growth rate forecasts. The remaining parts
12 of this section describe each of these inputs in turn.

13 **A. PRELIMINARY MATTERS**

14 **Q14. In the discussion of “preliminary matters” in *Appendix B* you discuss sample selection
15 and the capital structure/cost of capital data you need to complete your risk premium
16 analyses. What, if anything, is different when you use the DCF method?**

17 A14. First, the sample companies to which the DCF approach is applied differ slightly for the
18 water utility sample due to the availability of earnings forecasts. Two companies in the water
19 utility sample, Connecticut Water Services and SJW Corp, do not currently have long-term
20 growth forecasts from *IBES* and are therefore excluded from the DCF analysis. In addition,
21 the timing of the market value capital structure calculations is different in the DCF method

1 and in the equity risk premium method. The equity risk premium method relies on the
2 average capital structure over the past five years while the DCF approach uses only current
3 data, so the relevant market value capital structure measure is the most recent that can be
4 calculated. This capital structure is reported in columns 1- 3 of Table No. BV-4 for the
5 water utility sample and Table No. BV-14 for the gas LDC sample.

6 **B. GROWTH RATES**

7 **Q15. What growth rates do you use?**

8 A15. For reasons discussed above, historical growth rates today are useless as forecasts of current
9 investor expectations for the water industry or the gas LDC sample. I therefore use rates
10 forecasted by security analysts.

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

20 Accordingly, the first step in my DCF analysis is to examine a sample of investment
21 analysts' forecasted earnings growth rates from the Institutional Brokers Estimate System
22 ("*IBES*") and from *Value Line* for both samples. Neither *IBES* nor *Value Line* provide

1 analysts' forecast for all companies in the water utility sample. *IBES* provides a (recent)
2 long-term growth forecast for six of the eight companies in the water utility sample. *IBES*
3 does not provide recent long-term earnings growth rates forecasts for Connecticut Water
4 Services or SJW Corp. Also, the consensus forecast from *IBES* is based on one analyst's
5 forecast for Middlesex Water. Value Line does not provide a long-term growth forecast for
6 Middlesex Water Co. or York Water Co. Among the gas LDC companies, *IBES* does not
7 currently provide a long-term earnings forecast for Laclede Group Inc. and only one analyst
8 provides a long-term earnings forecast for Cascade Natural Gas. *Value Line* provide long-
9 term growth rates for all companies in the gas LDC sample. *IBES* and *Value Line* projected
10 earnings growth rates for the companies in the water utility and the gas LDC samples are in
11 Tables No. BV-5 and BV-15, respectively. The tables report *IBES* long-term growth
12 forecast in column one, the number of analysts providing *IBES* growth forecasts in column
13 two, *Value Line* growth forecasts are in column five, and column six combines *IBES* and
14 *Value Line* growth forecasts. The combined growth forecasts weight the *IBES* forecasts by
15 the number of analysts providing a forecasts and the *Value Line* forecast by one.⁶

16 In the simple DCF, I use the five-year average annual growth rate as the perpetual
17 growth rate.⁷ In the multi-stage DCF model, I implement the combined *IBES* and *Value Line*
18 growth rates for the first five years while I rely on the long-term GDP growth as an estimate
19 of the perpetual earnings for the two samples.⁸ I report the yearly growth rates for the multi-

⁶ I treat the *Value Line* forecasts as though they overlap exactly with the forecasts from *IBES*. These growth rates underlie my simple and multi-stage DCF analyses.

⁷ This growth rate is in column 6 in Table No. B-5 for the water sample and in Table No. BV-15 for the gas LDC sample.

⁸ *Value Line* currently provides forecasts for the 2006 to 2010 and for the 2007 to 2011 horizon for the water utility and gas LDC sample, respectively. I treat the forecast as if it provides a five year forecast for both samples.

1 stage DCF model in Table No. BV-6, Panel B for the water sample and Table No. BV-16,
2 Panel B for the gas LDC sample.

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

4 A16. No. While forecasted growth rates are the quantity required in principle, the forecasts need
5 to go far enough out into the future so that it is reasonable to believe that investors expect
6 a stable growth path afterwards. As can be seen in Table No. BV-5 for the water utility
7 sample and in Table No. BV-15 for the gas LDC sample, the growth rate forecasts vary
8 widely from company to company. For example, the *IBES* growth forecast for Southwest
9 Water is 7.3 percent while the *Value Line* growth forecast is 28.3 percent.⁹ While the
10 differences between *IBES* and *Value Line* forecasts are lower for the gas LDC sample there
11 are still some variation.¹⁰ Also, for some companies, the five-year growth rate forecasts are
12 significantly above or below the long-term GDP growth rate indicating lack of stability in
13 growth rates. Overall, the growth rates indicates that some companies and maybe the
14 industries have yet to reach a stable equilibrium which is required for the correct application
15 of the DCF method.

16 It is clear that much longer detailed growth rate forecasts than currently available
17 from *IBES* and *Value Line* would be needed to implement the DCF model in a completely
18 reliable way for these two samples at this time; however, the general stability of the 5-year
19 growth rate forecasts for the gas LDC sample indicates a higher degree of reliability than for
20 the water sample at this time. I submit DCF evidence in this case for both the water utility
21 sample and the gas LDC sample as a check on the equity risk premium approach estimates.

⁹ See Table No. BV-5.

¹⁰ See Table No. BV-15.

1 **C. DIVIDEND AND PRICE INPUTS**

2 **Q17. What values do you use for dividends and stock prices?**

3 A17. Dividend payments are for the 4th quarter of 2005 as reported by Compustat. This dividend
4 is grown at the estimated growth rate and divided by the price described below to estimate
5 the dividend yield for the simple and multi-stage DCF models.

6 Stock prices are the average of the closing stock prices for the 15 trading days ending
7 on the day the *IBES* forecasts were released. For both the water sample and the gas LDC
8 sample, the 15-days end on March 31, 2006. Using these dates insure that the information
9 in growth rates and stock prices are contemporaneous. I use a 15-day average as a
10 compromise. Using a longer period would be inconsistent with the principles that the DCF
11 model relies on the current stock price. The DCF approach assumes the stock price is the
12 present value of future expected dividends. Stock prices six months or a year ago reflect
13 expectations at that time, which are different from those that underlie the current *IBES* and
14 *Value Line* forecasts. At the same time, use of an average over a brief period as opposed to
15 a single day helps guard against a company's price on a particular day price being unduly
16 influenced by mistaken information, differences in trading frequency, and the like.

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

D. COMPANY-SPECIFIC DCF COST OF CAPITAL ESTIMATES

Q18. What cost of equity estimates do these data yield?

A18. The cost of equity results for the simple and multi-stage DCF models are shown in Table No. BV-6 for the water utility sample and in Table No. BV-16 for the gas LDC sample. Panel A reports the results for the simple DCF method and Panel B reports the results for the multi-stage DCF method using the long-term GDP growth rate as the perpetual growth rate.

Q19. What information is provided in Table No. BV-7 and Table No. BV-17?

A19. In these tables, the capital structure, cost of equity estimates, and cost of debt estimates are combined to obtain the overall cost of capital for each sample company. The results are presented in Table No. BV-7 for the water utility sample and in Table No. BV-17 for the gas LDC sample. Panel A relies on the simple DCF cost of equity results, and Panel B relies on the multi-stage DCF cost of equity results.

For both samples, I also report the average for the subsample of companies that have a large percentage of revenue from regulated activities.¹¹

Q20. What do the values in Table No. BV-8 and Table No. BV- 18 imply about the cost of equity for the sample companies at Sun City's 40 percent equity ratio?

A20. The overall after-tax weighted-average cost of capital from both DCF methods are reported in column one of Table No. BV-8 and Table No. BV-18. Column 6 of the tables reports the cost of equity consistent with Sun City's requested 40 percent equity thicknesses and the samples' average weighted-average cost of capital. The sample average ATWACCs are

¹¹ In the subsample, the 2005 revenues from regulated businesses is above 75 percent for both samples. (See Table No. BV-2 and Table No. BV-12.)

1 displayed in Table C-1 at the end of this appendix. The costs of equity at a 40 percent equity
2 ratio are displayed in Table 4 of my direct testimony.

3 The implications of these numbers are discussed in my direct testimony, along with
4 the findings of the equity risk premium approach.

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Table C-1 Discounted Cash Flow After-Tax Weighted-Average Cost of Capital Estimates Panel A: for All Companies in the Water Utility and Gas LDC Samples		
	Water Utility	Gas LDC
Simple DCF Method (Quarterly)	8.9%	7.5%
Multi-Stage DCF Using the Long-Term GDP Forecast as the Perpetual Rate	6.8%	7.4%

Source: Tables No. BV-8 and BV-18.

Table C-1 Discounted Cash Flow After-Tax Weighted-Average Cost of Capital Estimates Panel B: for Companies with at least 75 Percent Regulated Revenue in the Water Utility and Gas LDC Samples		
	Water Utility	Gas LDC
Simple DCF Method (Quarterly)	9.1%	7.4%
Multi-Stage DCF Using the Long-Term GDP Forecast as the Perpetual Rate	6.9%	7.0%

Source: Tables No. BV-8 and BV-18.

APPENDIX D: EFFECT OF DEBT ON THE COST OF EQUITY

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
<u>I. AN OVERVIEW OF THE ECONOMIC LITERATURE</u>	1
A. TAX EFFECTS	2
1. Base Case: No Taxes, No Risk to High Debt Ratios	2
2. Corporate Tax Deduction for Interest Expense	4
3. Personal Tax Burden on Interest Expense	6
B. NON-TAX EFFECTS	9
<u>II. EXPANDED EXAMPLE</u>	14
A. DETAILS OF DIFFERENT LEVELS OF DEBT	15
B. THE IMPACT OF INCOME AND INTEREST	16
C. THE EFFECT OF TAXES	19
D. COMBINED EFFECTS	26

1 **Q1. What is the purpose of this appendix?**

2 A1. In this appendix, I provide details on the effects of debt on the cost of equity. First, I
3 summarize a fairly large body of financial research on capital structure. Second, I elaborate
4 on the example used in the main testimony.

5 **I. AN OVERVIEW OF THE ECONOMIC LITERATURE**

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

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

17 **Q3. How is this section of the appendix organized?**

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

1 **A. TAX EFFECTS**

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

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

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

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

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

16 In the base case, issuing debt merely divides the cash flows into two pools, one for
17 bondholders and one for shareholders. If the divided pools have different priorities in claims
18 on the cash flows, the risks and costs of capital will differ for each pool. But the risk and

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.

1 overall cost of capital of the entire firm, the sum of the two pools, is constant regardless of
2 the debt ratio. Thus,

$$3 \quad r_{1}^{*} = r_{A1} \quad (D-1a)$$

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

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

$$11 \quad r_{E1} \times (E/V) + r_{D1} \times (D/V) = r_{1}^{*} \quad (D-1b)$$

12 with the overall cost of capital (r_{1}^{*}) on the *right* side, as the *independent* variable, and the
13 costs of equity (r_{E1}) and debt (r_{D1}) on the left side, as *dependent* variables determined by the
14 overall cost of capital and by the capital structure (i.e., the shares of equity (E) and debt (D)
15 in overall firm value)² that the firm happens to choose. Note that if equation (D-1a) were
16 correct, the equation that solved it for the cost of equity would be,

$$17 \quad r_{E1} = r_{1}^{*} + (r_{1}^{*} - r_{D1}) \times (D/E) \quad (D-1c)$$

² For simplicity, I assume, the firm has only debt and equity, so $V = E + D$.

1 Note also that (D/E) gets exponentially higher in this equation as the debt-to-value
2 ratio increases.³ I.e., the cost of equity increases exponentially with leverage.

3 2. Corporate Tax Deduction for Interest Expense

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

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

13 *How much* the value of the firm would rise and *how far* the overall cost of capital
14 would fall would depend in part on how often the company adjusts its capital structure, but
15 this is a second-order effect in practice. (The biggest effect would be if companies could
16 issue riskless perpetual debt, an assumption Profs. Modigliani and Miller explored in 1963,

³ 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 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.

1 in the second seminal paper;⁴ this assumption could *not* be true for a real company.) Prof.
2 Robert A. Taggart provides a unified treatment of the main papers in this literature and
3 shows how various cases relate to one another.⁵ Perhaps the most useful set of benchmark
4 equations for the case where only corporate taxes matter are:

$$5 \quad r_2^* = r_{A2} - r_D \times t_C \times (D/V) \quad (D-2a)$$

$$6 \quad r_{E2} \times (E/V) + r_D \times (D/V) \times (1 - t_C) = r_2^* \quad (D-2b)$$

7 which imply for the cost of equity,

$$8 \quad r_{E2} = r_{A2} + (r_{A2} - r_D) \times (D/E) \quad (D-2c)$$

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

11 Note that Equation (D-2a) implies that when only corporate taxes matter, the overall
12 after-tax cost of capital declines steadily as more debt is added, until it reaches a minimum
13 at 100 percent debt (i.e., when $D/V = 1.0$). Note also that Equation (D-2c) still implies an
14 exponentially increasing cost of equity as more and more debt is added. In fact, except for
15 the subscript, Equation (D-2c) looks just like Equation (D-1c).

16 However, whether any value is added and whether the cost of capital changes at all
17 also depends on the effect of taxes at the personal level.

⁴ Franco Modigliani and Merton H. Miller (1963), “Corporate Income Taxes and the Cost of Capital: A Correction,” *American Economic Review*, 53, pp. 433-443.

⁵ Robert A. Taggart, Jr. (1991), “Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes,” *Financial Management* 20, pp. 8-20.

1 **3. Personal Tax Burden on Interest Expense**

2 **Q7. How do personal taxes affect the results?**

3 A7. Ultimately, the purpose of investment is to provide income for consumption, so personal
4 taxes affect investment returns. For example, in the U.S., municipal bonds have lower
5 interest rates than corporate bonds with a similar rating because their income is taxed less
6 heavily at the personal level. In general, capital appreciation on common stocks is taxed less
7 heavily than interest on corporate bonds because (1) taxes on unrealized capital gains are
8 deferred until the gains are realized, and (2) the capital gains tax rate is lower. Dividends
9 are taxed less heavily than interest, also, under current tax law.⁶ The effects of personal
10 taxes on the cost of common equity are hard to measure, however, because common equity
11 is so risky.

12 Professor Miller, in his Presidential Address to the American Finance Association,⁷
13 explored the issue of how personal taxes affect the overall cost of capital. The paper pointed
14 out that personal tax effects could offset the effect of corporate taxes entirely.

15 **Q8. Is it likely that the effect of personal taxes will completely neutralize the effect of**
16 **corporate taxes?**

⁶ This provision was recently extended to 2010.

⁷ Merton H. Miller (1977), "Debt and Taxes," *The Journal of Finance*, 32: 261-276, the third of the seminal papers mentioned earlier.

1 A8. I do not believe so, although the likelihood of such a result would be increased if the current
2 federal tax reductions on dividends and capital gains became permanent rather than expiring
3 in 2010. However, personal taxes are important even if they do not make the corporate tax
4 advantage on interest vanish entirely. Capital gains and dividend tax advantages definitely
5 convey some personal tax advantage to equity, and even a partial personal advantage to
6 equity reduces the corporate advantage to debt.

7 The Taggart paper explores the case of a partial offset, also. With personal taxes, the
8 risk-free rate on the security market line is the after-personal-tax rate, which must be equal
9 for risk-free debt and risk-free equity.⁸ Therefore, the pre-personal-tax risk-free rate for
10 equity will generally not be equal to the pre-personal-tax risk-free rate for debt. In
11 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
12 and t_E and t_D are the personal tax rates for equity and debt, respectively. In terms of the cost
13 of debt, the Taggart paper's results imply that a formal statement of these effects can be
14 written as:⁹

⁸ 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.

⁹ 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 (D-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.

1
$$r^*_3 = r_{A3} - r_D \times t_N \times (D/V) \quad (D-3a)$$

2
$$r_{E3} \times (E/V) + r_D \times (D/V) \times (1 - t_C) = r^*_3 \quad (D-3b)$$

3 which imply

4
$$r_{E3} = r_{A3} + \{r_{A3} - r_D \times [(1 - t_D)/(1 - t_E)]\} \times (D/E) \quad (D-3c)$$

5 Suppose, for example, that $t_C = 0.35$ percent, $t_E = 7.7$ percent and $t_D = 40$ percent. Then
6 $[(1 - t_D)/(1 - t_E)] = 0.65 = (1 - t_C)$. That condition corresponds to Miller's 1977 paper, in which
7 the net personal tax advantage of equity fully offsets the net corporate tax advantage of debt.
8 Note also that in that case, $t_N = 0$.¹⁰ Therefore, if the personal tax advantage on equity fully
9 offsets the corporate tax advantage on debt, Equation (D-3a) confirms that the overall after-
10 tax cost of capital is a constant.

11 However, it is unlikely that the personal tax advantage of equity fully offsets the
12 corporate tax advantage of debt. If taxes were all that mattered (i.e., if there were no other
13 costs to debt), the overall after-corporate-tax cost of capital would still fall as debt was
14 added, just not as fast.

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

¹⁰ In the above example, $t_N = \{[0.35 + 0.077 - 0.4 - (0.35 \times 0.077)] / (1.0 - 0.077)\} = 0.0 / 0.923 = 0$.

1 **B. NON-TAX EFFECTS**

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

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

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

13 Even if the company is generally healthy, more debt increases the risk that the
14 company cannot use all of the interest tax shields in a bad year. As debt continues to grow,
15 this problem grows and others may crop up. Management begins to worry about meeting
16 debt payments instead of making good operating decisions. Suppliers are less willing to
17 extend trade credit, and a liquidity shortage can translate into lower operating profits.
18 Ultimately, the firm might have to go through the costs of bankruptcy and reorganization.
19 Collectively, such factors are known as the costs of "financial distress."¹¹

¹¹ In addition to legal and administrative costs of financial distress, firms in financial distress incur indirect costs as management divert attention away from the firm's main business, conflicts arise between
(continued...)

1 The net tax advantage to debt, if positive, is affected by costs such as a growing risk
2 that the firm might have to bear the costs of financial distress. First, the expected present
3 value of these costs offsets the value added by the interest tax shield. Second, since the
4 likelihood of financial distress is greater in bad times when other investments also do poorly,
5 the possibility of financial distress will increase the risks investors bear. These effects
6 increase the variability of the value of the firm. Thus, firms that use too much debt can end
7 up with a higher overall cost of capital than those that use none.

8 Other parts of the answer include the signals companies send to investors by the
9 decision to issue new securities, and by the type of securities they issue. Other threads of
10 the literature explore cases where management acts against shareholder interests, or where
11 management attempts to “time” the market by issuing specific securities under different
12 conditions. For present purposes, the important point is that no theory, whether based on
13 taxes or on some completely different issue, has emerged as “the” explanation for capital
14 structure decisions by firms. Nonetheless, despite the lack of a single “best” theory, there
15 is a great deal of relevant empirical research.

16 **Q10. What does that research show?**

17 A10. The research does not support the view that debt makes a material difference in the value of
18 the firm, at least not once a modest amount of debt is in place. If debt were truly valuable,

¹¹ (...continued)
shareholders and creditors, suppliers and others restrict their dealings with the company, etc.

1 competitive firms should use as much as possible without producing financial distress, and
2 competitive firms that use less debt ought to be less profitable. The research shows exactly
3 the opposite.

4 For example, Kester¹² found that firms in the same industry in both the U.S. and
5 Japan do not band around a single, “optimal” capital structure, and the most profitable firms
6 are the ones that use the *least* debt. This finding comes despite the fact that both countries
7 at the time (unlike the U.S. currently) had fully “classical” tax systems, in which dividends
8 are taxed fully at both the corporate and personal level. Wald¹³ confirms that high
9 profitability implies low debt ratios in France, Germany, Japan, the U.K., and the U.S.
10 Booth *et al.* find the same result for a sample of developing nations.¹⁴ Fama and French¹⁵
11 analyze over 2000 firms for 28 years (1965-1992, inclusive) and conclude, “Our tests thus
12 produce no indication that debt has net tax benefits.”¹⁶ A recent paper by Graham¹⁷ carefully

¹² Carl Kester (1986), “Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Corporations,” *Financial Management*, 15:5-16.

¹³ John K. Wald (1999), “How Firm Characteristics Affect Capital Structure: An International Comparison,” *Journal of Financial Research*, 22:161-167.

¹⁴ 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 ...”

¹⁵ Eugene F. Fama and Kenneth R. French (1998), “Taxes, Financing Decisions and Firm Value,” *The Journal of Finance*, 53:819-843.

¹⁶ *Ibid.*, p. 841.

¹⁷ John R. Graham (2000), “How Big Are the Tax Benefits of Debt,” *The Journal of Finance*, 55:1901-1942.

1 analyzes the factors that might have led a firm not to take advantage of debt. It confirms that
2 a large proportion of firms that ought to benefit substantially from use of additional debt,
3 including large, profitable, liquid firms, appear not to use it “enough.”

4 This research leaves us with only three options: either (1) apparently good, profit-
5 generating managers are making major mistakes or deliberately acting against shareholder
6 interests, (2) the benefits of the tax deduction on debt are less than they appear, or (3) the
7 non-tax costs to use of debt offset the potential tax benefits. Only the first of these
8 possibilities is consistent with the view that the tax deductibility of debt conveys a material
9 cost advantage. Moreover, if the first explanation were interpreted to mean that otherwise
10 good managers are acting against shareholder interests, either deliberately or by mistake, it
11 would require the additional assumption that their competitors (and potential acquirers) let
12 them get away with it.

13 **Q11. Are there any explanations in the financial literature for this puzzle other than stupid**
14 **or self-serving managers at the most profitable firms?**

15 A11. Yes. For example, Stewart C. Myers, a leading expert on capital structure, made it the topic
16 of his Presidential Address to the American Finance Association.¹⁸ The poor performance
17 of tax-based explanations for capital structure led him to propose an entirely different
18 mechanism, the “pecking order” hypothesis. This hypothesis holds that the net tax benefits

¹⁸ 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 and Investment Decisions When Firms Have Information that Investors Do Not Have,” *Journal of Financial Economics* 13:187-222.

1 of debt (i.e., corporate tax advantage over personal tax disadvantage) are at most of a second
2 order of importance relative to other factors that drive actual debt decisions.¹⁹ Similarly,
3 Baker and Wurgler (2002)²⁰ observe a strong and persistent impact that fluctuations in
4 market value have on capital structure. They argue that this impact is not consistent with
5 other theories. The authors suggest a new capital structure theory based on market timing --
6 capital structure is the cumulative outcome of attempts to time the equity market.²¹ In this
7 theory, there is no optimal capital structure, so market timing financing decisions just
8 accumulate over time into the capital structure outcome. (Of course, this theory only makes
9 sense if investors do not recognize what managers are doing.)

10 **Q12. Do inter-firm differences within an industry explain the wide variations in capital**
11 **structure across the firms in an industry?**

12 A12. No. This view is contradicted by the empirical research. As mentioned before, it has long
13 been found that the most profitable firms in an industry, i.e., those in the best position to take
14 advantage of debt, use the least.²² Graham (2000) carefully examines differences in firm
15 characteristics as possible explanations for why firms use “too little” debt and concludes that

¹⁹ 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.

²⁰ Malcolm Baker and Jeffrey Wurgler (2002), “Market Timing and Capital Structure,” *The Journal of Finance* 57:1-32.

²¹ *Ibid.*, p. 29.

²² For example, Kestler, *op. cit.* and Wald, *op. cit.*

1 such differences are *not* the explanation: firms that ought to benefit substantially from more
2 debt by all measurable criteria, if the net tax advantage of debt is truly valuable, voluntarily
3 do not use it.²³

4 Nor does the research support the view that firms are constantly trying to adjust their
5 capital structures to optimal levels. Additional research on the pecking order hypothesis
6 demonstrates that firms do not tend towards a target capital structure, or at least do not do
7 so with any regularity, and that past studies that seemed to show the contrary actually lacked
8 the power to distinguish whether the hypothesis was true or not.²⁴ In the words of the
9 Shyam-Sunder - Myers paper p. 242, “If our sample companies did have well-defined
10 optimal debt ratios, it seems that their managers were not much interested in getting there.”

11 **II. EXPANDED EXAMPLE**

12 **Q13. What topics do you cover in this section?**

13 A13. The discussion in my testimony did not detail the impact of different starting points for the
14 level of debt not did it address income earned on the investment, interest expense, or taxes.

²³ 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* 40, 259-281, 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 the traditional static analysis (of the sort used by Graham).

²⁴ 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.

This section covers these topics. First, it discusses how the level of debt affects the cost of equity detail. Second, it discusses the effect of earning and income on the investment and interest expenses. Third, it addresses tax effects.

A. DETAILS OF DIFFERENT LEVELS OF DEBT

Q14. What happens if the investor finances the real estate purchase with 0 percent, 30 percent, 50 percent or 70 percent debt?

A14. Table D-1 below calculates the return on equity at each level of debt when real estate prices increases by 10 percent.

Table D-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

1 increases the return on equity by 13.3 percent. This illustrates a general point; the rate of
2 return on equity increases more quickly at higher levels of debt than at lower levels.
3 Investors demand a higher rate of return to bear more risk and debt magnifies equity's risk
4 at an ever increasing rate. Therefore, the required rate of return goes up at an ever increasing
5 rate as debt is added. This is not only basic finance theory, it is the everyday experience of
6 anyone who buys a home. The bigger the mortgage, the more percentage risk the equity
7 faces from changes in housing prices.

8 **B. THE IMPACT OF INCOME AND INTEREST**

9 **Q15. How does earning income from the investment and paying interest on debt affect the**
10 **results?**

11 A15. In the following, I ignore income taxes which I deal with in Section C. Assume the investor
12 is receiving income, e.g., rent, from the real estate. Specifically, assume the investor
13 receives \$500 per month in income after all non-interest expenses (\$6,000 per year). Also,
14 assume that the expected appreciation is 5 percent per year, so the expected market value is
15 \$105,000 after one year. Then the expected rate of return from the real estate with all equity
16 financing is:

17
18
19
20

$$\begin{array}{l} \text{Expected Return} \\ \text{on Equity} \\ \text{@ 0\% Debt} \end{array} = \frac{\text{Expected Net Income} + \text{Expected Appreciation}}{\text{Initial Investment}}$$

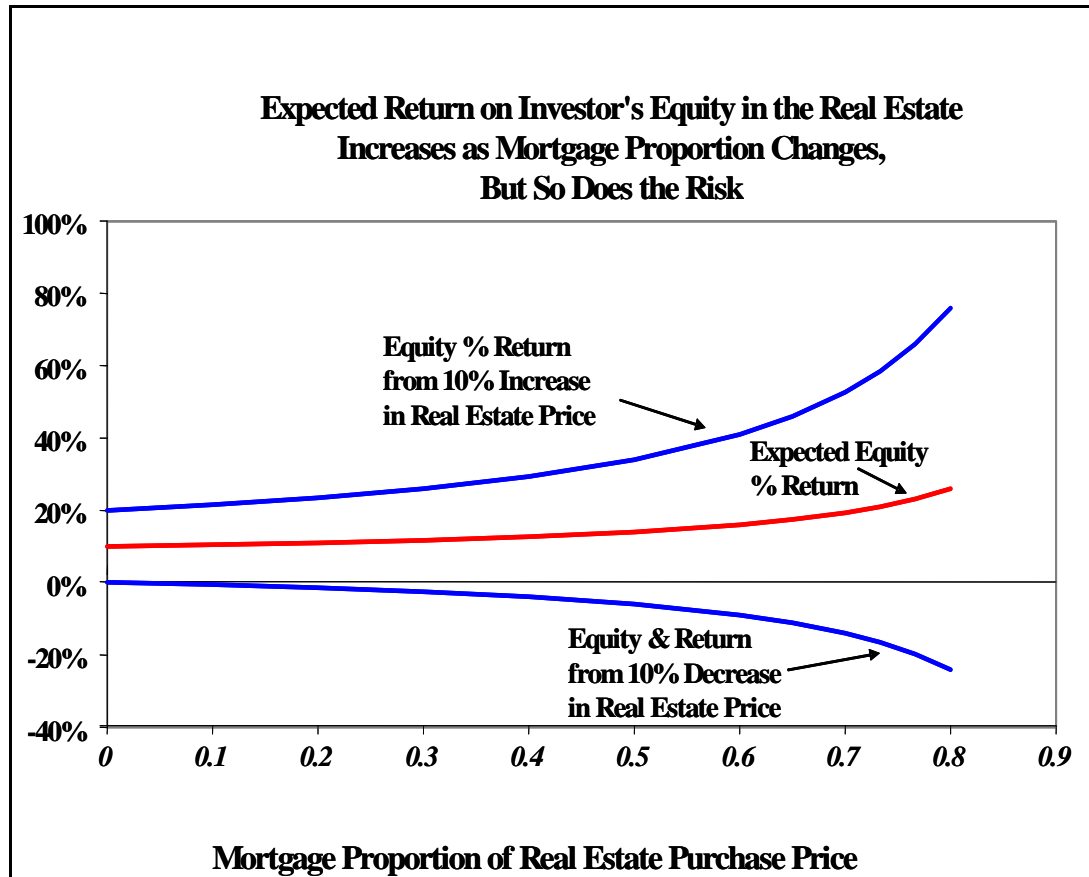


Figure D-1

1
2
3
4
5
6

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 bear 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 at the mortgage percentage increases, too.

²⁵ (...continued)
the general shape of the graphs remains the same.

1 **Q17. What are the implications of this example?**

2 A17. Any time an individual or a company uses debt to finance part an investment, the same risk
3 magnifies. For example, if an investor buy stocks “on margin” -- by borrowing part of the
4 money used to buy the stock -- the expected rate of return will be higher as will the risks the
5 investor carries. As an everyday example, imagine investing your retirement savings in a
6 stock portfolio bought with as much margin as possible. If you were lucky, you could end
7 up living very well in retirement. But you would be taking a lot of risk of the opposite
8 outcome, since your portfolio could decline by more than 100 percent of your initial
9 investment.

10 The same risk-magnifying effects happen when companies borrow to finance part of
11 their investments.

12 **C. THE EFFECT OF TAXES**

13 **Q18. What is the impact of taxes?**

14 A18. Analyzing the net effect of taxes in capital structure decisions by corporations is an
15 important part of the financial research. (Other parts of that research address such issues as
16 the risk of financial distress or bankruptcy, and the signals corporations send investors by
17 the choice of how to finance new investments.) The bottom line is that taxes complicate the
18 picture without changing the basic conclusion.

19 **Q19. Please describe the potential impact of taxes.**

1 A19. Interest expense is tax-deductible for corporations. That increases the pool of cash the
2 corporation gets to keep out of its operating earnings (i.e., its earnings before interest
3 expense). With no debt, 100 percent of operating income is subject to taxes. With debt, only
4 the equity part of the operating income is subject to taxes.

5 All else equal, the extra money kept from operating income increases the value of the
6 corporation. The standard way to recognize that increase in value is to use an after-tax
7 weighted-average cost of capital as a discount rate when valuing a company's operating cash
8 flows.

9 **Q20. Do personal taxes affect the value of debt, too?**

10 A20. Yes, but in the other direction. One offset to debt's tax benefits at the corporate level is its
11 higher tax burden at the personal level. Investors care about the money they get to keep after
12 all taxes are paid, and while the corporation saves taxes by opting for debt over equity,
13 individuals pay more taxes on interest than on capital gains from equity (and for now, on
14 dividends as well).

15 **Q21. Are there factors other than taxes matter?**

16 A21. Absolutely. "All else" does not remain equal as more debt is added. The more debt, the
17 more the non-tax effects of debt offset the tax benefits. Other costs include such effects as
18 a loss of flexibility, the possibility of sending negative signals to investors, and a host of
19 costs and risks associated with the danger of financial distress.

1 **Q22. Does the tradeoff between the tax and non-tax effects of debt mean that firms have**
2 **well-defined, optimal capital structures?**

3 A22. No, this sort of “tradeoff” model does not explain actual corporate behavior. A substantial
4 body of economic research confirms that real-world corporations act as if, after a moderate
5 amount of debt is in place, the tax benefits of debt are not worth debt’s other costs. In
6 country after country and in industry after industry, the most profitable corporations in an
7 industry tend to use the least debt. The research on this point is quite thorough, and the
8 finding that the most profitable companies tend to use the least debt in a given industry is
9 robust. Yet these are the companies with the most operating income to shield from taxes,
10 who would benefit most if interest tax shields were truly valuable net of debt’s other costs.
11 They also presumptively are the best-managed on average (else why are they the most
12 profitable?).

13 This means it is unrealistic to suppose that more debt is always better, or that greater
14 tax savings due to higher interest expense always add value to the firm on balance.

15 **Q23. If the tradeoff model doesn’t explain capital structure decisions by firms, is there a**
16 **model that does?**

17 A23. No single model as (yet) emerged as ‘the’ explanation of capital structure. However, several
18 alternative models attempt to model the tradeoff (e.g., the “pecking order” hypothesis and
19 “agency cost” explanations).

1 **Q24. What does the absence of an agreed theory of capital structure in the financial**
2 **literature imply about the overall effect of debt on the value of the firm?**

3 A24. The findings of the financial literature mean that within an industry, there is no well-defined
4 optimal capital structure. The use of some debt does convey some value advantage in most
5 industries, but that advantage is offset by other costs as firms add more debt.²⁶ The range
6 of capital structures over which the value of the firm in any industry is maximized is wide
7 and should be treated as flat. The location and level of that range, however, does vary from
8 industry to industry, just as the overall cost of capital varies from industry to industry.

9 Figure D-2 illustrates the picture that emerges from the research. This figure shows
10 the present value of an investment in each of four different industries. For simplicity, the
11 investment is expected to yield \$1.00 per year forever. For firms in relatively high-risk
12 industries (Industry 1 in the graph, the lowest line), the \$1.00 perpetuity is not worth much
13 and any use of debt decreases firm value. For firms in relatively low-risk industries
14 (Industry 4 in the graph), the perpetuity is worth more and substantial amounts of debt make
15 sense. Industries 2 and 3 are intermediate cases.

²⁶ 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.

1 The maximum net rate at which taxes can increase value in this figure equals 20
2 percent of interest expense, representing a balance between the corporate tax advantage to
3 debt and the personal tax disadvantage. The figure plots the maximum possible impact of
4 taxes on value as a separate line, starting at the all-equity value of the lowest-risk industry
5 (Industry 4).

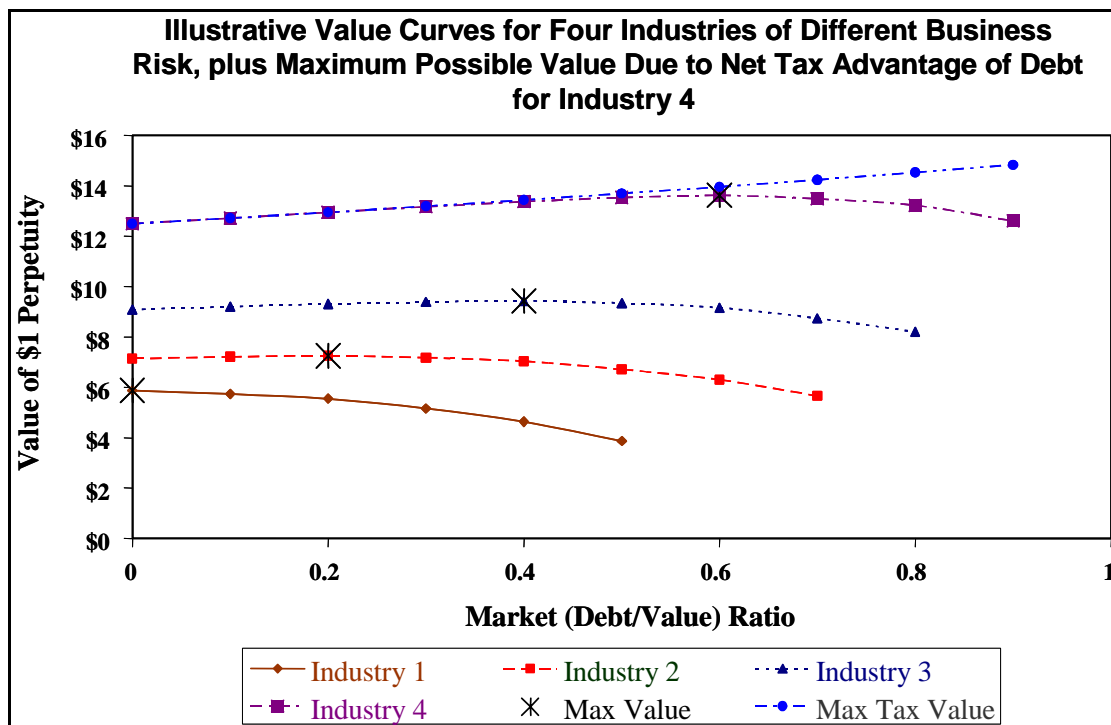


Figure D-2

6 Figure D-2 identifies a particular point as the maximum value on each of the four
7 curves. However, the research shows that reliable identification of this maximum point,
8 except in the extreme case where no debt should be used, is impossible. In accord with the
9 research, the graph is prepared so that in none of the industries does a change in capital

1 structure make much difference near the top of the curve. Even Industry 4, which increases
2 in value at the maximum rate as quite a lot of debt is added, eventually must reach a broad
3 range where changes in the debt ratio make little difference to firm value, given the research.
4 For Industry 4, debt makes less than a 2 percent difference in the total value of the firm for
5 debt-to-value ratios between 40 and 70 percent. (While these particular values are
6 illustrative, numbers of this order of magnitude are the only ones consistent with the
7 research.)

8 **Q25. What does this imply for the overall cost of capital?**

9 A25. Figure D-3 plots the after-tax weighted-average costs of capital (“ATWACCs”) that
10 correspond to the value curves in Figure D-2. This picture just turns Figure D-2 upside
11 down.²⁷ All the same conclusions remain, except that they are stated in terms of the overall
12 cost of capital instead of the overall firm value. In particular, except for high-risk industries,
13 the overall cost of capital is essentially flat across a broad middle range of capital structures
14 for each industry, which is the only outcome consistent with the research. For Industry 4,
15 for example, the ATWACC changes by less than 15 basis points for debt-to-value ratios
16 between 40 and 70 percent.

²⁷ Note that the actual estimated ATWACC at higher debt ratios will tend to underestimate the ATWACC that corresponds to the value curves in Figure D-2, which are depicted in Figure D-3, and so will tend to overestimate the value of debt to the firm. The reason is that some of the non-tax effects of excessive debt, such as a loss of financial flexibility, may be hard to detect and not show up in cost of capital measurement.

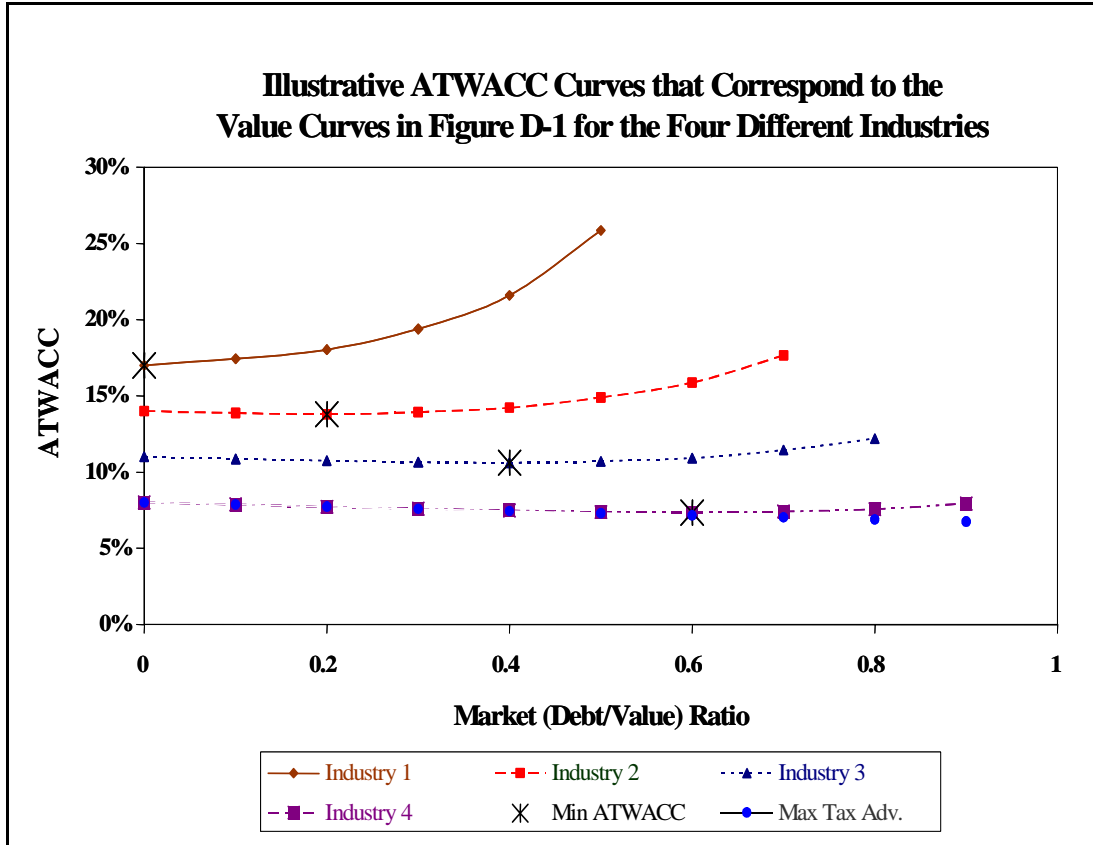


Figure D-3

1 Q26. How does this discussion relate to estimation of the right cost of equity for ratemaking
 2 purposes?

3 A26. When an analyst estimates the cost of equity for a sample of companies, s/he does so at the
 4 sample's actual market-value capital structure. That is, the sample evidence corresponds to
 5 ATWACCs that are already out somewhere in the broad middle range in which changes in
 6 the debt ratio have little or no impact on the overall value of the firm or the ATWACC.

1 An analyst therefore should assume the ATWACCs for the sample companies are
2 literally flat. This assumption always provides the exact tradeoff between the cost of equity
3 and capital structure at the literal minimum of the company's ATWACC curve. The
4 research shows that this minimum is actually a broad, flat region, as depicted above. If the
5 company happens to be somewhat to one side or the other of the literal minimum within this
6 region, the recommended procedure may lead to a small understatement or overstatement
7 of the amount that the cost of equity will change as capital structure changes. The degree
8 of this under- or overstatement, however, is very small compared to the inherent uncertainty
9 in estimating the cost of equity in the first place. Otherwise, the financial research would
10 have found very different results about the existence of a narrowly defined optimal capital
11 structure.

12 **D. COMBINED EFFECTS**

13 **Q27. Please summarize the implications for the combined impact of the tax and non-tax**
14 **effects of debt.**

15 A27. The most profitable firms do not behave as if the precise amount of debt they use makes any
16 material difference to value, and competition does not force them into an alternative
17 decision, as it would if debt were genuinely valuable. The explanation that fits the facts and
18 the research is that within an industry, there is no well-defined optimal capital structure. Use
19 of some debt does convey an advantage in most industries, but that advantage is offset by
20 other costs as firms add more debt. The range of capital structures over which the value of

1 the firm in any industry is maximized is wide and should be treated as flat. The location and
2 level of that range, however, does vary from industry to industry, just as the overall cost of
3 capital varies from industry to industry. To conclude that more debt does add more value,
4 once the firm is somewhere in the normal range for the industry, is to conclude that corporate
5 management in general is either blind to an easy source of value or otherwise incompetent
6 (and that their competitors let them get away with it).

7 The finding that there is no narrowly defined optimal capital structure implies that
8 analysts should estimate the ATWACCs for a sample of companies in a given industry and
9 treat the average ATWACC value as independent of capital structure (at least within a broad
10 middle range of capital structures). The right cost of equity for a rate-regulated company in
11 the same industry is the number that yields the same ATWACC at the capital structure used
12 to set the revenue requirement, since that is the cost of equity that (estimation problems
13 aside) the sample companies would have had if their market-value capital structures had
14 been equal to the regulatory capital structure.