BEFORE THE TENNESSEE PUBLIC UTILITY COMMISSION
NASHVILLE, TENNESSEE

February 15, 2018

IN RE:	)	
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CHATTANOOGA GAS COMPANY	)	
PETITION FOR APPROVAL OF AN	)	
ADJUSTMENT IN RATES AND	)	**Docket No.**
TARIFF; THE TERMINATION OF	)	**18-**_00017
THE AUA MECHANISM AND THE	)	
RELATED TARIFF CHANGES AND	)	
REVENUE DEFICIENCY	)	
RECOVERY; AND AN ANNUAL	)	
RATE REVIEW MECHANISM	)	

DIRECT TESTIMONY OF

JAMES H. VANDER WEIDE, Ph. D

ON BEHALF OF

CHATTANOOGA GAS COMPANY

I. INTRODUCTION AND PURPOSE

Q. Please state your name, title, and business address.

A. My name is James H. Vander Weide. I am President of Financial Strategy Associates, a firm that provides strategic and financial consulting services to business clients. My business address is 3606 Stoneybrook Drive, Durham, North Carolina 27705.

Q. Please describe your educational background and prior academic experience.

A. I graduated from Cornell University with a Bachelor's Degree in Economics and from Northwestern University with a Ph.D. in Finance. After joining the faculty of the School of Business at Duke University, I was named Assistant Professor, Associate Professor, Professor, and then Research Professor. I have published research in the areas of finance and economics and taught courses in these fields at Duke for more than thirty-five years. I am now retired from my teaching duties at Duke. A summary of my research, teaching, and other professional experience is presented in Exhibit JVW-2, Appendix 1.

Q. Have you previously testified on financial or economic issues?

A. Yes. As an expert on financial and economic theory and practice, I have participated in more than five hundred regulatory and legal proceedings before the public service commissions of forty-five states and four Canadian provinces, the United States Congress, the Federal Energy Regulatory Commission, the National Energy Board (Canada), the Federal Communications Commission, the Canadian Radio-Television and Telecommunications Commission, the National Telecommunications and Information Administration, the insurance commissions of five states, the Iowa State Board of Tax Review, the National Association of Securities Dealers, and the North Carolina Property Tax Commission. In addition, I have prepared expert testimony in proceedings before the United States District Court for the District of Nebraska; the United States District Court for the District of New Hampshire; the United States District Court for the District of Northern Illinois; the United States District Court for the Eastern District of North Carolina; the United States District Court for the Northern District of California; the United States District Court for the Eastern District of Michigan; the United States Bankruptcy Court for the Southern District of West Virginia; the Montana Second Judicial District Court, Silver Bow County; the Superior Court, North Carolina, and the Supreme Court of the State of New York.

Q. What is the purpose of your testimony?

A. I have been asked by Chattanooga Gas Company ("CGC") to prepare an independent appraisal of CGC's cost of equity and to recommend to the Tennessee Public Utility Commission ("TPUC" or "the Commission") a rate of return on equity that is fair, that allows CGC to attract capital on reasonable terms, and that allows CGC to maintain its financial integrity.

II. SUMMARY OF TESTIMONY

Q. How do you estimate CGC's cost of equity?

A. I estimate CGC's cost of equity by applying several standard cost of equity methods to market data for a proxy group of natural gas utility companies of comparable business risk.

Q. Why do you use several standard cost of equity methods to estimate CGC's cost of equity?

A. I use several standard cost of equity methods to estimate CGC's cost of equity because the results of each method can be used to test the reasonableness of the results from a particular model. In addition, changes in capital market conditions at points in time may cause any particular method to produce unusually high or unusually low results. Thus, using the average result from several methods may provide a more reasonable estimate of a company's cost of equity.

Q. Why do you apply your cost of equity methods to a proxy group of utilities with comparable business risk, rather than solely to CGC?

A. I apply my cost of equity methods to a proxy group of utilities with comparable business risk because standard cost of equity methods such as the discounted cash flow ("DCF"), risk premium, and capital asset pricing model ("CAPM") require inputs of quantities that are not easily measured. The problem of difficult-to-measure inputs is especially acute for CGC because CGC does not have publicly-traded stock. Because these inputs can only be estimated, there is naturally some degree of uncertainty surrounding the estimate of the cost of equity for each company. However, the uncertainty in the estimate of the cost of equity for an individual company can be greatly reduced by applying cost of equity methods to a sample of comparable companies.

Intuitively, unusually high estimates for some individual companies are offset by unusually low estimates for other individual companies. Thus, financial economists invariably apply cost of equity methods to a group of comparable companies. In utility regulation, the practice of using a group of comparable companies, called the comparable company approach, is further supported by the United States Supreme Court standard that the utility should be allowed to earn a return on its investment that is commensurate with returns being earned on other investments of the same risk. *See Federal Power Comm'n v. Hope Natural Gas Co.*, 320 U.S. 561, 603 (1944), and *Bluefield Water Works and Improvement Co. v. Public Service Comm'n.* 262 U.S. 679, 692 (1923).

Q. What cost of equity do you find for your comparable companies in this proceeding?

A. On the basis of my studies, I find that the cost of equity for my comparable companies is 10.3 percent. This conclusion is based on my application of standard cost of equity estimation techniques, including the DCF model, the ex ante risk premium approach, the ex post risk premium approach, and the CAPM, to a broad group of companies of comparable ***business*** risk. As noted below, the cost of equity for my proxy companies must be adjusted to reflect the higher *financial* risk associated with CGC's ratemaking capital structure compared to the financial risk associated with the average market-value capital structure of my proxy company group. Making this adjustment produces a cost of equity for CGC equal to 11.4 percent. However, to be conservative, I conclude that CGC's fair rate of return on equity is equal to 11.25 percent. As discussed below, my 11.25 percent recommended fair rate of return produces an overall return that is approximately equal to the average overall return being requested by natural gas utilities in 2017.

Q. You note that your comparable company group has comparable business risk to CGC, but less financial risk than CGC. What is the difference between business risk and financial risk?

A. Business risk is the underlying risk that investors will earn less than their required return on investment when the investment is financed entirely with equity. Financial risk is the additional risk of earning less than the required return when the investment is financed with both fixed-cost debt and equity.

Q. You are adjusting the cost of equity of your proxy companies to reflect the higher financial risk in CGC's ratemaking capital structure. Why is that adjustment needed?

A. This adjustment is needed because the cost of equity for my proxy companies measures the return investors require in the capital markets on other investments of comparable risk, including both business risk and financial risk. Although my proxy company group has comparable business risk to CGC, the proxy group has less financial risk than CGC because CGC's recommended ratemaking capital structure contains a higher percentage of debt and a lower percentage of equity than the average market value capital structure investors use to measure the financial risk of investing in the proxy companies. It is both logically and economically inconsistent to apply a cost of equity developed for a sample of companies with a specific degree of financial risk to a capital structure with a different degree of financial risk. One must adjust the cost of equity for my proxy companies upward in order for investors in CGC to have an opportunity to earn a return on their investment in CGC that is commensurate with returns they could earn on other investments of comparable risk.

Q. Can you quantify the difference between CGC's financial risk, as reflected in its ratemaking capital structure, and the financial risk of your proxy companies as measured in the marketplace?

A. Yes. CGC's ratemaking capital structure in this proceeding contains 6.29 percent short-term debt, 44.41 percent long-term debt, and 49.30 percent common equity. The current average market value capital structure for my proxy group of companies contains approximately 8 percent short-term debt, 24 percent long-term debt, and 68 percent common equity. Because current market values of equity are at historically high levels, I have also examined the average market value capital structure for the Value Line natural gas utilities over a ten-year period; and I find that the average market value capital structure for the Value Line natural gas utilities contains approximately 9 percent short-term debt, 33 percent long-term debt, and 58 percent equity. Thus, the financial risk of CGC as reflected in its ratemaking capital structure is significantly greater than the financial risk reflected in the cost of equity estimates of my proxy company group.

Q. Do you have exhibits accompanying your testimony?

A. Yes. I have prepared or supervised the preparation of Exhibit JVW-1 consisting of eleven schedules and Exhibit JVW-2 consisting of five appendices that accompany my testimony. The information contained in my exhibits is true and correct to the best of my knowledge and belief.

III. ECONOMIC AND LEGAL PRINCIPLES

Q. How do economists define the required rate of return, or cost of capital, associated with particular investment decisions such as the decision to invest in natural gas utility plant and equipment?

A. Economists define the cost of capital as the return investors expect to receive on alternative investments of comparable risk.

Q. How does the cost of capital affect a firm's investment decisions?

A. The goal of a firm is to maximize the value of the firm. This goal can be accomplished by investing only in that plant and equipment with an expected rate of return that is equal to or greater than the cost of capital. Thus, a firm should continue to invest in plant and equipment only so long as the return on its investment is greater than or equal to its cost of capital.

Q. How does the cost of capital affect investors' willingness to invest in a company?

A. The cost of capital measures the return investors can expect on investments of comparable risk. The cost of capital also measures the required rate of return on investment because rational investors will not invest if they expect a return that is less than the cost of capital. Thus, the cost of capital is a hurdle rate for both investors and the firm.

Q. Do all investors have the same position in the firm?

A. No. Debt investors have a fixed claim on a firm's assets and income that must be paid prior to any payment to the firm's equity investors. Since the firm's equity investors have a residual claim on the firm's assets and income, equity investments are riskier than debt investments. Thus, the cost of equity exceeds the cost of debt.

Q. What is the overall or average cost of capital?

A. The overall or average cost of capital is a weighted average of the cost of debt and cost of equity, where the weights are the percentages of debt and equity in a firm's capital structure.

Q. Can you illustrate the calculation of the overall or weighted average cost of capital?

A. Yes. Assume that the cost of debt is 7 percent, the cost of equity is 13 percent, and the percentages of debt and equity in the firm's capital structure are 50 percent and 50 percent, respectively. Then the weighted average cost of capital is expressed by 0.50 times 7 percent plus 0.50 times 13 percent, or 10.0 percent.

Q. How do economists define the cost of equity?

A. Economists define the cost of equity as the return investors expect to receive on alternative equity investments of comparable risk. Since the return on an equity investment of comparable risk is not a contractual return, the cost of equity is more difficult to measure than the cost of debt. However, as I have already noted, there is agreement among economists that the cost of equity is greater than the cost of debt. There is also agreement among economists that the cost of equity, like the cost of debt, is both forward looking and market based.

Q. How do economists measure the percentages of debt and equity in a firm's capital structure?

A. Economists measure the percentages of debt and equity in a firm's capital structure by first calculating the market value of the firm's debt and the market value of its equity. Economists then calculate the percentage of debt by the ratio of the market value of debt to the combined market value of debt and equity, and the percentage of equity by the ratio of the market value of equity to the combined market value of debt and equity. For example, if a firm's debt has a market value of $25 million and its equity has a market value of $75 million, then its total market capitalization is $100 million, and its capital structure contains twenty-five percent debt and seventy-five percent equity.

Q. Why do economists measure a firm's capital structure in terms of the market values of its debt and equity?

A. Economists measure a firm's capital structure in terms of the market values of its debt and equity because: (1) the weighted average cost of capital is defined as the return investors expect to earn on a portfolio of the company's debt and equity securities; (2) investors measure the expected return and risk on their portfolios using market value weights, not book value weights; and (3) market values are the best measures of the amounts of debt and equity investors have invested in the company on a going forward basis.

Q. Why do investors measure the expected return and risk on their investment portfolios using market value weights rather than book value weights?

A. Investors measure the expected return and risk on their investment portfolios using market value weights because: (1) the expected return on a portfolio is calculated by comparing the expected value of the portfolio at the end of the investment period to its current value; (2) the risk of a portfolio is calculated by examining the variability of the end-of-period return on the portfolio about the expected value; and (3) market values are the best measure of the current value of the portfolio. From the investor's point of view, the historical cost, or book value of the investment, is irrelevant for the purpose of assessing the required return and risk on their portfolios because if they were to sell their investments, they would receive market value, not historical cost. Thus, the return can only be measured in terms of market values.

Q. Is the economic definition of the weighted average cost of capital consistent with regulators' traditional definition of the average cost of capital?

A. No. The economic definition of the weighted average cost of capital is based on the market costs of debt and equity, the market value percentages of debt and equity in a company's capital structure, and the future expected risk of investing in the company. In contrast, regulators have traditionally defined the weighted average cost of capital using the embedded cost of debt and the book or accounting values of debt and equity shown on a company's balance sheet. A company's market value capital structure generally differs from its book value capital structure because the market value capital structure reflects the current values of the company's debt and equity in the capital markets, whereas the company's book value capital structure reflects the values of the company's debt and equity based on historical accounting costs.

Q. Will investors have an opportunity to earn a fair return on the value of their equity investment in the company if regulators calculate the weighted average cost of capital using the book value of equity in the company's capital structure?

A. No. Investors will only have an opportunity to earn a fair return on the value of their equity investment if regulators either: (1) calculate the weighted average cost of capital using the market value of equity in the company's capital structure; or (2) adjust the cost of equity for the difference between the financial risk reflected in the market value capital structures of the proxy companies and the financial risk reflected in the company's ratemaking capital structure.

Q. Are the economic principles regarding the fair return for capital recognized in any United States Supreme court cases?

A. Yes. These economic principles, relating to the supply of and demand for capital, are recognized in two United States Supreme Court cases: (1) *Bluefield Water Works and Improvement Co. v. Public Service Comm'n. of W. Va.*; and (2) *Federal Power Comm'n v. Hope Natural Gas Co*. In *Bluefield Water Works*, the Court stated:

> A public utility is entitled to such rates as will permit it to earn a return upon the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties; but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility, and should be adequate, under efficient and economical management, to maintain and support its credit,

> and enable it to raise the money necessary for the proper discharge of its public duties. [*Bluefield Water Works and Improvement Co. v. Public Service Comm'n.* 262 U.S. 679, 692 (1923).]

The Court clearly recognizes here that: (1) a regulated firm cannot remain financially sound unless the return it is allowed to earn on the value of its property is at least equal to the cost of capital (the principle relating to the demand for capital); and (2) a regulated firm will not be able to attract capital if it does not offer investors an opportunity to earn a return on their investment equal to the return they expect to earn on other investments of the same risk (the principle relating to the supply of capital).

In the *Hope Natural Gas* case, the Court reiterates the financial soundness and capital attraction principles of *Bluefield Water Works*:

> From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock.... By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital. [*Federal Power Comm'n v. Hope Natural Gas Co.*, 320 U.S. 591, 603 (1944).]

The Court clearly recognizes that the fair rate of return on equity should be: (1) comparable to returns investors expect to earn on other investments of similar risk; (2) sufficient to assure confidence in the company's financial integrity; and (3) adequate to maintain and support the company's credit and to attract capital.

IV. BUSINESS AND FINANCIAL RISKS

Q. How do investors estimate the expected rate of return on specific investments, such as an investment in CGC?

A. Investors estimate the expected rate of return in several steps. First, they estimate how much they are going to invest in the company. Second, they estimate the timing and amounts of the cash flows they expect to receive from their investment over the life of the investment. Third, they determine the return, or discount rate, that equates the present value of the expected cash receipts from their investment in the company to the current value of their investment in the company.

Q. Are the returns on investment opportunities, such as an investment in CGC, known with certainty at the time the investment is made?

A. No. The return on an investment in CGC depends on the Company's expected future cash flows over the life of the investment, as discussed above. Since the Company's expected future cash flows are uncertain at the time the investment is made, the return on the investment is also uncertain.

Q. You note that investors require a return on investment that is equal to the return they expect to receive on other investments of similar risk. Does the required return on an investment depend on the investor's estimate of the risk of that investment?

A. Yes. Since investors are averse to risk, they require a higher rate of return on investments with greater risk.

Q. What fundamental risk do investors face when they invest in a company such as CGC?

A. Investors face the fundamental risk that their realized, or actual, return on investment will be less than their required return on investment.

Q. How do investors measure investment risk?

A. Investors generally measure investment risk by estimating the probability, or likelihood, of earning less than the required return on investment. For investments with potential returns distributed symmetrically about the expected, or mean, return, investors can also measure investment risk by estimating the variance, or volatility, of the potential return on investment.

Q. What are the primary determinants of a natural gas utility's business risk?

A. The business risk of investing in natural gas utilities such as CGC is caused by: (1) demand uncertainty; (2) operating expense uncertainty; (3) investment cost uncertainty; (4) high operating leverage; and (5) regulatory uncertainty.

Q. How does demand uncertainty affect a natural gas utility's business risk?

A. Demand uncertainty affects a natural gas utility's business risk through its impact on the variability of the company's revenues and its return on investment. The greater the uncertainty in demand, the greater is the uncertainty in the company's revenues and its return on investment.

Q. What causes the demand for natural gas distribution services to be uncertain?

A. Natural gas distribution utilities experience demand uncertainty in both the short-run and the long-run. Short-run demand uncertainty is caused by the strong dependence of natural gas demand on the state of the economy, the average temperature during the peak heating season, and the possibility of service interruptions due to accidents and/or natural disasters. Long-run demand uncertainty is caused by (1) the sensitivity of demand to changes in rates; (2) customer efforts to conserve energy; (3) the ability of customers to switch to alternative sources of energy such as electricity or propane; and (4) customer use of more efficient appliances.

Q. How does short-run demand uncertainty affect a natural gas utility's business risk?

A. Short-run demand uncertainty affects a natural gas utility's business risk through its impact on the variability of the company's revenues and its return on investment. The greater the short-run uncertainty in demand, the greater is the uncertainty in the company's yearly revenues and return on investment.

Q. How does long-run demand uncertainty affect a natural gas utility's business risk?

A. Long-run demand uncertainty affects a natural gas utility's business risk through its impact on the utility's revenues over the life of its plant investments. Long-run demand uncertainty creates greater risk for natural gas utilities because investments in gas utility infrastructure are long-lived and irreversible. If demand turns out to be less than expected over the life of the investment, the utility may not be able to generate sufficient revenues over the life of the investment to cover its operating expenses and earn a fair return on its investment.

Q. Does CGC experience demand uncertainty?

A. Yes. CGC experiences demand uncertainty in both the short run and the long run. The Company experiences short-run demand uncertainty as a result of economic cycles, such as times of economic uncertainty, when fewer homes are built, fewer new businesses are started, and factories are running at less than full capacity; and as a result of weather patterns, such as unusually warm winters and cool summers. CGC experiences long-run demand uncertainty when it invests in major long-lived plant additions or replacements that are expected to remain in service over the next thirty or forty years.

Q. Why are a natural gas utility's operating expenses uncertain?

A. Operating expense uncertainty arises as a result of variability in (1) purchased gas costs; (2) pipeline capacity costs; (3) employee-related costs such as salaries and wages, pensions, and insurance; (4) maintenance and materials costs; and (5) bad debt expenses.

Q. Why are a natural gas utility's investment costs uncertain?

A. The natural gas utility business requires large investments in the storage and distribution facilities required to deliver natural gas to customers. The future amounts of required investment in storage and distribution facilities are uncertain because of variability in forecasts of: (1) long-run demand; (2) the potential significant costs of complying with environmental, health, and safety laws and regulations; (3) costs to maintain and replace aging plant and equipment; and (4) costs required to assure adequate natural gas supply to meet forecasted demand.

Q. You note that uncertainty associated with the costs of complying with environmental, health, and safety laws and regulations is a cause of a gas utility's investment cost uncertainty. Are investors aware of the risk that Southern Company's natural gas utility subsidiaries, including CGC, may face increasing costs of complying with environmental, health, and safety laws and regulations?

A. Yes. The Southern Company reports in its 2016 Form 10-K that the costs of compliance with current and future environmental laws and regulations are a significant risk factor for Southern Company and its subsidiaries:

> The Southern Company system is subject to extensive federal, state, and local environmental requirements which, among other things, regulate air emissions, GHG [greenhouse gases], water usage and discharge, release of hazardous substances, and the management and disposal of waste in order to adequately protect the environment. Compliance with these environmental requirements requires the traditional electric operating companies, Southern Power, and Southern Company Gas to commit significant expenditures, including installation and operation of pollution control equipment, environmental monitoring, emissions fees, remediation costs, and/or permits at substantially all of their respective facilities. Southern Company, the traditional electric operating companies, Southern Power, and Southern Company Gas expect that these expenditures will continue to be significant in the future. [The Southern Company 2016 Form 10-K at I-20]

Q. You note above that high operating leverage contributes to the business risk of natural gas utilities. What is operating leverage?

A. Operating leverage is the increased sensitivity of a company's earnings to sales variability that arises when some of the company's costs are fixed.

Q. How do economists measure operating leverage?

A. Economists typically measure operating leverage by the ratio of a company's fixed expenses to its operating margin (revenues minus variable expenses).

Q. What is the difference between fixed and variable expenses?

A. Fixed expenses are expenses that do not vary with output, and variable expenses are expenses that vary directly with output. For natural gas utilities, fixed expenses include the fixed component of operating and maintenance costs, depreciation and amortization, and taxes. Variable expenses include fuel costs and the variable component of operations and maintenance costs.

Q. Do natural gas utilities experience high operating leverage?

A. Yes. As noted above, operating leverage increases when a firm's commitment to fixed costs rises in relation to its operating margin on sales. The relatively high degree of fixed costs in the natural gas utility business arises primarily from: (1) the average natural gas utility's large investment in fixed, long-lived plant and equipment; and (2) the relative "fixity" of a natural gas utility's operating and maintenance costs. High operating leverage causes the average natural gas utility's operating income to be highly sensitive to demand and revenue fluctuations.

Q. How does operating leverage affect a company's business risk?

A. Operating leverage affects a company's business risk through its impact on the variability of the company's profits or income. Generally speaking, the higher a company's operating leverage, the higher is the variability of the company's operating profits.

Q. Does regulation create uncertainty for natural gas utilities?

A. Yes. Rates for natural gas distribution services are generally set by state regulatory authorities in a manner that provides natural gas distribution companies an opportunity to recover prudently-incurred operating expenses and earn a fair rate of return on their prudently-incurred investment in property, plant, and equipment. Investors' perceptions of the business and financial risks of natural gas utilities are strongly influenced by their views of the quality of regulation. Investors are aware that regulators in some jurisdictions may be unwilling at times to set rates that allow companies an opportunity to recover their cost of service in a timely manner and earn a fair and reasonable return on investment. Investors are also aware that, even if a company presently has an opportunity to earn a fair return on its investment in property, plant, and equipment, there is no assurance that they will continue to have such an opportunity in the future. If investors perceive that regulators may not provide an opportunity to earn a fair rate of return on investment, investors may demand a higher rate of return for natural gas utilities operating in such jurisdictions. If investors perceive that regulators are likely to continue to provide an opportunity for a company to earn a fair rate of return on investment, investors will view the risk of earning a less than fair return as minimal.

Q. You note that financial leverage increases the risk of investing in natural gas utilities such as CGC. How do economists measure financial leverage?

A. Economists generally measure financial leverage by the percentages of debt and equity in a company's market value capital structure. Companies with a high percentage of debt compared to equity are considered to have high financial leverage.

Q. Why does financial leverage affect the risk of investing in a natural gas utility's stock?

A. High debt leverage is a source of additional risk to utility stock investors because it increases the percentage of the firm's costs that are fixed, and the presence of higher fixed costs increases the variability of the equity investors' return on investment.

Q. Can the risks facing natural gas utilities such as CGC be distinguished from the risks of investing in companies in other industries?

A. Yes. The risks of investing in natural gas utilities such as CGC can be distinguished from the risks of investing in companies in many other industries in several ways. First, the risks of investing in natural gas utilities are increased because of the greater capital intensity of the natural gas utility business and the fact that most investments in natural gas facilities are largely irreversible once they are made. Second, unlike returns in competitive industries, the returns from investment in natural gas utilities are largely asymmetric. That is, there is little opportunity for natural gas utilities to earn more than the required return, and a significant chance that the utilities will earn less than the required return.

V. COST OF EQUITY ESTIMATION METHODS

Q. What methods do you use to estimate CGC's cost of equity?

A. I use several generally accepted methods for estimating the cost of equity for CGC. These are the DCF, the ex ante risk premium, the ex post risk premium, and the CAPM. The DCF method assumes that the current market price of a firm's stock is equal to the discounted value of all expected future cash flows. The ex ante risk premium method assumes that an investor's expectations regarding the equity risk premium can be estimated from data on the DCF expected rate of return on equity compared to the interest rate on long-term bonds. The ex post risk premium method assumes that an investor's expectations regarding the equity-debt return differential are influenced by the historical record of comparable returns on stock and bond investments. The cost of equity under both risk premium methods is then equal to the expected interest rate on bond investments plus the expected risk premium. The CAPM assumes that the investor's required rate of return on equity is equal to an expected risk-free rate of interest plus the product of a company-specific risk factor, beta, and the expected risk premium on the market portfolio.

A. DISCOUNTED CASH FLOW METHOD

Q. Please describe the DCF model.

A. The DCF model is based on the assumption that investors value an asset because they expect to receive a sequence of cash flows from owning the asset. Thus, investors value an investment in a bond because they expect to receive a sequence of semi-annual coupon payments over the life of the bond and a terminal payment equal to the bond's face value at the time the bond matures. Likewise, investors value an investment in a firm's stock because they expect to receive a sequence of dividend payments and, perhaps, expect to sell the stock at a higher price sometime in the future.

A second fundamental principle of the DCF method is that investors value a dollar received in the future less than a dollar received today. A future dollar is valued less than a current dollar because investors could invest a current dollar in an interest earning account and increase their wealth. This principle is called the time value of money.

Applying the two fundamental DCF principles noted above to an investment in a bond leads to the conclusion that investors value their investment in the bond on the basis of the present value of the bond's future cash flows. Thus, the price of the bond should be equal to:

EQUATION 1

$$P_B = C/(1+i) + C/(1+i)^2 + \cdots + (C+F)/(1+i)^n$$

where:

P_B	=	Bond price;
C	=	Cash value of the coupon payment (assumed for notational convenience to occur annually rather than semi-annually);
F	=	Face value of the bond;
i	=	The rate of interest the investor could earn by investing his money in an alternative bond of equal risk; and
n	=	The number of periods before the bond matures.

Applying these same principles to an investment in a firm's stock suggests that the price of the stock should be equal to:

EQUATION 2

$$P_S = D_1/(1+k) + D_2/(1+k)^2 + \cdots + (D_n + P_n)/(1+k)^n$$

where:

P_S	=	Current price of the firm's stock;
$D_1, D_2 \ldots D_n$	=	Expected annual dividend per share on the firm's stock;
P_n	=	Price per share of stock at the time the investor expects to sell the stock; and
k	=	Return the investor expects to earn on alternative investments of the same risk, i.e., the investor's required rate of return.

Equation 2 is frequently called the annual discounted cash flow model of stock valuation. Assuming that dividends grow at a constant annual rate, *g*, this equation can be solved for *k*, the cost of equity. The resulting cost of equity equation is $k = D_1/P_s + g$, where k is the cost of equity, D_1 is the expected next period annual dividend, P_s is the current price of the stock, and *g* is the constant annual growth rate in earnings, dividends, and book value per share. The term D_1/P_s is called the expected dividend yield component of the annual DCF model, and the term *g* is called the expected growth component of the annual DCF model.

Q. Are you recommending that the annual DCF model be used to estimate CGC's cost of equity?

A. No. The DCF model assumes that a company's stock price is equal to the present discounted value of all expected future dividends. The annual DCF model is only a correct expression for the present value of future dividends if dividends are paid annually at the end of each year. Because the companies in my comparable group all pay dividends quarterly, the current market price that investors are willing to pay reflects the expected quarterly receipt of dividends. Therefore, a quarterly DCF model should be used to estimate the cost of equity for these firms. The quarterly DCF model differs from the annual DCF model in that it expresses a company's price as the present value of a quarterly stream of dividend payments. A complete analysis of the implications of the quarterly payment of dividends on the DCF model is provided in Exhibit JVW-2, Appendix 2. For the reasons cited there, I employed the quarterly DCF model throughout my calculations, even though the results of the quarterly DCF model for my companies are approximately equal to the results of a properly applied annual DCF model (in which the end-of-year dividend is estimated by multiplying the current annual dividend by the factor one plus the growth rate).

Q. Please describe the quarterly DCF model you use.

A. The quarterly DCF model I use is described on Exhibit JVW-1, Schedule 1 and in Exhibit JVW-2, Appendix 2. The quarterly DCF equation shows that the cost of equity is: the sum of the future expected dividend yield and the growth rate, where the dividend in the dividend yield is the equivalent future value of the four quarterly dividends at the end of the year, and the growth rate is the expected growth in dividends or earnings per share.

Q. How do you estimate the quarterly dividend payments in your quarterly DCF model?

A. The quarterly DCF model requires an estimate of the dividends, d_1, d_2, d_3, and d_4, investors expect to receive over the next four quarters. I estimate the next four quarterly dividends by multiplying the previous four quarterly dividends by the factor, *(1 + the growth rate, g)*.

Q. Can you illustrate how you estimate the next four quarterly dividends with data for a specific company?

A. Yes. In the case of Atmos Energy, the first company shown in Exhibit JVW- 1, Schedule 1, the last four quarterly dividends are equal to 0.42, 0.45, 0.45, and 0.45. Thus dividend d_1 is equal to 0.449 [.42 x (1 + .07) = 0.449] and dividends d_2, d_3, and d_4 are equal to 0.482 [0.45 x (1 + .07) = 0.482]. (As noted previously, the logic underlying this procedure is described in Exhibit JVW-2, Appendix 2.)

Q. How do you estimate the growth component of the quarterly DCF model?

A. I use the analysts' estimates of future earnings per share (EPS) growth reported by I/B/E/S Thomson Reuters.

Q. What are the analysts' estimates of future EPS growth?

A. As part of their research, financial analysts working at Wall Street firms periodically estimate EPS growth for each firm they follow. The EPS forecasts for each firm are then published. Investors who are contemplating purchasing or selling shares in individual companies review the forecasts. These estimates represent three- to five-year forecasts of EPS growth.

Q. What is I/B/E/S?

A. I/B/E/S is a division of Thomson Reuters that reports analysts' EPS growth forecasts for a broad group of companies. The forecasts are expressed in terms of a mean forecast and a standard deviation of forecast for each firm. Investors use the mean forecast as an estimate of future firm performance.

Q. Why do you use the I/B/E/S growth estimates?

A. I use the I/B/E/S growth rates because they: (1) are widely circulated in the financial community, (2) include the projections of reputable financial analysts who develop estimates of future EPS growth, (3) are reported on a timely basis to investors, and (4) are widely used by institutional and other investors.

Q. Why do you rely on analysts' projections of future EPS growth in estimating the investors' expected growth rate rather than looking at past historical growth rates?

A. I rely on analysts' projections of future EPS growth because there is considerable empirical evidence that investors use analysts' forecasts to estimate future earnings growth.

Q. Have you performed any studies of whether analysts' EPS forecasts are reliable estimates of the EPS growth rates investors use to value companies' stock?

A. Yes. I prepared a study with Willard T. Carleton, Professor Emeritus of Finance at the University of Arizona, which is described in a paper entitled "Investor Growth Expectations and Stock Prices: Analysts vs. History," published in the Spring 1988 edition of *The Journal of Portfolio Management*.

Q. Please summarize the results of your study.

A. We performed a correlation analysis to identify the historically-oriented growth rates which best described a firm's stock price. We then performed a regression study comparing the historical growth rates and retention growth rates with the average I/B/E/S analysts' forecasts. In every case, the regression equations containing the average of analysts' forecasts statistically outperformed the regression equations containing the historical growth and retention growth estimates. These results are consistent with those found by Cragg and Malkiel, the early major research in this area (John G. Cragg and Burton G. Malkiel, *Expectations and the Structure of Share Prices*, University of Chicago Press, 1982). These results are also consistent with the hypothesis that investors use analysts' forecasts, rather than historically-oriented growth calculations, in making decisions to buy and sell stock. The results provide overwhelming evidence that the analysts' forecasts of future growth are superior to historically-oriented growth measures in predicting a firm's stock price. I note that researchers at State Street Financial Advisors updated my study in 2004, and their results continue to confirm that analysts' growth forecasts are superior to historically-oriented growth measures in predicting a company's stock price.

Q. What price do you use in your DCF model?

A. I use a simple average of the monthly high and low stock prices for each firm for the three-month period ending June 2017. These high and low stock prices were obtained from Thomson Reuters.

Q. Why do you use the three-month average stock price in applying the DCF method?

A. I use the three-month average stock price in applying the DCF method because stock prices fluctuate daily, while financial analysts' forecasts for a given company are generally changed less frequently, often on a quarterly basis. Thus, to match the stock price with an earnings forecast, it is appropriate to average stock prices over a three-month period.

Q. Do you include an allowance for flotation costs in your DCF analysis?

A. Yes. I include a five percent allowance for flotation costs in my DCF calculations. A complete explanation of the need for flotation costs is contained in Exhibit JVW-2, Appendix 3.

Q. Please explain your inclusion of flotation costs.

A. All firms that have sold securities in the capital markets have incurred some level of flotation costs, including the costs of underwriters' commissions, legal fees, and printing expense, for example. These costs are withheld from the proceeds of the stock sale or are paid separately, and must be recovered over the life of the equity issue. Costs vary depending upon the size of the issue, the type of registration method used and other factors, but in general these costs range between three and five percent of the proceeds from the issue [see Inmoo Lee, Scott Lochhead, Jay Ritter, and Quanshui Zhao, "The Costs of Raising Capital," *The Journal of Financial Research,* Vol. XIX No 1 (Spring 1996), 59-74, and Clifford W. Smith, "Alternative Methods for Raising Capital," *Journal of Financial Economics* 5 (1977) 273-307]. In addition to these costs, for large equity issues (in relation to outstanding equity shares), there is likely to be a decline in price associated with the sale of shares to the public. On average, the decline in price associated with new stock issuances has been estimated at two to three percent (see Richard H. Pettway, "The Effects of New Equity Sales upon Utility Share Prices," *Public Utilities Fortnightly*, May 10, 1984, 35—39). Thus, the total flotation cost, including both issuance expense and stock price decline, generally ranges from five to eight percent of the proceeds of an equity issue. In my opinion, a combined five percent allowance for flotation costs is a conservative estimate that should be used in applying the DCF model in this proceeding (see Exhibit JVW-1, Schedule 1).

Q. How do you apply the DCF approach to estimate the required return on equity for CGC?

A. I apply the DCF approach to the Value Line natural gas utilities shown in Exhibit JVW-1, Schedule 1.

Q. How do you select your natural gas utility company group?

A. I select all the natural gas utilities followed by Value Line that: (1) paid dividends during every quarter of the last two years; (2) did not decrease dividends during any quarter of the past two years; (3) have an available positive I/B/E/S long-term growth forecast; (4) have an investment grade bond rating and a Value Line Safety Rank of 1, 2, or 3; and (5) are not the subject of a merger offer that has not been completed.

Q. Why do you eliminate companies that have either decreased or eliminated their dividend in the past two years?

A. The DCF model requires the assumption that dividends will grow at a constant rate into the indefinite future. If a company has either decreased or eliminated its dividend in recent years, the DCF model cannot be used to estimate the cost of equity because the company's recent dividend experience is inconsistent with this fundamental DCF model assumption. (For example, if the company has eliminated its dividend, there is no dividend input for the model.) At this time, no Value Line natural gas utilities are eliminated from my proxy group as a result of this criterion.

Q. Why do you eliminate companies that are the subject of a merger offer that has not been completed?

A. A merger announcement can sometimes have a significant impact on a company's stock price because of anticipated merger-related cost savings and new market opportunities. Analysts' growth forecasts, on the other hand, are necessarily related to companies as they currently exist, and do not reflect investors' views of the potential cost savings and new market opportunities associated with mergers. The use of a stock price that includes the value of potential mergers in conjunction with growth forecasts that do not include the growth-enhancing prospects of potential mergers produces DCF results that tend to distort a company's cost of equity. At this time, WGL Resources is not included in the proxy group because it is the subject of an offer to be acquired by AltaGas Ltd.

Q. Please summarize the results of your application of the DCF model to your proxy group.

A. As shown on JVW-1, Schedule 1, I obtain an average DCF result of 9.4 percent.

B. RISK PREMIUM METHOD

Q. Please describe the risk premium method of estimating the cost of equity.

A. The risk premium method is based on the principle that investors expect to earn a return on an equity investment that reflects a "premium" above the interest rate they expect to earn on an investment in bonds. This equity risk premium compensates equity investors for the additional risk they bear in making equity investments versus bond investments.

Q. Does the risk premium approach specify what debt instrument should be used to estimate the interest rate component in the methodology?

A. No. The risk premium approach can be implemented using virtually any debt instrument. However, the risk premium approach does require that the debt instrument used to estimate the risk premium be the same as the debt instrument used to calculate the interest rate component of the risk premium approach. For example, if the risk premium on equity is calculated by comparing the returns on stocks to the interest rate on A-rated utility bonds, then the interest rate on A-rated utility bonds must be used to estimate the interest rate component of the risk premium approach.

Q. Does the risk premium approach require that the same companies be used to estimate the stock return as are used to estimate the bond return?

A. No. For example, many analysts apply the risk premium approach by comparing the return on a portfolio of stocks to the income return on Treasury securities such as long-term Treasury bonds. Clearly, in this widely accepted application of the risk premium approach, the same companies are not used to estimate the stock return as are used to estimate the bond return, since the United States government is not a company.

Q. How do you measure the required risk premium on an equity investment in your group of publicly-traded natural gas utilities?

A. I use two methods to estimate the required risk premium on an equity investment in publicly-traded natural gas utilities. The first is called the ex ante risk premium method and the second is called the ex post risk premium method.

1. Ex Ante Risk Premium Method

Q. Please describe your ex ante risk premium approach for measuring the required risk premium on an equity investment in natural gas utilities.

A. My ex ante risk premium method is based on studies of the DCF expected return on a group of natural gas utilities compared to the interest rate on Moody's A-rated utility bonds. Specifically, for each month in my study period, I calculated the risk premium using the equation,

$$RP_{PROXY} = DCF_{PROXY} - I_A$$

where:

RP_{PROXY}	=	the required risk premium on an equity investment in the proxy group of companies,
DCF_{PROXY}	=	average DCF estimated cost of equity on a portfolio of proxy companies; and
I_A	=	the yield to maturity on an investment in A-rated utility bonds.

I then perform regression analyses to determine if there is a relationship between the calculated risk premium and interest rates. A detailed description of my ex ante risk premium studies is contained in Exhibit JVW-2, Appendix 4, and the underlying DCF results and interest rates are displayed in Exhibit JVW-1, Schedule 2.

Q. From your regression analyses, do you find that there is a relationship between the calculated equity risk premium and interest rates?

A. Yes. My regression analyses confirm that there is an inverse relationship between the calculated equity risk premium and interest rates. Specifically, my analyses indicate that when the yield to maturity on A-rated utility bonds declines by 100 basis points, the required equity risk premium increases by approximately 60 basis points; and when the yield on A-rated utility bonds increases by 100 basis points, the required equity risk premium declines by 60 basis points (*see* Appendix 4, p. 3).

Q. How do you use the regression analyses to estimate the cost of equity in your ex ante risk premium method?

A. To estimate the cost of equity, I add the estimated 5.2 percent required equity risk premium obtained from my regression analyses to the forecasted interest rate on A-rated utility bonds.

Q. What cost of equity estimate do you obtain using your ex ante risk premium method?

A. I obtain a cost of equity estimate of 11.0 percent using my ex ante risk premium method. This cost of equity estimate is the sum of the estimated 5.2 percent equity risk premium from my regression analyses and the 5.8 percent forecasted yield to maturity on A-rated utility bonds.

Q. How do you obtain the expected yield on A-rated utility bonds?

A. I obtain the expected yield to maturity on A-rated utility bonds, 5.8 percent, by averaging forecast data from Value Line and the U.S. Energy Information Administration (EIA). Value Line Selection & Opinion (June 2, 2017) projects a Aaa-rated Corporate bond yield equal to 5.5 percent. The June 2017 average spread between A-rated utility bonds and Aaa-rated Corporate bonds is 26 basis points (A-rated utility, 3.94 percent, less Aaa-rated Corporate, 3.68 percent, equals 26 basis points). Adding 26 basis points to the 5.5 percent Value Line Aaa Corporate bond forecast equals a forecast yield of 5.76 percent for the A-rated utility bonds. The EIA forecasts a AA-rated utility bond yield equal to 5.71 percent. The average spread between AA-rated utility and A-rated utility bonds at June 2, 2017 is 12 basis points (3.82 percent less 3.94 percent). Adding 12 basis points to EIA's 5.71 percent AA-utility bond yield forecast equals a forecast yield for A-rated utility bonds equal to 5.83 percent. The average of the forecasts (5.76 percent using Value Line data and 5.83 percent using EIA data) is 5.8 percent.

Q. Why do you use a forecasted yield to maturity on A-rated utility bonds rather than a current yield to maturity?

A. I use a forecasted yield to maturity on A-rated utility bonds rather than a current yield to maturity because the fair rate of return standard requires that a company have an opportunity to earn its required return on its investment during the forward-looking period during which rates will be in effect. Economists project that future interest rates will be higher than current interest rates as the Federal Reserve allows interest rates to rise in order to prevent inflation. Thus, the use of forecasted interest rates is consistent with the fair rate of return standard, whereas the use of current interest rates at this time is not.

2. Ex Post Risk Premium Method

Q. Please describe your ex post risk premium method for measuring the required risk premium on an equity investment in natural gas utilities.

A. I first perform a study of the comparable returns received by stock and bond investors over the 80 years of my study. I estimate the returns on stock and bond portfolios, using stock price and dividend yield data on the S&P 500 and bond yield data on Moody's A-rated Utility Bonds. My study consists of making an investment of one dollar in the S&P 500 and Moody's A-rated utility bonds at the beginning of 1937, and reinvesting the principal plus return each year to 2017. The return associated with each stock portfolio is the sum of the annual dividend yield and capital gain (or loss) which accrued to this portfolio during the year(s) in which it was held. The return associated with the bond portfolio, on the other hand, is the sum of the annual coupon yield and capital gain (or loss) which accrued to the bond portfolio during the year(s) in which it was held. The resulting annual returns on the stock and bond portfolios purchased in each year from 1937 to 2017 are shown on Exhibit JVW-1, Schedule 3. The average annual return on an investment in the S&P 500 stock portfolio is 11.2 percent, while the average annual return on an investment in the Moody's A-rated utility bond portfolio is 6.6 percent. The risk premium on the S&P 500 stock portfolio is, therefore, 4.6 percent (11.2 – 6.6 = 4.6).

I also conduct a second study using stock data on the S&P Utilities rather than the S&P 500. As shown on Exhibit JVW-1, Schedule 4, the average annual return on an investment in the S&P Utility stock portfolio is 10.6 percent per year. Thus, the return on the S&P Utility stock portfolio exceeded the return on the Moody's A-rated utility bond portfolio by 4.0 percent (10.6 – 6.6 = 4.0).

Q. Why is it appropriate to perform your ex post risk premium analysis using both the S&P 500 and the S&P Utilities stock indices?

A. I perform my ex post risk premium analysis on both the S&P 500 and the S&P Utilities because I believe natural gas utilities today face risks that are somewhere in between the average risk of the S&P Utilities and the S&P 500 over the years 1937 to 2017. Thus, I use the average of the two historically-based risk premiums as my estimate of the required risk premium in my ex post risk premium method.

Q. Would your study provide a different risk premium if you started with a different time period?

A. Yes. The risk premium results vary somewhat depending on the historical time period chosen. My policy is to go back as far in history as I can get reliable data. I thought it would be most meaningful to begin after the passage and implementation of the Public Utility Holding Company Act of 1935 (the 1935 Act). This Act significantly changed the structure of the public utility industry. Because the 1935 Act was not implemented until the beginning of 1937, I concluded that data prior to 1937 should not be used in my study. (The repeal of the 1935 Act has not materially impacted the structure of the public utility industry; thus, the Act's repeal does not have any impact on my choice of time period.)

Q. Why is it necessary to examine the yield from debt investments in order to determine the investors' required rate of return on equity capital?

A. As previously explained, investors expect to earn a return on their equity investment that exceeds currently available bond yields because the return on equity, as a residual return, is less certain than the yield on bonds; and investors must be compensated for this uncertainty. Investors' expectations concerning the amount by which the return on equity will exceed the bond yield may be influenced by historical differences in returns to bond and stock investors. Thus, we can estimate investors' expected returns from an equity investment based on information about past differences between returns on stocks and bonds. In interpreting this information, investors would also recognize that risk premiums increase when interest rates are low.

Q. What conclusions do you draw from your ex post risk premium analyses about the required return on an equity investment in natural gas utilities?

A. My studies provide strong evidence that investors today require an equity return of at least 4.0 to 4.6 percentage points above the expected yield on A-rated utility bonds. As discussed above, the forecast yield on A-rated utility bonds is 5.8 percent. Adding a 4.0 to 4.6 percentage point risk premium to a yield of 5.8 percent on A-rated utility bonds, I obtain an expected return on equity in the range 9.8 percent to 10.4 percent, with a midpoint of 10.1 percent. Adding a 14 basis-point allowance for flotation costs, I obtain an estimate of 10.3 percent as the ex post risk premium cost of equity. (I determine the flotation cost allowance by calculating the difference in my DCF results with and without a flotation cost allowance.)

C. CAPITAL ASSET PRICING MODEL

Q. What is the CAPM?

A. The CAPM is an equilibrium model of the security markets in which the expected or required return on a given security is equal to the risk-free rate of interest, plus the company equity "beta," times the market risk premium:

Cost of equity = Risk-free rate + (Equity beta x Market risk premium)

The risk-free rate in this equation is the expected rate of return on a risk-free government security, the equity beta is a measure of the company's risk relative to the market as a whole, and the market risk premium is the premium investors require to invest in the market basket of all securities compared to the risk-free security.

Q. How do you use the CAPM to estimate the cost of equity for your proxy companies?

A. The CAPM requires an estimate of the risk-free rate, the company-specific risk factor or beta, and the expected return on the market portfolio. For my estimate of the risk-free rate, I use a forecasted yield to maturity on 20-year Treasury bonds of 4.2 percent, obtained using data from Value Line and EIA. For my estimate of the company-specific risk, or beta, I use both the current average 0.74 Value Line beta for my group of natural gas utilities and the 0.90 beta estimated from the relationship between the historical risk premium on utilities and the historical risk premium on the market portfolio. For my estimate of the expected risk premium on the market portfolio, I use two approaches. First, I estimate the risk premium on the market portfolio using historical risk premium data reported in the *2017 Valuation Handbook* for the years 1926 through 2016, data which are consistent with the data previously reported by Ibbotson® SBBI®. Second, I estimate the risk premium on the market portfolio from the difference between the DCF cost of equity for the S&P 500 and the forecasted yield to maturity on 20-year Treasury bonds.

Q. How do you obtain the forecasted yield to maturity on 20-year Treasury bonds?

A. As noted above, I use data from Value Line and EIA to obtain a forecasted yield to maturity on 20-year Treasury bonds. Value Line forecasts a yield on 10-year Treasury notes equal to 4.0 percent. The spread between the average June 2017 yield on 10-year Treasury notes (2.19 percent) and 20-year Treasury bonds (2.54 percent) is 35 basis points. Adding 35 basis points to Value Line's 4.0 percent forecasted yield on 10-year Treasury notes produces a forecasted yield of 4.35 percent for 20-year Treasury bonds (see Value Line Investment Survey, Selection & Opinion, June 2, 2016). EIA forecasts a yield of 3.75 percent on 10-year Treasury notes. Adding the 35 basis point spread between 10-year Treasury notes and 20-year Treasury bonds to the EIA forecast of 3.75 percent for 10-year Treasury notes produces an EIA forecast for 20-year Treasury bonds equal to 4.10 percent. The average of the forecasts is 4.2 percent (4.35 percent using Value Line data and 4.1 percent using EIA data).

1. Historical CAPM

Q. How do you estimate the expected risk premium on the market portfolio using historical risk premium data developed by Ibbotson® SBBI®?

A. I estimate the expected risk premium on the market portfolio by calculating the difference between the arithmetic mean total return on the S&P 500 from 1926 to 2017 (11.96 percent) and the average income return on 20-year U.S. Treasury bonds over the same period (5.01 percent). Thus, my historical risk premium method produces a risk premium of 6.9 percent (11.96 – 5.01 = 6.94).

Q. Why do you recommend that the risk premium on the market portfolio be estimated using the arithmetic mean return on the S&P 500?

A. I recommend that the risk premium on the market portfolio be estimated using the arithmetic mean return on the S&P 500 because, in my opinion, the arithmetic mean return is the best measure of the return investors expect to receive in the future. For an investment which has an uncertain outcome, the arithmetic mean is the best historically-based measure of the return investors expect to receive in the future because the arithmetic mean is the only return which will make the initial investment grow to the expected value of the investment at the end of the investment horizon. A discussion of the importance of using arithmetic mean returns in the context of CAPM or risk premium studies is contained in Exhibit JVW-1, Schedule 5.

Q. Why do you recommend that the risk premium on the market portfolio be measured using the income return on 20-year Treasury bonds rather than the total return on these bonds?

A. As discussed above, the CAPM requires an estimate of the risk-free rate of interest. When Treasury bonds are issued, the income return on the bond is risk free, but the total return, which includes both income and capital gains or losses, is not. Thus, the income return should be used in the CAPM because it is only the income return that is risk free.

Q. What CAPM result do you obtain when you estimate the expected risk premium on the market portfolio from the arithmetic mean difference between the return on the market and the yield on 20-year Treasury bonds?

A. Using a risk-free rate equal to 4.2 percent, a natural gas utility beta equal to 0.74, a risk premium on the market portfolio equal to 6.9 percent, and a flotation cost allowance equal to fourteen basis points, I obtain an historical CAPM estimate of the cost of equity equal to 9.5 percent for my natural gas utility group (4.2 + 0.74 x 6.9 + 0.14= 9.5) (see Exhibit JVW-1, Schedule 6).

Q. Can a reasonable application of the CAPM produce higher cost of equity results than you have just reported?

A. Yes. There is evidence that the CAPM tends to underestimate the cost of equity for small market capitalization companies, such as many of the natural gas utilities, and for companies whose betas are less than 1.0.

Q. Does the finance literature support an adjustment to the CAPM equation to account for a company's size as measured by market capitalization?

A. Yes. For example, the 2017 Valuation Yearbook supports such an adjustment. Their estimates of the size premium required to be added to the basic CAPM cost of equity are shown below in TABLE 1**.**

TABLE 1			
ESTIMATES OF PREMIUMS FOR COMPANY SIZE			
Decile	Smallest Mkt. Cap. ($Mils)	Largest Mkt. Cap. ($Mils)	Premium
Large-Cap	10,712.000		0
Mid-Cap (3-5)	2,392.689	10,711.194	1.02%
Low-Cap (6-8)	569.279	2,390.899	1.75%
Micro-Cap (9-10)	2.516	567.843	3.67%

Q. What is the evidence that the CAPM tends to underestimate the cost of equity for companies with betas less than 1.0 and is less reliable the further the estimated beta is from 1.0?

A. The original evidence that the unadjusted CAPM tends to underestimate the cost of equity for companies whose equity beta is less than 1.0 and is less reliable the further the estimated beta is from 1.0 was presented in a paper by Black, Jensen, and Scholes, "The Capital Asset Pricing Model: Some Empirical Tests." Numerous subsequent papers have validated the Black, Jensen, and Scholes findings, including those by Litzenberger and Ramaswamy (1979), Banz (1981), Fama and French (1992), Fama and French (2004), Fama and MacBeth (1973), and Jegadeesh and Titman (1993). (*See*, for example, Fischer Black, Michael C. Jensen, and Myron Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," in Studies in the Theory of Capital Markets, M. Jensen, ed. New York: Praeger, 1972; Eugene Fama and James MacBeth, "Risk, Return, and Equilibrium: Empirical Tests," Journal of Political Economy 81 (1973), pp. 607 36; Robert Litzenberger and Krishna Ramaswamy, "The Effect of Personal Taxes and Dividends on Capital Asset Prices: Theory and Empirical Evidence," Journal of Financial Economics 7 (1979), pp. 163 95.; Rolf Banz, “The Relationship between Return and Market Value of Common Stocks,” Journal of Financial Economics (March 1981), pp. 3 18; and Eugene Fama and Kenneth French, “The Cross Section of Expected Returns,” Journal of Finance (June 1992), pp. 427 465.)

Q. Can you briefly summarize these articles?

A. Yes. The CAPM conjectures that security returns increase with increases in security betas in line with the equation:

$$ER_i = R_f + b_i [ER_m - R_f],$$

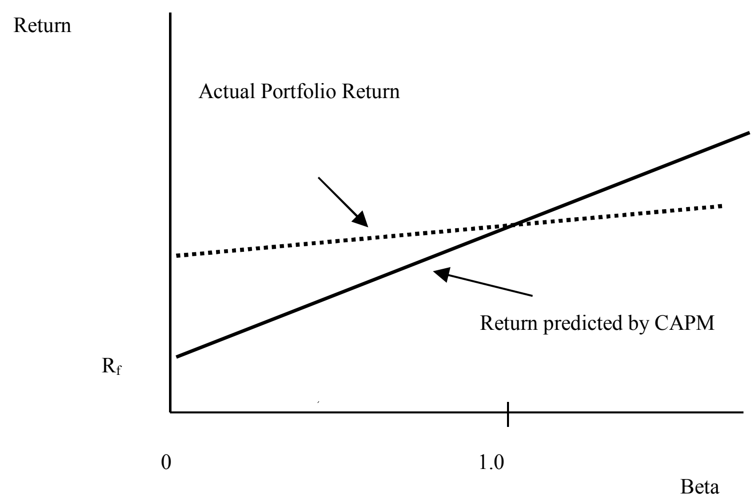
where ER_i is the expected return on security or portfolio *i*, R_f is the risk-free rate, $ER_m - R_f$ is the expected risk premium on the market portfolio, and β_i is a measure of the risk of investing in security or portfolio *i* (see **SHOWN BELOW**.

FIGURE 1). If the CAPM correctly predicts the relationship between risk and return in the marketplace, then the realized returns on portfolios of securities and the corresponding portfolio betas should lie on the solid straight line with intercept R_f and slope $[R_m - R_f]$ shown below.

FIGURE 1

AVERAGE RETURNS COMPARED TO BETA

FOR PORTFOLIOS FORMED ON PRIOR BETA



Financial scholars have studied the relationship between estimated portfolio betas and the achieved returns on the underlying portfolio of securities to test whether the CAPM correctly predicts achieved returns in the marketplace. They find that the relationship between returns and betas is inconsistent with the relationship posited by the CAPM. As described in Fama and French (1992) and Fama and French (2004), the actual relationship between portfolio betas and returns is shown by the dotted line in Figure 1 above. Although financial scholars disagree on the reasons why the return/beta relationship looks more like the dotted line in Figure 1 than the solid line, they generally agree that the dotted line lies above the solid line for portfolios with betas less than 1.0 and below the solid line for portfolios with betas greater than 1.0. Thus, in practice, scholars generally agree that the CAPM underestimates portfolio returns for companies with betas less than 1.0, and overestimates portfolio returns for portfolios with betas greater than 1.0.

Q. Do you have additional evidence that the CAPM tends to underestimate the cost of equity for utilities with average betas less than 1.0?

A. Yes. As shown in Exhibit JVW-1, Schedule 7, over the period 1937 to 2017, investors in the S&P Utilities Stock Index have earned a risk premium over the yield on long-term Treasury bonds equal to 5.47 percent, while investors in the S&P 500 have earned a risk premium over the yield on long-term Treasury bonds equal to 6.08 percent. According to the CAPM, investors in utility stocks should expect to earn a risk premium over the yield on long-term Treasury securities equal to the average utility beta times the expected risk premium on the S&P 500. Thus, the ratio of the risk premium on the utility portfolio to the risk premium on the S&P 500 should equal the utility beta. However, the average utility beta at the time of my studies is approximately 0.75, whereas the historical ratio of the utility risk premium to the S&P 500 risk premium is 0.90 (5.47 ÷ 6.08 = 0.90). In short, the current 0.74 measured beta for natural gas utilities underestimates the cost of equity for natural gas utilities, providing further support for the conclusion that the CAPM underestimates the cost of equity for natural gas utilities at this time.

Q. Can you adjust for the tendency of the CAPM to underestimate the cost of equity for companies with betas less than 1.0?

A. Yes. I can implement the CAPM using the 0.90 beta I discuss above, which I obtain by comparing the historical returns on utilities to historical returns on the S&P 500.

Q. What CAPM result do you obtain when you use a beta equal to 0.90 rather than a natural gas utility beta equal to 0.74?

A. I obtain a CAPM result equal to 10.6 percent using a risk free rate equal to 4.2 percent, a beta equal to 0.90, the historical market risk premium equal to 6.9 percent, and a flotation cost allowance of 14 basis points (4.2 + 0.90 x 6.9+ 0.14= 10.6). (See Exhibit JVW-1, Schedule 8.)

Q. What is the average of your two historical CAPM results?

A. The average of my two historical CAPM results is 10.0 percent (9.5 percent + 10.6 percent) ÷ 2 = 10.0 percent). I use 10.0 percent as my estimate of the historical CAPM cost of equity.

2. DCF-Based CAPM

Q. How does your DCF-Based CAPM differ from your historical CAPM?

A. As noted above, my DCF-based CAPM differs from my historical CAPM only in the method I use to estimate the risk premium on the market portfolio. In the historical CAPM, I use historical risk premium data to estimate the risk premium on the market portfolio. In the DCF-based CAPM, I estimate the risk premium on the market portfolio from the difference between the DCF cost of equity for the S&P 500 and the forecasted yield to maturity on 20-year Treasury bonds.

Q. What risk premium do you obtain when you calculate the difference between the DCF-return on the S&P 500 and the risk-free rate?

A. Using this method, I obtain a risk premium on the market portfolio equal to 7.7 percent. This value is obtained by subtracting the forecasted risk-free rate, 4.2 percent, from the DCF estimate of the market return, 11.9 percent (11.9 – 4.2 = 7.7).

Q. What CAPM result do you obtain when you estimate the expected return on the market portfolio by applying the DCF model to the S&P 500?

A. Using a risk-free rate of 4.2 percent, a natural gas utility beta of 0.74, a risk premium on the market portfolio of 7.7 percent, and a flotation cost allowance equal to 14 basis points, I obtain a CAPM result of 10.0 percent for my natural gas utility group. Using a risk-free rate of 4.2 percent, a natural gas utility beta of 0.90, a risk premium on the market portfolio of 7.7 percent, and a flotation cost allowance of 14 basis points, I obtain a CAPM result of 11.3 percent for my natural gas utility group. (See Exhibit JVW-1, Schedule 9.) The average of these two results is 10.7 percent [(10.0 percent + 11.3 percent) ÷ 2 = 10.7 percent]. I use 10.7 percent as my estimate of the DCF-based CAPM cost of equity.

VI. CONCLUSION REGARDING THE FAIR RATE OF RETURN ON EQUITY

Q. What is the fair rate of return on equity?

A. The fair rate of return on equity is a forward-looking return on equity that provides the regulated company with an opportunity to earn a return on its investment over the period in which rates are in effect that is commensurate with returns that investors expect to earn on other investments of similar risk, as I discuss above. Because the fair rate of return is a forward-looking return, the estimate of the fair return requires consideration of investors' expectations for a reasonably long period into the future.

Q. Based on your application of several cost of equity methods to your proxy company groups, what is your conclusion regarding the fair rate of return on equity for your comparable companies?

A. Based on my application of several cost of equity methods, I conclude that the fair rate of return on equity for my comparable companies is in the range 9.4 percent to 11.0 percent, with an average equal to 10.3 percent (see TABLE 2 below).

TABLE 2 Cost of Equity Model Results	
Model	Model Result
Discounted Cash Flow	9.4%
Ex Ante Risk Premium	11.0%
Ex Post Risk Premium	10.3%
CAPM – Historical	10.0%
CAPM - DCF Based	10.7%
Average	10.3%

Q. Does your 10.3 percent fair rate of return on equity conclusion for your proxy companies depend on the percentages of debt and equity in the proxy companies' average capital structure?

A. Yes. My 10.3 percent fair rate of return on equity conclusion reflects the financial risk associated with the average market value capital structure of my proxy companies, which has approximately 68 percent equity. Because market conditions are at historically high levels, I have also examined the average market value capital structure of the Value Line natural gas utilities over the last ten years; and, as noted above, I find that the average market value capital structure of the Value Line natural gas utilities contains 58 percent equity (see Exhibit JVW-1, Schedule 10).

Q. What capital structure is CGC recommending in this proceeding for the purpose of ratemaking?

A. CGC is recommending that a capital structure containing 6.29 percent short-term debt, 44.41 percent long-term debt, and 49.30 percent common equity be used for ratemaking purposes in this proceeding.

Q. How does the financial risk reflected in CGC's recommended ratemaking capital structure in this proceeding compare to the financial risk reflected in the cost of equity estimates for your proxy companies?

A. Although CGC's recommended capital structure contains an appropriate mix of debt and equity and is a reasonable capital structure for ratemaking purposes in this proceeding, this recommended ratemaking capital structure embodies greater financial risk than is reflected in my cost of equity estimates from my proxy companies.

Q. You discuss above that the cost of equity depends on a company's capital structure. Is there a way to adjust the 10.3 percent cost of equity for your proxy companies to reflect the higher financial risk of CGC's ratemaking capital structure in this proceeding?

A. Yes. Because my proxy groups are similar in business risk to CGC, CGC should have the same weighted average cost of capital as my proxy companies. One may easily determine the cost of equity CGC would need in order to have the same weighted average cost of capital as my proxy companies.

Q. Do you perform such a calculation?

A. Yes. I adjust the 10.3 percent average cost of equity for my proxy groups by recognizing that to attract capital, CGC must have the same weighted average cost of capital as my proxy group. My analysis, which is shown on Exhibit JVW-1, Schedule 11, indicates that CGC would require a fair rate of return on equity equal to 11.4 percent in order to have the same weighted average cost of capital as my proxy companies.

Q. What return on common equity do you recommend for CGC?

A. I recommend a return on common equity equal to 11.25 percent for CGC. My recommendation is conservative in that it does not fully reflect the higher average percentage of equity in the market value capital structure of my proxy companies in today's market environment compared to the average market value of equity in the capital structure of the Value Line natural gas utilities over the last ten years. My recommendation is reasonable in that it produces an overall return that is approximately equal to the average overall return being requested by natural gas utilities in pending rate proceedings filed in 2017.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

LIST OF SCHEDULES AND APPENDICES

EXHIBIT JVW-1 SCHEDULE 1
SUMMARY OF DISCOUNTED CASH FLOW ANALYSIS
FOR NATURAL GAS UTILITIES

	COMPANY	MOST RECENT QUARTERLY DIVIDEND (d_0)	STOCK PRICE (P_0)	FORECAST OF FUTURE EARNINGS GROWTH	MARKET CAP $ (MIL)	DCF MODEL RESULT
1	Atmos Energy	0.450	81.735	7.00%	8,960	9.5%
2	Chesapeake Utilities	0.325	73.432	7.05%	1,220	9.0%
3	New Jersey Resources	0.255	40.975	6.00%	3,669	8.9%
4	NiSource Inc.	0.175	24.968	7.90%	8,458	11.1%
5	Northwest Nat. Gas	0.470	60.208	4.50%	1,787	8.0%
6	ONE Gas Inc.	0.420	69.658	5.50%	3,774	8.0%
7	South Jersey Inds.	0.273	36.202	6.00%	2,931	9.5%
8	Spire Inc.	0.525	68.877	4.47%	3,496	7.9%
9	UGI Corp.	0.250	49.514	7.95%	8,795	10.2%
10	Average					9.1%
11	Market-weighted Average					9.6%
12	Average Line 10, 11					9.4%

Notes:

d_0	=	Most recent quarterly dividend
d_1,d_2,d_3,d_4	=	Next four quarterly dividends, calculated by multiplying the last four quarterly dividends by the factor (1 + g)
P_0	=	Average of the monthly high and low stock prices during the three months ending June 2017 per Thomson Reuters
FC	=	Flotation cost allowance (five percent) as a percent of stock price
g	=	I/B/E/S forecast of future earnings growth June 2017 from Thomson Reuters
k	=	Cost of equity using the quarterly version of the DCF model

$$k = \frac{d_1(1+k)^{.75} + d_2(1+k)^{.50} + d_3(1+k)^{.25} + d_4}{P_0(1-FC)} + g$$

In my analysis, I also eliminate outlier results, including results that are less than one hundred basis points above forecasted bond yields for the companies' ratings. The forecasted A-rated utility bond yield at the time of Dr. Vander Weide's studies is 5.8 percent, the forecasted BBB+-rated utility bond yield is 6.0 percent, and the forecasted yield on BBB-rated utility bonds is 6.2 percent.

EXHIBIT JVW-1 SCHEDULE 2
COMPARISON OF DCF EXPECTED RETURN ON AN INVESTMENT IN NATURAL GAS UTILITY STOCKS TO THE INTEREST RATE ON MOODY'S A-RATED UTILITY BONDS

In this analysis, I compute a natural gas utility equity risk premium by comparing the DCF estimated cost of equity for an electric utility proxy group to the interest rate on A-rated utility bonds. For each month in my June 1998 through June 2017 study period:

DCF	=	Average DCF-estimated cost of equity on a portfolio of proxy companies;
Bond Yield	=	Yield to maturity on an investment in A-rated utility bonds; and
Risk Premium	=	DCF – Bond yield.

A more detailed description of my *ex ante* risk premium method is contained in Appendix 4.

LINE	DATE	DCF	BOND YIELD	RISK PREMIUM
1	Jun-98	0.1154	0.0703	0.0451
2	Jul-98	0.1186	0.0703	0.0483
3	Aug-98	0.1234	0.0700	0.0534
4	Sep-98	0.1273	0.0693	0.0580
5	Oct-98	0.1260	0.0696	0.0564
6	Nov-98	0.1211	0.0703	0.0508
7	Dec-98	0.1185	0.0691	0.0494
8	Jan-99	0.1195	0.0697	0.0498
9	Feb-99	0.1243	0.0709	0.0534
10	Mar-99	0.1257	0.0726	0.0531
11	Apr-99	0.1260	0.0722	0.0538
12	May-99	0.1221	0.0747	0.0474
13	Jun-99	0.1208	0.0774	0.0434
14	Jul-99	0.1222	0.0771	0.0451
15	Aug-99	0.1220	0.0791	0.0429
16	Sep-99	0.1226	0.0793	0.0433
17	Oct-99	0.1233	0.0806	0.0427
18	Nov-99	0.1240	0.0794	0.0446
19	Dec-99	0.1280	0.0814	0.0466
20	Jan-00	0.1301	0.0835	0.0466
21	Feb-00	0.1344	0.0825	0.0519
22	Mar-00	0.1344	0.0828	0.0516
23	Apr-00	0.1316	0.0829	0.0487
24	May-00	0.1292	0.0870	0.0422
25	Jun-00	0.1295	0.0836	0.0459
26	Jul-00	0.1317	0.0825	0.0492
27	Aug-00	0.1290	0.0813	0.0477
28	Sep-00	0.1257	0.0823	0.0434
29	Oct-00	0.1260	0.0814	0.0446
30	Nov-00	0.1251	0.0811	0.0440
31	Dec-00	0.1239	0.0784	0.0455
32	Jan-01	0.1261	0.0780	0.0481
33	Feb-01	0.1261	0.0774	0.0487
34	Mar-01	0.1275	0.0768	0.0507
35	Apr-01	0.1227	0.0794	0.0433
36	May-01	0.1302	0.0799	0.0503
37	Jun-01	0.1304	0.0785	0.0519
38	Jul-01	0.1338	0.0778	0.0560

LINE	DATE	DCF	BOND YIELD	RISK PREMIUM
39	Aug-01	0.1327	0.0759	0.0568
40	Sep-01	0.1268	0.0775	0.0493
41	Oct-01	0.1268	0.0763	0.0505
42	Nov-01	0.1268	0.0757	0.0511
43	Dec-01	0.1254	0.0783	0.0471
44	Jan-02	0.1236	0.0766	0.0470
45	Feb-02	0.1241	0.0754	0.0487
46	Mar-02	0.1189	0.0776	0.0413
47	Apr-02	0.1159	0.0757	0.0402
48	May-02	0.1162	0.0752	0.0410
49	Jun-02	0.1170	0.0741	0.0429
50	Jul-02	0.1242	0.0731	0.0511
51	Aug-02	0.1234	0.0717	0.0517
52	Sep-02	0.1260	0.0708	0.0552
53	Oct-02	0.1250	0.0723	0.0527
54	Nov-02	0.1221	0.0714	0.0507
55	Dec-02	0.1216	0.0707	0.0509
56	Jan-03	0.1219	0.0706	0.0513
57	Feb-03	0.1232	0.0693	0.0539
58	Mar-03	0.1195	0.0679	0.0516
59	Apr-03	0.1162	0.0664	0.0498
60	May-03	0.1126	0.0636	0.0490
61	Jun-03	0.1114	0.0621	0.0493
62	Jul-03	0.1127	0.0657	0.0470
63	Aug-03	0.1139	0.0678	0.0461
64	Sep-03	0.1127	0.0656	0.0471
65	Oct-03	0.1123	0.0643	0.0480
66	Nov-03	0.1089	0.0637	0.0452
67	Dec-03	0.1071	0.0627	0.0444
68	Jan-04	0.1059	0.0615	0.0444
69	Feb-04	0.1039	0.0615	0.0424
70	Mar-04	0.1037	0.0597	0.0440
71	Apr-04	0.1041	0.0635	0.0406
72	May-04	0.1045	0.0662	0.0383
73	Jun-04	0.1036	0.0646	0.0390
74	Jul-04	0.1011	0.0627	0.0384
75	Aug-04	0.1008	0.0614	0.0394
76	Sep-04	0.0976	0.0598	0.0378
77	Oct-04	0.0974	0.0594	0.0380
78	Nov-04	0.0962	0.0597	0.0365
79	Dec-04	0.0970	0.0592	0.0378
80	Jan-05	0.0990	0.0578	0.0412
81	Feb-05	0.0979	0.0561	0.0418
82	Mar-05	0.0979	0.0583	0.0396
83	Apr-05	0.0988	0.0564	0.0424
84	May-05	0.0981	0.0553	0.0427
85	Jun-05	0.0976	0.0540	0.0436
86	Jul-05	0.0966	0.0551	0.0415
87	Aug-05	0.0969	0.0550	0.0419
88	Sep-05	0.0980	0.0552	0.0428
89	Oct-05	0.0990	0.0579	0.0411

LINE	DATE	DCF	BOND YIELD	RISK PREMIUM
90	Nov-05	0.1049	0.0588	0.0461
91	Dec-05	0.1045	0.0580	0.0465
92	Jan-06	0.0982	0.0575	0.0407
93	Feb-06	0.1124	0.0582	0.0542
94	Mar-06	0.1127	0.0598	0.0529
95	Apr-06	0.1100	0.0629	0.0471
96	May-06	0.1056	0.0642	0.0414
97	Jun-06	0.1049	0.0640	0.0409
98	Jul-06	0.1087	0.0637	0.0450
99	Aug-06	0.1041	0.0620	0.0421
100	Sep-06	0.1053	0.0600	0.0453
101	Oct-06	0.1030	0.0598	0.0432
102	Nov-06	0.1033	0.0580	0.0453
103	Dec-06	0.1035	0.0581	0.0454
104	Jan-07	0.1013	0.0596	0.0417
105	Feb-07	0.1018	0.0590	0.0428
106	Mar-07	0.1018	0.0585	0.0433
107	Apr-07	0.1007	0.0597	0.0410
108	May-07	0.0967	0.0599	0.0368
109	Jun-07	0.0970	0.0630	0.0340
110	Jul-07	0.1006	0.0625	0.0381
111	Aug-07	0.1021	0.0624	0.0397
112	Sep-07	0.1014	0.0618	0.0396
113	Oct-07	0.1080	0.0611	0.0469
114	Nov-07	0.1083	0.0597	0.0486
115	Dec-07	0.1084	0.0616	0.0468
116	Jan-08	0.1113	0.0602	0.0511
117	Feb-08	0.1139	0.0621	0.0518
118	Mar-08	0.1147	0.0621	0.0526
119	Apr-08	0.1167	0.0629	0.0538
120	May-08	0.1069	0.0627	0.0442
121	Jun-08	0.1062	0.0638	0.0424
122	Jul-08	0.1086	0.0640	0.0446
123	Aug-08	0.1123	0.0637	0.0486
124	Sep-08	0.1130	0.0649	0.0481
125	Oct-08	0.1213	0.0756	0.0457
126	Nov-08	0.1221	0.0760	0.0461
127	Dec-08	0.1162	0.0654	0.0508
128	Jan-09	0.1131	0.0639	0.0492
129	Feb-09	0.1155	0.0630	0.0524
130	Mar-09	0.1198	0.0642	0.0556
131	Apr-09	0.1146	0.0648	0.0498
132	May-09	0.1225	0.0649	0.0576
133	Jun-09	0.1208	0.0620	0.0588
134	Jul-09	0.1145	0.0597	0.0548
135	Aug-09	0.1109	0.0571	0.0538
136	Sep-09	0.1109	0.0553	0.0556
137	Oct-09	0.1146	0.0555	0.0592
138	Nov-09	0.1148	0.0564	0.0584
139	Dec-09	0.1123	0.0579	0.0544
140	Jan-10	0.1198	0.0577	0.0621

LINE	DATE	DCF	BOND YIELD	RISK PREMIUM
141	Feb-10	0.1167	0.0587	0.0580
142	Mar-10	0.1074	0.0584	0.0490
143	Apr-10	0.0934	0.0582	0.0352
144	May-10	0.0970	0.0552	0.0418
145	Jun-10	0.0953	0.0546	0.0407
146	Jul-10	0.1050	0.0526	0.0524
147	Aug-10	0.1038	0.0501	0.0537
148	Sep-10	0.1034	0.0501	0.0533
149	Oct-10	0.1050	0.0510	0.0540
150	Nov-10	0.1041	0.0536	0.0505
151	Dec-10	0.1029	0.0557	0.0472
152	Jan-11	0.1019	0.0557	0.0462
153	Feb-11	0.1004	0.0568	0.0436
154	Mar-11	0.1014	0.0556	0.0458
155	Apr-11	0.1031	0.0555	0.0476
156	May-11	0.1018	0.0532	0.0486
157	Jun-11	0.1020	0.0526	0.0494
158	Jul-11	0.1035	0.0527	0.0508
159	Aug-11	0.1179	0.0469	0.0710
160	Sep-11	0.1155	0.0448	0.0707
161	Oct-11	0.1150	0.0452	0.0698
162	Nov-11	0.1120	0.0425	0.0695
163	Dec-11	0.1092	0.0435	0.0657
164	Jan-12	0.1078	0.0434	0.0644
165	Feb-12	0.1081	0.0436	0.0645
166	Mar-12	0.1081	0.0448	0.0633
167	Apr-12	0.1133	0.0440	0.0693
168	May-12	0.1203	0.0420	0.0783
169	Jun-12	0.1013	0.0408	0.0605
170	Jul-12	0.0978	0.0393	0.0585
171	Aug-12	0.1025	0.0400	0.0625
172	Sep-12	0.1040	0.0402	0.0638
173	Oct-12	0.1011	0.0391	0.0620
174	Nov-12	0.1032	0.0384	0.0648
175	Dec-12	0.1023	0.0400	0.0623
176	Jan-13	0.1013	0.0415	0.0598
177	Feb-13	0.0982	0.0418	0.0564
178	Mar-13	0.1018	0.0420	0.0598
179	Apr-13	0.1001	0.0400	0.0601
180	May-13	0.1000	0.0417	0.0583
181	Jun-13	0.1000	0.0453	0.0547
182	Jul-13	0.0983	0.0468	0.0515
183	Aug-13	0.0982	0.0473	0.0509
184	Sep-13	0.0991	0.0480	0.0511
185	Oct-13	0.0998	0.0470	0.0528
186	Nov-13	0.0964	0.0477	0.0487
187	Dec-13	0.0966	0.0481	0.0485
188	Jan-14	0.0948	0.0463	0.0485
189	Feb-14	0.1019	0.0453	0.0566
190	Mar-14	0.1027	0.0451	0.0576
191	Apr-14	0.1081	0.0441	0.0640

LINE	DATE	DCF	BOND YIELD	RISK PREMIUM
192	May-14	0.1069	0.0426	0.0643
193	Jun-14	0.1059	0.0429	0.0630
194	Jul-14	0.1075	0.0423	0.0652
195	Aug-14	0.1069	0.0413	0.0656
196	Sep-14	0.1058	0.0424	0.0634
197	Oct-14	0.1131	0.0406	0.0725
198	Nov-14	0.1113	0.0409	0.0704
199	Dec-14	0.1105	0.0395	0.0710
200	Jan-15	0.1043	0.0358	0.0685
201	Feb-15	0.1043	0.0367	0.0676
202	Mar-15	0.1062	0.0374	0.0688
203	Apr-15	0.1072	0.0375	0.0697
204	May-15	0.1067	0.0417	0.0650
205	Jun-15	0.1020	0.0439	0.0581
206	Jul-15	0.0974	0.0440	0.0534
207	Aug-15	0.0949	0.0425	0.0524
208	Sep-15	0.0975	0.0439	0.0536
209	Oct-15	0.0961	0.0429	0.0532
210	Nov-15	0.1007	0.0440	0.0567
211	Dec-15	0.1027	0.0435	0.0592
212	Jan-16	0.1017	0.0427	0.0590
213	Feb-16	0.1002	0.0411	0.0591
214	Mar-16	0.0973	0.0416	0.0557
215	Apr-16	0.0974	0.0400	0.0574
216	May-16	0.0944	0.0393	0.0551
217	Jun-16	0.0963	0.0378	0.0585
218	Jul-16	0.0952	0.0357	0.0595
219	Aug-16	0.0971	0.0359	0.0612
220	Sep-16	0.0978	0.0366	0.0612
221	Oct-16	0.0990	0.0377	0.0613
222	Nov-16	0.1041	0.0408	0.0633
223	Dec-16	0.1032	0.0427	0.0605
224	Jan-17	0.1021	0.0414	0.0607
225	Feb-17	0.0991	0.0418	0.0573
226	Mar-17	0.0983	0.0423	0.0560
227	Apr-17	0.0975	0.0412	0.0563
228	May-17	0.0984	0.0412	0.0572
229	Jun-17	0.0968	0.0394	0.0574

Notes: Utility bond yield information from *Mergent Bond Record* (formerly Moody's). See Appendix 4 for a description of my ex ante risk premium approach. DCF results are calculated using a quarterly DCF model as follows:

d_0	=	Latest quarterly dividend
P_0	=	Average of the monthly high and low stock prices for each month per Thomson Reuters
FC	=	Flotation cost allowance (five percent) as a percentage of stock price
g	=	I/B/E/S forecast of future earnings growth for each month
k	=	Cost of equity using the quarterly version of the DCF model

$$k = \left[\frac{d_0 (1+g)^{\frac{1}{4}}}{P_0 (1 - FC)} + (1+g)^{\frac{1}{4}} \right]^4 - 1$$

EXHIBIT JVW-1 SCHEDULE 3
COMPARATIVE RETURNS ON S&P 500 STOCK INDEX
AND MOODY'S A-RATED UTILITY BONDS 1937 – 2017

LINE	YEAR	S&P 500 STOCK PRICE	STOCK DIVIDEND YIELD	STOCK RETURN	A-RATED BOND PRICE	BOND RETURN	RISK PREMIUM
1	2017	2,275.12	0.0209		$96.13		
2	2016	1,918.60	0.0222	20.80%	$95.48	4.87%	15.93%
3	2015	2,028.18	0.0208	-3.32%	$107.65	-7.59%	4.26%
4	2014	1,822.36	0.0210	13.39%	$89.89	24.20%	-10.81%
5	2013	1,481.11	0.0220	25.24%	$97.45	-3.65%	28.89%
6	2012	1,300.58	0.0214	16.02%	$94.36	7.52%	8.50%
7	2011	1,282.62	0.0185	3.25%	$77.36	27.14%	-23.89%
8	2010	1,123.58	0.0203	16.18%	$75.02	8.44%	7.74%
9	2009	865.58	0.0310	32.91%	$68.43	15.48%	17.43%
10	2008	1,378.76	0.0206	-35.16%	$72.25	0.24%	-35.40%
11	2007	1,424.16	0.0181	-1.38%	$72.91	4.59%	-5.97%
12	2006	1,278.72	0.0183	13.20%	$75.25	2.20%	11.01%
13	2005	1,181.41	0.0177	10.01%	$74.91	5.80%	4.21%
14	2004	1,132.52	0.0162	5.94%	$70.87	11.34%	-5.40%
15	2003	895.84	0.0180	28.22%	$62.26	20.27%	7.95%
16	2002	1,140.21	0.0138	-20.05%	$57.44	15.35%	-35.40%
17	2001	1,335.63	0.0116	-13.47%	$56.40	8.93%	-22.40%
18	2000	1,425.59	0.0118	-5.13%	$52.60	14.82%	-19.95%
19	1999	1,248.77	0.0130	15.46%	$63.03	-10.20%	25.66%
20	1998	963.35	0.0162	31.25%	$62.43	7.38%	23.87%
21	1997	766.22	0.0195	27.68%	$56.62	17.32%	10.36%
22	1996	614.42	0.0231	27.02%	$60.91	-0.48%	27.49%
23	1995	465.25	0.0287	34.93%	$50.22	29.26%	5.68%
24	1994	472.99	0.0269	1.05%	$60.01	-9.65%	10.71%
25	1993	435.23	0.0288	11.56%	$53.13	20.48%	-8.93%
26	1992	416.08	0.0290	7.50%	$49.56	15.27%	-7.77%
27	1991	325.49	0.0382	31.65%	$44.84	19.44%	12.21%
28	1990	339.97	0.0341	-0.85%	$45.60	7.11%	-7.96%
29	1989	285.41	0.0364	22.76%	$43.06	15.18%	7.58%
30	1988	250.48	0.0366	17.61%	$40.10	17.36%	0.25%
31	1987	264.51	0.0317	-2.13%	$48.92	-9.84%	7.71%
32	1986	208.19	0.0390	30.95%	$39.98	32.36%	-1.41%
33	1985	171.61	0.0451	25.83%	$32.57	35.05%	-9.22%
34	1984	166.39	0.0427	7.41%	$31.49	16.12%	-8.72%
35	1983	144.27	0.0479	20.12%	$29.41	20.65%	-0.53%
36	1982	117.28	0.0595	28.96%	$24.48	36.48%	-7.51%
37	1981	132.97	0.0480	-7.00%	$29.37	-3.01%	-3.99%
38	1980	110.87	0.0541	25.34%	$34.69	-3.81%	29.16%
39	1979	99.71	0.0533	16.52%	$43.91	-11.89%	28.41%
40	1978	90.25	0.0532	15.80%	$49.09	-2.40%	18.20%

LINE	YEAR	S&P 500 STOCK PRICE	STOCK DIVIDEND YIELD	STOCK RETURN	A-RATED BOND PRICE	BOND RETURN	RISK PREMIUM
41	1977	103.80	0.0399	-9.06%	$50.95	4.20%	-13.27%
42	1976	96.86	0.0380	10.96%	$43.91	25.13%	-14.17%
43	1975	72.56	0.0507	38.56%	$41.76	14.75%	23.81%
44	1974	96.11	0.0364	-20.86%	$52.54	-12.91%	-7.96%
45	1973	118.40	0.0269	-16.14%	$58.51	-3.37%	-12.77%
46	1972	103.30	0.0296	17.58%	$56.47	10.69%	6.89%
47	1971	93.49	0.0332	13.81%	$53.93	12.13%	1.69%
48	1970	90.31	0.0356	7.08%	$50.46	14.81%	-7.73%
49	1969	102.00	0.0306	-8.40%	$62.43	-12.76%	4.36%
50	1968	95.04	0.0313	10.45%	$66.97	-0.81%	11.26%
51	1967	84.45	0.0351	16.05%	$78.69	-9.81%	25.86%
52	1966	93.32	0.0302	-6.48%	$86.57	-4.48%	-2.00%
53	1965	86.12	0.0299	11.35%	$91.40	-0.91%	12.26%
54	1964	76.45	0.0305	15.70%	$92.01	3.68%	12.02%
55	1963	65.06	0.0331	20.82%	$93.56	2.61%	18.20%
56	1962	69.07	0.0297	-2.84%	$89.60	8.89%	-11.73%
57	1961	59.72	0.0328	18.94%	$89.74	4.29%	14.64%
58	1960	58.03	0.0327	6.18%	$84.36	11.13%	-4.95%
59	1959	55.62	0.0324	7.57%	$91.55	-3.49%	11.06%
60	1958	41.12	0.0448	39.74%	$101.22	-5.60%	45.35%
61	1957	45.43	0.0431	-5.18%	$100.70	4.49%	-9.67%
62	1956	44.15	0.0424	7.14%	$113.00	-7.35%	14.49%
63	1955	35.60	0.0438	28.40%	$116.77	0.20%	28.20%
64	1954	25.46	0.0569	45.52%	$112.79	7.07%	38.45%
65	1953	26.18	0.0545	2.70%	$114.24	2.24%	0.46%
66	1952	24.19	0.0582	14.05%	$113.41	4.26%	9.79%
67	1951	21.21	0.0634	20.39%	$123.44	-4.89%	25.28%
68	1950	16.88	0.0665	32.30%	$125.08	1.89%	30.41%
69	1949	15.36	0.0620	16.10%	$119.82	7.72%	8.37%
70	1948	14.83	0.0571	9.28%	$118.50	4.49%	4.79%
71	1947	15.21	0.0449	1.99%	$126.02	-2.79%	4.79%
72	1946	18.02	0.0356	-12.03%	$126.74	2.59%	-14.63%
73	1945	13.49	0.0460	38.18%	$119.82	9.11%	29.07%
74	1944	11.85	0.0495	18.79%	$119.82	3.34%	15.45%
75	1943	10.09	0.0554	22.98%	$118.50	4.49%	18.49%
76	1942	8.93	0.0788	20.87%	$117.63	4.14%	16.73%
77	1941	10.55	0.0638	-8.98%	$116.34	4.55%	-13.52%
78	1940	12.30	0.0458	-9.65%	$112.39	7.08%	-16.73%
79	1939	12.50	0.0349	1.89%	$105.75	10.05%	-8.16%
80	1938	11.31	0.0784	18.36%	$99.83	9.94%	8.42%
81	1937	17.59	0.0434	-31.36%	$103.18	0.63%	-31.99%
82	Average			11.2%		6.6%	4.62%

Note: See Appendix 5 for an explanation of how stock and bond returns are derived and the source of the data presented.

EXHIBIT JVW-1 SCHEDULE 4
COMPARATIVE RETURNS ON S&P UTILITY STOCK INDEX
AND MOODY'S A-RATED UTILITY BONDS 1937 – 2017

LINE	YEAR	S&P UTILITY STOCK PRICE	STOCK DIVIDEND YIELD	STOCK RETURN	A-RATED BOND PRICE	BOND RETURN	RISK PREMIUM
1	2017				$96.13		
2	2016			17.44%	$95.48	4.87%	12.57%
3	2015			-3.90%	$107.65	-7.59%	3.69%
4	2014			28.91%	$89.89	24.20%	4.71%
5	2013			13.01%	$97.45	-3.65%	16.66%
6	2012			2.09%	$94.36	7.52%	-5.43%
7	2011			19.99%	$77.36	27.14%	-7.15%
8	2010			7.04%	$75.02	8.44%	-1.40%
9	2009			10.71%	$68.43	15.48%	-4.77%
10	2008			-25.90%	$72.25	0.24%	-26.14%
11	2007			16.56%	$72.91	4.59%	11.96%
12	2006			20.76%	$75.25	2.20%	18.56%
13	2005			16.05%	$74.91	5.80%	10.25%
14	2004			22.84%	$70.87	11.34%	11.50%
15	2003			23.48%	$62.26	20.27%	3.21%
16	2002			-14.73%	$57.44	15.35%	-30.08%
17	2001	307.70	0.0287	-17.90%	$56.40	8.93%	-26.83%
18	2000	239.17	0.0413	32.78%	$52.60	14.82%	17.96%
19	1999	253.52	0.0394	-1.72%	$63.03	-10.20%	8.48%
20	1998	228.61	0.0457	15.47%	$62.43	7.38%	8.09%
21	1997	201.14	0.0492	18.58%	$56.62	17.32%	1.26%
22	1996	202.57	0.0454	3.83%	$60.91	-0.48%	4.31%
23	1995	153.87	0.0584	37.49%	$50.22	29.26%	8.23%
24	1994	168.70	0.0496	-3.83%	$60.01	-9.65%	5.82%
25	1993	159.79	0.0537	10.95%	$53.13	20.48%	-9.54%
26	1992	149.70	0.0572	12.46%	$49.56	15.27%	-2.81%
27	1991	138.38	0.0607	14.25%	$44.84	19.44%	-5.19%
28	1990	146.04	0.0558	0.33%	$45.60	7.11%	-6.78%
29	1989	114.37	0.0699	34.68%	$43.06	15.18%	19.51%
30	1988	106.13	0.0704	14.80%	$40.10	17.36%	-2.55%
31	1987	120.09	0.0588	-5.74%	$48.92	-9.84%	4.10%
32	1986	92.06	0.0742	37.87%	$39.98	32.36%	5.51%
33	1985	75.83	0.0860	30.00%	$32.57	35.05%	-5.04%
34	1984	68.50	0.0925	19.95%	$31.49	16.12%	3.83%
35	1983	61.89	0.0948	20.16%	$29.41	20.65%	-0.49%
36	1982	51.81	0.1074	30.20%	$24.48	36.48%	-6.28%
37	1981	52.01	0.0978	9.40%	$29.37	-3.01%	12.41%
38	1980	50.26	0.0953	13.01%	$34.69	-3.81%	16.83%
39	1979	50.33	0.0893	8.79%	$43.91	-11.89%	20.68%
40	1978	52.40	0.0791	3.96%	$49.09	-2.40%	6.36%
41	1977	54.01	0.0714	4.16%	$50.95	4.20%	-0.04%

LINE	YEAR	S&P UTILITY STOCK PRICE	STOCK DIVIDEND YIELD	STOCK RETURN	A-RATED BOND PRICE	BOND RETURN	RISK PREMIUM
42	1976	46.99	0.0776	22.70%	$43.91	25.13%	-2.43%
43	1975	38.19	0.0920	32.24%	$41.76	14.75%	17.49%
44	1974	48.60	0.0713	-14.29%	$52.54	-12.91%	-1.38%
45	1973	60.01	0.0556	-13.45%	$58.51	-3.37%	-10.08%
46	1972	60.19	0.0542	5.12%	$56.47	10.69%	-5.57%
47	1971	63.43	0.0504	-0.07%	$53.93	12.13%	-12.19%
48	1970	55.72	0.0561	19.45%	$50.46	14.81%	4.64%
49	1969	68.65	0.0445	-14.38%	$62.43	-12.76%	-1.62%
50	1968	68.02	0.0435	5.28%	$66.97	-0.81%	6.08%
51	1967	70.63	0.0392	0.22%	$78.69	-9.81%	10.03%
52	1966	74.50	0.0347	-1.72%	$86.57	-4.48%	2.76%
53	1965	75.87	0.0315	1.34%	$91.40	-0.91%	2.25%
54	1964	67.26	0.0331	16.11%	$92.01	3.68%	12.43%
55	1963	63.35	0.0330	9.47%	$93.56	2.61%	6.86%
56	1962	62.69	0.0320	4.25%	$89.60	8.89%	-4.64%
57	1961	52.73	0.0358	22.47%	$89.74	4.29%	18.18%
58	1960	44.50	0.0403	22.52%	$84.36	11.13%	11.39%
59	1959	43.96	0.0377	5.00%	$91.55	-3.49%	8.49%
60	1958	33.30	0.0487	36.88%	$101.22	-5.60%	42.48%
61	1957	32.32	0.0487	7.90%	$100.70	4.49%	3.41%
62	1956	31.55	0.0472	7.16%	$113.00	-7.35%	14.51%
63	1955	29.89	0.0461	10.16%	$116.77	0.20%	9.97%
64	1954	25.51	0.0520	22.37%	$112.79	7.07%	15.30%
65	1953	24.41	0.0511	9.62%	$114.24	2.24%	7.38%
66	1952	22.22	0.0550	15.36%	$113.41	4.26%	11.10%
67	1951	20.01	0.0606	17.10%	$123.44	-4.89%	21.99%
68	1950	20.20	0.0554	4.60%	$125.08	1.89%	2.71%
69	1949	16.54	0.0570	27.83%	$119.82	7.72%	20.10%
70	1948	16.53	0.0535	5.41%	$118.50	4.49%	0.92%
71	1947	19.21	0.0354	-10.41%	$126.02	-2.79%	-7.62%
72	1946	21.34	0.0298	-7.00%	$126.74	2.59%	-9.59%
73	1945	13.91	0.0448	57.89%	$119.82	9.11%	48.79%
74	1944	12.10	0.0569	20.65%	$119.82	3.34%	17.31%
75	1943	9.22	0.0621	37.45%	$118.50	4.49%	32.96%
76	1942	8.54	0.0940	17.36%	$117.63	4.14%	13.22%
77	1941	13.25	0.0717	-28.38%	$116.34	4.55%	-32.92%
78	1940	16.97	0.0540	-16.52%	$112.39	7.08%	-23.60%
79	1939	16.05	0.0553	11.26%	$105.75	10.05%	1.21%
80	1938	14.30	0.0730	19.54%	$99.83	9.94%	9.59%
81	1937	24.34	0.0432	-36.93%	$103.18	0.63%	-37.55%
82	Average			10.6%		6.6%	4.0%

Note: See Appendix 5 for an explanation of how stock and bond returns are derived and the source of the data presented. Standard & Poor's discontinued its S&P Utilities Index in December 2001 and replaced its utilities stock index with separate indices for electric and natural gas utilities. In this study, the stock returns beginning in 2002 are based on the total returns for the EEI Index of U.S. shareholder-owned electric utilities, as reported by EEI on its website.
http://www.eei.org/whatwedo/DataAnalysis/IndusFinanAnalysis/Pages/QtrlyFinancialUpdates.aspx

EXHIBIT JVW-1 SCHEDULE 5
USING THE ARITHMETIC MEAN TO ESTIMATE
THE COST OF EQUITY CAPITAL

Consider an investment that in a given year generates a return of 30 percent with probability equal to 0.5 and a return of -10 percent with a probability equal to 0.5. For each one dollar invested, the possible outcomes of this investment at the end of year one are:

END OF YEAR 1	*WEALTH AFTER ONE YEAR*	*PROBABILITY*
	$1.30	0.5
	$0.90	0.5

At the end of year two, the possible outcomes are:

END OF YEAR 2	*WEALTH AFTER TWO YEARS*		*VALUE*	*PROBABILITY*	*WEALTH X PROBABILITY*
	(1.30) (1.30)	=	$ 1.69	0.25	$ 0.4225
	(1.30) (.9)	=	$ 1.17	0.25	$ 0.2925
	(.9) (1.30)	=	$ 1.17	0.25	$ 0.2925
	(.9) (.9)	=	$ 0.81	0.25	$ 0.2025
	Expected Wealth	=			$ 1.21

The expected value of this investment at the end of year two is $1.21. In a competitive capital market, the cost of equity is equal to the expected rate of return on an investment. In the above example, the cost of equity is that rate of return which will make the initial investment of one dollar grow to the expected value of $1.21 at the end of two years. Thus, the cost of equity is the solution to the equation:

$$1(1+k)^2 = 1.21 \text{ or}$$

$$k = (1.21/1)^{.5} - 1 = 10\%.$$

The arithmetic mean of this investment is:

$$(30\%)\ (.5) + (-10\%)\ (.5) = 10\%.$$

Thus, the arithmetic mean is equal to the cost of equity capital.

The geometric mean of this investment is:

$$[(1.3)\ (.9)]^{.5} - 1 = .082 = 8.2\%.$$

Thus, the geometric mean is not equal to the cost of equity capital.

The lesson is obvious: for an investment with an uncertain outcome, the arithmetic mean is the best measure of the cost of equity capital because the arithmetic mean is the only return which will make the initial investment grow to the expected value of the investment at the end of the investment horizon.

EXHIBIT JVW-1 SCHEDULE-6
CALCULATION OF CAPITAL ASSET PRICING MODEL COST OF EQUITY
USING AN HISTORICAL 6.9 PERCENT RISK PREMIUM

LINE	COMPANY	VALUE LINE BETA	RISK-FREE RATE	MARKET RISK PREMIUM	BETA X RISK PREMIUM	CAPM RESULT
1	Atmos Energy	0.70	4.2%	6.9%	4.86%	9.2%
2	Chesapeake Utilities	0.70	4.2%	6.9%	4.86%	9.2%
3	NiSource Inc.	0.65	4.2%	6.9%	4.51%	8.9%
4	New Jersey Resources	0.80	4.2%	6.9%	5.55%	9.9%
5	Northwest Nat. Gas	0.65	4.2%	6.9%	4.51%	8.9%
6	ONE Gas Inc.	0.70	4.2%	6.9%	4.86%	9.2%
7	South Jersey Inds.	0.80	4.2%	6.9%	5.55%	9.9%
8	Spire Inc.	0.70	4.2%	6.9%	4.86%	9.2%
9	UGI Corp.	0.90	4.2%	6.9%	6.25%	10.6%
10	Southwest Gas	0.75	4.2%	6.9%	5.21%	9.6%
11	Historical CAPM Model Result					9.5%

Historical Ibbotson® SBBI® risk premium including years 1926 through year end 2016 from 2017 Valuation Handbook. Value Line beta for comparable companies from Value Line Investment Analyzer. Flotation cost allowance of 14 basis points. Treasury bond yield forecast from data in Value Line Selection & Opinion, June 2, 2017, and Energy Information Administration, 2017, determined as follows. Value Line forecasts a yield on 10-year Treasury notes equal to 4.0 percent. The spread between the average June 2017 yield on 10-year Treasury notes (2.19 percent) and 20-year Treasury bonds (2.54 percent) is 35 basis points. Adding 35 basis points to Value Line's 4.0 percent forecasted yield on 10-year Treasury notes produces a forecasted yield of 4.35 percent for 20-year Treasury bonds (see Value Line Investment Survey, Selection & Opinion, June 2, 2016). EIA forecasts a yield of 3.75 percent on 10-year Treasury notes. Adding the 34 basis point spread between 10-year Treasury notes and 20-year Treasury bonds to the EIA forecast of 3.75 percent for 10-year Treasury notes produces an EIA forecast for 20-year Treasury bonds equal to 4.10 percent. The average of the forecasts is 4.2 percent (4.35 percent using Value Line data and 4.1 percent using EIA data).

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EXHIBIT JVW-1 SCHEDULE-7
COMPARISON OF RISK PREMIUMS ON
S&P500 AND S&P UTILITIES 1937 – 2017

YEAR	S&P UTILITIES STOCK RETURN	SP500 STOCK RETURN	10-YR. TREASURY BOND YIELD	UTILITIES RISK PREMIUM	MARKET RISK PREMIUM
2016	0.1744	0.2080	0.0184	0.1560	0.1896
2015	-0.0390	-0.0332	0.0214	-0.0604	-0.0546
2014	0.2891	0.1339	0.0254	0.2637	0.1085
2013	0.1301	0.2524	0.0235	0.1066	0.2289
2012	0.0209	0.1602	0.0180	0.0029	0.1422
2011	0.1999	0.0325	0.0278	0.1721	0.0047
2010	0.0704	0.1618	0.0322	0.0382	0.1296
2009	0.1071	0.3291	0.0326	0.0745	0.2965
2008	-0.2590	-0.3516	0.0367	-0.2957	-0.3883
2007	0.1656	-0.0138	0.0463	0.1193	-0.0601
2006	0.2076	0.1320	0.0479	0.1597	0.0841
2005	0.1605	0.1001	0.0429	0.1176	0.0572
2004	0.2284	0.0594	0.0427	0.1857	0.0167
2003	0.2348	0.2822	0.0401	0.1947	0.2421
2002	-0.1473	-0.2005	0.0461	-0.1934	-0.2466
2001	-0.1790	-0.1347	0.0502	-0.2292	-0.1849
2000	0.3278	-0.0513	0.0603	0.2675	-0.1116
1999	-0.0172	0.1546	0.0564	-0.0736	0.0982
1998	0.1547	0.3125	0.0526	0.1021	0.2599
1997	0.1858	0.2768	0.0635	0.1223	0.2133
1996	0.0383	0.2702	0.0644	-0.0261	0.2058
1995	0.3749	0.3493	0.0658	0.3091	0.2835
1994	-0.0383	0.0105	0.0708	-0.1091	-0.0603
1993	0.1095	0.1156	0.0587	0.0508	0.0569
1992	0.1246	0.0750	0.0701	0.0545	0.0049
1991	0.1425	0.3165	0.0786	0.0639	0.2379
1990	0.0033	-0.0085	0.0855	-0.0822	-0.0940
1989	0.3468	0.2276	0.0850	0.2618	0.1426
1988	0.1480	0.1761	0.0884	0.0596	0.0877
1987	-0.0574	-0.0213	0.0838	-0.1412	-0.1051
1986	0.3787	0.3095	0.0768	0.3019	0.2327
1985	0.3000	0.2583	0.1062	0.1938	0.1521
1984	0.1995	0.0741	0.1244	0.0751	-0.0503
1983	0.2016	0.2012	0.1110	0.0906	0.0902
1982	0.3020	0.2896	0.1300	0.1720	0.1596
1981	0.0940	-0.0700	0.1391	-0.0451	-0.2091
1980	0.1301	0.2534	0.1146	0.0155	0.1388
1979	0.0879	0.1652	0.0944	-0.0065	0.0708

YEAR	S&P UTILITIES STOCK RETURN	SP500 STOCK RETURN	10-YR. TREASURY BOND YIELD	UTILITIES RISK PREMIUM	MARKET RISK PREMIUM
1978	0.0396	0.1580	0.0841	-0.0445	0.0739
1977	0.0416	-0.0906	0.0742	-0.0326	-0.1648
1976	0.2270	0.1096	0.0761	0.1509	0.0335
1975	0.3224	0.3856	0.0799	0.2425	0.3057
1974	-0.1429	-0.2086	0.0756	-0.2185	-0.2842
1973	-0.1345	-0.1614	0.0684	-0.2029	-0.2298
1972	0.0512	0.1758	0.0621	-0.0109	0.1137
1971	-0.0007	0.1381	0.0616	-0.0623	0.0765
1970	0.1945	0.0708	0.0735	0.1210	-0.0027
1969	-0.1438	-0.0840	0.0667	-0.2105	-0.1507
1968	0.0528	0.1045	0.0565	-0.0037	0.0480
1967	0.0022	0.1605	0.0507	-0.0485	0.1098
1966	-0.0172	-0.0648	0.0492	-0.0664	-0.1140
1965	0.0134	0.1135	0.0428	-0.0294	0.0707
1964	0.1611	0.1570	0.0419	0.1192	0.1151
1963	0.0947	0.2082	0.0400	0.0547	0.1682
1962	0.0425	-0.0284	0.0395	0.0030	-0.0679
1961	0.2247	0.1894	0.0388	0.1859	0.1506
1960	0.2252	0.0618	0.0412	0.1840	0.0206
1959	0.0500	0.0757	0.0433	0.0067	0.0324
1958	0.3688	0.3974	0.0332	0.3356	0.3642
1957	0.0790	-0.0518	0.0365	0.0425	-0.0883
1956	0.0716	0.0714	0.0318	0.0398	0.0396
1955	0.1016	0.2840	0.0282	0.0734	0.2558
1954	0.2237	0.4552	0.0240	0.1997	0.4312
1953	0.0962	0.0270	0.0281	0.0681	-0.0011
1952	0.1536	0.1405	0.0248	0.1288	0.1157
1951	0.1710	0.2039	0.0241	0.1469	0.1798
1950	0.0460	0.3230	0.0205	0.0255	0.3025
1949	0.2783	0.1610	0.0193	0.2590	0.1417
1948	0.0541	0.0928	0.0215	0.0326	0.0713
1947	-0.1041	0.0199	0.0185	-0.1226	0.0014
1946	-0.0700	-0.1203	0.0174	-0.0874	-0.1377
1945	0.5789	0.3818	0.0173	0.5616	0.3645
1944	0.2065	0.1879	0.0209	0.1856	0.1670
1943	0.3745	0.2298	0.0207	0.3538	0.2091
1942	0.1736	0.2087	0.0211	0.1525	0.1876
1941	-0.2838	-0.0898	0.0199	-0.3037	-0.1097
1940	-0.1652	-0.0965	0.0220	-0.1872	-0.1185
1939	0.1126	0.0189	0.0235	0.0891	-0.0046
1938	0.1954	0.1836	0.0255	0.1699	0.1581
1937	-0.3693	-0.3136	0.0269	-0.3962	-0.3405
Risk Premium 1937 to 2017				0.0547	0.0608
RP Utilities/RP SP500				0.90	

EXHIBIT JVW-1 SCHEDULE-8
CALCULATION OF CAPITAL ASSET PRICING MODEL COST OF EQUITY
USING AN HISTORICAL 6.9 PERCENT RISK PREMIUM AND A 0.90 UTILITY BETA

		BETA	RISK-FREE RATE	MARKET RISK PREMIUM	BETA X MRP	MODEL RESULT
1	Historical Utility Beta	0.90	4.2%	6.9%	6.2%	10.6%

Historical Ibbotson® SBBI® risk premium including years 1926 through year end 2016 from 2017 Valuation Handbook. Historical utility beta per Schedule 7. Flotation cost allowance of 14 basis points. Treasury bond yield forecast from data in Value Line Selection & Opinion, June 2, 2017, and Energy Information Administration, 2017, determined as follows. Value Line forecasts a yield on 10-year Treasury notes equal to 4.0 percent. The spread between the average June 2017 yield on 10-year Treasury notes (2.19 percent) and 20-year Treasury bonds (2.54 percent) is 35 basis points. Adding 35 basis points to Value Line's 4.0 percent forecasted yield on 10-year Treasury notes produces a forecasted yield of 4.35 percent for 20-year Treasury bonds (see Value Line Investment Survey, Selection & Opinion, June 2, 2016). EIA forecasts a yield of 3.75 percent on 10-year Treasury notes. Adding the 34 basis point spread between 10-year Treasury notes and 20-year Treasury bonds to the EIA forecast of 3.75 percent for 10-year Treasury notes produces an EIA forecast for 20-year Treasury bonds equal to 4.10 percent. The average of the forecasts is 4.2 percent (4.35 percent using Value Line data and 4.1 percent using EIA data).

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EXHIBIT JVW-1 SCHEDULE 9
CALCULATION OF CAPITAL ASSET PRICING MODEL COST OF EQUITY
USING DCF ESTIMATE OF THE EXPECTED RATE OF RETURN
ON THE MARKET PORTFOLIO

LINE	COMPANY	VALUE LINE BETA	RISK-FREE RATE	DCF S&P 500	MARKET RISK PREMIUM	BETA X RISK PREMIUM	CAPM COST OF EQUITY
1	Atmos Energy	0.70	4.2%	11.9%	7.7%	5.38%	9.7%
2	Chesapeake Utilities	0.70	4.2%	11.9%	7.7%	5.38%	9.7%
3	NiSource Inc.	0.65	4.2%	11.9%	7.7%	4.99%	9.4%
4	New Jersey Resources	0.80	4.2%	11.9%	7.7%	6.15%	10.5%
5	Northwest Nat. Gas	0.65	4.2%	11.9%	7.7%	4.99%	9.4%
6	ONE Gas Inc.	0.70	4.2%	11.9%	7.7%	5.38%	9.7%
7	South Jersey Inds.	0.80	4.2%	11.9%	7.7%	6.15%	10.5%
8	Spire Inc.	0.70	4.2%	11.9%	7.7%	5.38%	9.7%
9	UGI Corp.	0.90	4.2%	11.9%	7.7%	6.91%	11.3%
10	Southwest Gas	0.75	4.2%	11.9%	7.7%	5.76%	10.1%
11	DCF CAPM Result						10.0%
	Beta Equal to 0.90						
1	DCF CAPM Result	0.90	4.2%	11.9%	7.7%	6.91%	11.3%

Historical Ibbotson® SBBI® risk premium including years 1926 through year end 2016 from 2017 Valuation Handbook. Beta per Value Line for proxy utilities and per Schedule 7. Treasury bond yield forecast from data in Value Line Selection & Opinion, June 2, 2017, and Energy Information Administration, 2017, determined as follows. Value Line forecasts a yield on 10-year Treasury notes equal to 4.0 percent. The spread between the average June 2017 yield on 10-year Treasury notes (2.19 percent) and 20-year Treasury bonds (2.54 percent) is 35 basis points. Adding 35 basis points to Value Line's 4.0 percent forecasted yield on 10-year Treasury notes produces a forecasted yield of 4.35 percent for 20-year Treasury bonds (see Value Line Investment Survey, Selection & Opinion, June 2, 2016). EIA forecasts a yield of 3.75 percent on 10-year Treasury notes. Adding the 34 basis point spread between 10-year Treasury notes and 20-year Treasury bonds to the EIA forecast of 3.75 percent for 10-year Treasury notes produces an EIA forecast for 20-year Treasury bonds equal to 4.10 percent. The average of the forecasts is 4.2 percent (4.35 percent using Value Line data and 4.1 percent using EIA data).

EXHIBIT JVW-1 SCHEDULE 9 (CONTINUED)
SUMMARY OF DISCOUNTED CASH FLOW ANALYSIS
FOR S&P 500 COMPANIES

	COMPANY	STOCK PRICE (P_0)	D_0	FORECAST OF FUTURE EARNINGS GROWTH	MODEL RESULT	MARKET CAP $ (MILS)
1	3M	200.33	4.70	9.33%	11.9%	126,191
2	ABBOTT LABORATORIES	45.10	1.06	11.22%	13.9%	83,501
3	ACCENTURE CLASS A	121.29	2.42	9.42%	11.6%	78,503
4	ADV.AUTO PARTS	137.38	0.24	11.63%	11.8%	9,685
5	AETNA	140.78	2.00	12.02%	13.6%	49,523
6	AFLAC	75.26	1.72	7.97%	10.5%	30,875
7	AGILENT TECHS.	57.17	0.53	9.87%	10.9%	19,026
8	ALLERGAN	236.08	2.80	12.38%	13.7%	78,848
9	ALLIANCE DATA SYSTEMS	248.89	2.08	12.29%	13.2%	13,921
10	ALTRIA GROUP	73.45	2.44	7.87%	11.5%	147,597
11	AMERICAN WATER WORKS	78.92	1.66	7.70%	10.0%	14,622
12	AMERISOURCEBERGEN	88.40	1.46	8.84%	10.6%	20,619
13	ANTHEM	180.98	2.60	11.78%	13.4%	50,016
14	APPLE	147.44	2.52	11.07%	13.0%	752,305
15	AT&T	39.23	1.96	7.25%	12.7%	238,788
16	AUTOMATIC DATA PROC.	101.39	2.28	11.39%	13.9%	45,712
17	AVERY DENNISON	83.71	1.80	11.11%	13.5%	7,576
18	BALL	39.38	0.20	11.16%	11.7%	14,450
19	BANK OF AMERICA	23.29	0.30	11.71%	13.2%	234,268
20	BECTON DICKINSON	185.85	2.92	9.90%	11.6%	43,373
21	BRISTOL MYERS SQUIBB	54.74	1.56	9.19%	12.3%	89,423
22	C R BARD	299.32	1.04	11.46%	11.8%	22,734
23	CAPITAL ONE FINL.	81.07	1.60	8.32%	10.5%	39,289
24	CENTERPOINT EN.	28.03	1.07	5.89%	10.0%	12,330
25	CHURCH & DWIGHT CO.	51.05	0.76	8.24%	9.9%	13,348
26	CIGNA	160.06	0.04	13.60%	13.6%	42,826
27	CITIGROUP	61.35	0.64	9.46%	10.6%	176,484
28	CLOROX	134.60	3.36	6.93%	9.6%	18,052
29	CMS ENERGY	46.17	1.33	7.52%	10.7%	13,484
30	COLGATE-PALM.	73.98	1.60	8.57%	10.9%	67,439
31	COMCAST 'A'	39.61	0.63	11.95%	13.7%	196,157
32	CORNING	28.74	0.62	9.36%	11.7%	27,046
33	COSTCO WHOLESALE	172.65	2.00	9.97%	11.2%	78,973
34	CUMMINS	154.99	4.10	10.48%	13.4%	27,162
35	CVS HEALTH	79.34	2.00	7.89%	10.6%	81,595
36	D R HORTON	33.43	0.40	11.14%	12.5%	12,702
37	DISCOVER FINANCIAL SVS.	62.13	1.20	8.43%	10.5%	23,085
38	DOW CHEMICAL	62.61	1.84	6.96%	10.1%	78,311
39	DR PEPPER SNAPPLE GROUP	93.62	2.32	8.73%	11.4%	17,238
40	E I DU PONT DE NEMOURS	79.84	1.52	8.06%	10.1%	71,244

	COMPANY	STOCK PRICE (P_0)	D_0	FORECAST OF FUTURE EARNINGS GROWTH	MODEL RESULT	MARKET CAP $ (MILS)
41	EATON	76.35	2.40	10.36%	13.9%	34,057
42	ECOLAB	129.62	1.48	11.91%	13.2%	38,823
43	EMERSON ELECTRIC	59.26	1.92	7.00%	10.5%	38,836
44	EQUIFAX	137.17	1.56	11.00%	12.3%	17,024
45	ESTEE LAUDER COS.'A'	90.95	1.36	9.66%	11.3%	21,839
46	FEDEX	196.05	2.00	11.78%	12.9%	56,269
47	FIDELITY NAT.INFO.SVS.	83.64	1.16	12.48%	14.0%	28,440
48	FOOT LOCKER	64.91	1.24	7.58%	9.7%	6,937
49	GAP	23.93	0.92	7.33%	11.5%	9,138
50	GENERAL MILLS	57.77	1.96	6.21%	9.9%	33,951
51	GOLDMAN SACHS GP.	220.69	3.00	12.24%	13.8%	87,870
52	HARLEY-DAVIDSON	56.08	1.46	9.23%	12.1%	9,608
53	HARTFORD FINL.SVS.GP.	49.31	0.92	9.97%	12.0%	19,055
54	HERSHEY	110.18	2.47	8.22%	10.7%	17,481
55	HONEYWELL INTL.	131.31	2.66	7.42%	9.6%	102,512
56	HUMANA	225.03	1.60	12.98%	13.8%	33,540
57	HUNT JB TRANSPORT SVS.	88.93	0.92	12.15%	13.3%	9,930
58	HUNTINGTON BCSH.	12.95	0.32	10.56%	13.3%	14,448
59	ILLINOIS TOOL WORKS	139.96	2.60	9.11%	11.2%	51,199
60	INGERSOLL-RAND	87.98	1.60	10.64%	12.7%	23,006
61	INTEL	35.80	1.09	8.36%	11.7%	166,275
62	JP MORGAN CHASE & CO.	86.25	2.00	7.98%	10.5%	307,566
63	JUNIPER NETWORKS	29.31	0.40	12.12%	13.7%	11,027
64	KANSAS CITY SOUTHERN	93.69	1.32	11.90%	13.5%	10,806
65	KEYCORP	18.11	0.38	10.32%	12.7%	20,475
66	KOHL'S	38.59	2.20	5.04%	11.2%	6,356
67	KRAFT HEINZ	90.38	2.40	9.25%	12.2%	111,596
68	L BRANDS	50.39	2.40	8.00%	13.2%	14,936
69	M&T BANK	157.55	3.00	8.15%	10.2%	24,851
70	MARSH & MCLENNAN	75.75	1.50	10.23%	12.4%	41,278
71	MCCORMICK & COMPANY NV.	100.67	1.88	8.46%	10.5%	11,966
72	MCDONALDS	144.32	3.76	9.05%	11.9%	123,214
73	MEDTRONIC	84.12	1.84	7.38%	9.7%	119,996
74	MICROSOFT	68.81	1.56	9.35%	11.9%	539,664
75	MONDELEZ INTERNATIONAL CL.A	44.84	0.76	10.11%	12.0%	69,613
76	MOODY'S	116.94	1.52	10.31%	11.8%	23,129
77	NEWELL BRANDS	50.14	0.92	10.45%	12.5%	26,372
78	NEXTERA ENERGY	136.51	3.93	6.70%	9.8%	66,418
79	NIELSEN	39.38	1.36	8.42%	12.2%	13,738
80	NIKE 'B'	54.66	0.72	11.23%	12.7%	70,104
81	NISOURCE	24.97	0.70	7.49%	10.5%	8,458
82	NVIDIA	127.51	0.56	12.19%	12.7%	90,660
83	OMNICOM GROUP	83.25	2.20	7.85%	10.7%	19,285
84	ORACLE	45.63	0.76	8.57%	10.4%	183,293

	COMPANY	STOCK PRICE (P_0)	D_0	FORECAST OF FUTURE EARNINGS GROWTH	MODEL RESULT	MARKET CAP $ (MILS)
85	PATTERSON COMPANIES	44.84	1.04	7.51%	10.0%	4,549
86	PAYCHEX	58.65	1.84	8.22%	11.7%	21,817
87	PERKINELMER	61.77	0.28	9.87%	10.4%	7,027
88	PFIZER	33.35	1.28	5.64%	9.8%	195,388
89	PNC FINL.SVS.GP.	120.64	3.00	10.01%	12.8%	59,505
90	PPG INDUSTRIES	108.70	1.60	9.72%	11.3%	28,520
91	PRAXAIR	128.24	3.15	8.39%	11.1%	38,483
92	QUEST DIAGNOSTICS	105.88	1.80	8.17%	10.0%	14,740
93	RAYTHEON 'B'	158.38	3.19	9.02%	11.2%	47,329
94	REPUBLIC SVS.'A'	63.18	1.28	10.68%	12.9%	22,008
95	REYNOLDS AMERICAN	65.28	2.04	9.97%	13.4%	93,721
96	ROBERT HALF INTL.	46.94	0.96	8.20%	10.4%	6,116
97	ROCKWELL AUTOMATION	157.84	3.04	8.87%	11.0%	20,820
98	ROCKWELL COLLINS	104.42	1.32	10.60%	12.0%	17,390
99	ROSS STORES	62.32	0.64	10.27%	11.4%	23,705
100	S&P GLOBAL	139.15	1.64	12.35%	13.7%	38,268
101	SCRIPPS NETWORKS INTACT. 'A'	71.57	1.20	11.13%	13.0%	6,489
102	SEMPRA EN.	113.15	3.29	9.90%	13.1%	28,841
103	SHERWIN-WILLIAMS	334.15	3.40	10.96%	12.1%	32,735
104	SOUTHWEST AIRLINES	58.08	0.50	12.11%	13.1%	36,346
105	STRYKER	137.58	1.70	9.70%	11.1%	52,787
106	SYNCHRONY FINANCIAL	29.07	0.52	8.82%	10.8%	23,901
107	SYSCO	53.13	1.32	11.00%	13.8%	29,720
108	T ROWE PRICE GROUP	71.15	2.28	9.36%	12.9%	17,673
109	TEXAS INSTRUMENTS	80.49	2.00	10.13%	12.9%	79,786
110	THERMO FISHER SCIENTIFIC	168.26	0.60	10.65%	11.0%	68,123
111	TIFFANY & CO	91.05	2.00	9.01%	11.4%	11,346
112	TIME WARNER	99.07	1.61	11.11%	12.9%	76,871
113	TJX	75.58	1.25	10.76%	12.6%	46,663
114	TOTAL SYSTEM SERVICES	57.57	0.40	11.61%	12.4%	10,928
115	TWENTY-FIRST CENTURY FOX CL.A	29.30	0.36	11.74%	13.1%	29,192
116	TWENTY-FIRST CENTURY FOX CL.B	29.30	0.36	11.74%	13.1%	29,192
117	UNITED PARCEL SER.'B'	106.68	3.32	8.35%	11.8%	75,944
118	V F	55.01	1.68	8.32%	11.7%	22,466
119	WALT DISNEY	110.13	1.56	9.41%	11.0%	165,846
120	WASTE MANAGEMENT	72.83	1.70	10.41%	13.0%	32,726
121	WELLS FARGO & CO	53.59	1.52	8.23%	11.3%	269,355
122	WILLIS TOWERS WATSON	138.85	2.12	10.71%	12.4%	20,065
123	XILINX	63.59	1.40	8.54%	10.9%	16,090
124	ZIMMER BIOMET HDG.	121.47	0.96	9.72%	10.6%	25,375
125	ZOETIS	58.71	0.42	12.88%	13.7%	30,621
126	Average				11.9%	

Notes: In applying the DCF model to the S&P 500, I included in the DCF analysis only those companies in the S&P 500 group which pay a dividend, have a positive growth rate, and have at least three analysts' long-term growth estimates. I also eliminated those 25 percent of companies with the highest and lowest DCF results, a decision which had no impact on my CAPM estimate of the cost of equity.

D_0	=	Current dividend per Thomson Reuters
P_0	=	Average of the monthly high and low stock prices during the three months ending June 2017 per Thomson Reuters
g	=	I/B/E/S forecast of future earnings growth June 2017
k	=	Cost of equity using the quarterly version of the DCF model shown below:

$$k = \left[\frac{d_0 (1+g)^{\frac{1}{4}}}{P_0} + (1+g)^{\frac{1}{4}} \right]^4 - 1$$

EXHIBIT JVW-1 SCHEDULE 10
AVERAGE MARKET VALUE CAPITAL STRUCTURE
VALUE LINE NATURAL GAS UTILITIES 2007 - 2016

	YEAR	SHORT-TERM DEBT	LONG-TERM DEBT	MARKET EQUITY	TOTAL CAPITAL	PERCENT SHORT-TERM DEBT	PERCENT LONG-TERM DEBT	PERCENT MARKET EQUITY
1	2007	2,619	10,678	19,061	32,357	8%	33%	59%
2	2008	5,645	16,547	19,613	41,804	14%	40%	47%
3	2009	4,673	16,684	25,547	46,904	10%	36%	54%
4	2010	5,649	15,464	29,165	50,277	11%	31%	58%
5	2011	4,209	16,035	27,553	47,797	9%	34%	58%
6	2012	5,946	20,440	37,625	64,011	9%	32%	59%
7	2013	5,854	22,999	40,254	69,107	8%	33%	58%
8	2014	6,664	24,858	47,554	79,077	8%	31%	60%
9	2015	5,650	23,532	51,433	80,616	7%	29%	64%
10	2016	4,621	19,329	45,928	69,878	7%	28%	66%
11	Average					9%	33%	58%

Notes:
Data from The Value Line Investment Analyzer; data for each year as reported by Value Line at May of following year.

EXHIBIT JVW-1 SCHEDULE 11
ILLUSTRATION OF CALCULATION OF COST OF EQUITY
REQUIRED FOR THE COMPANY TO HAVE THE SAME WEIGHTED AVERAGE COST OF CAPITAL AS COMPARABLE NATURAL GAS UTILITIES

10-YR. Weighted Average Cost of Capital - Value Line Natural Gas Utilities			
Capital Source	% of Total	After-tax Cost Rate	Weighted Cost
Short-term Debt	9%	2.38%	0.21%
Long-term Debt	33%	3.74%	1.23%
Common Equity	58%	10.3%	5.97%
Total	100%		7.42%
Weighted Cost of Debt – Company			
Capital Source	% of Total	After-tax Cost Rate	Weighted Cost
Short-term Debt	6.29%	2.38%	0.15%
Long-term Debt	44.41%	3.74%	1.66%
Total Weighted Cost of Short-term and Long-term Debt	50.70%		1.81%
Cost of Equity Required to Achieve Equivalent WACC			
(1) Average WACC Proxy Companies	7.42%		
(2) Weighted Cost of Short-term, Long-term Debt	1.81%		
(1) Less (2)	5.61%		
Cost of Equity (5.6% ÷ 49.3% = 11.4%)	11.4%		
Capital Source	% of Total	After-tax Cost Rate	Weighted Cost
Short-term Debt	6.29%	2.38%	0.15%
Long-term Debt	44.41%	3.74%	1.66%
Common Equity	49.30%	11.4%	5.61%
Total	100.00%		7.42%
Notes:			
	Before-tax Cost	After-tax Cost	Source
Tax rate	21%		
Short-term Debt	3.01%	2.38%	Company
Long-term debt cost rate	4.73%	3.74%	Company
Cost of equity	10.3%		Cost of equity proxy group
Adjusted cost of equity:	11.4%		

APPENDIX 1

QUALIFICATIONS OF JAMES H. VANDER WEIDE, PH.D.

3606 STONEYBROOK DRIVE
DURHAM, NC 27705
TEL. 919.383.6659

James H. Vander Weide is President of Financial Strategy Associates, a consulting firm that provides financial and economic consulting services, including cost of capital and valuation studies, to corporate clients. Dr. Vander Weide holds a Ph.D. in Finance from Northwestern University and a Bachelor of Arts in Economics from Cornell University. After receiving his Ph.D. in Finance, Dr. Vander Weide joined the faculty at Duke University, the Fuqua School of Business, and was named Assistant Professor, Associate Professor, Professor, and then Research Professor of Finance and Economics.

As a Professor at Duke University and the Fuqua School of Business, Dr. Vander Weide has published research in the areas of finance and economics and taught courses in corporate finance, investment management, management of financial institutions, statistics, economics, operations research, and the theory of public utility pricing. Dr. Vander Weide has been active in executive education at Duke and Duke Corporate Education, leading executive development seminars on topics including financial analysis, cost of capital, creating shareholder value, mergers and acquisitions, capital budgeting, measuring corporate performance, and valuation. In addition, Dr. Vander Weide designed and served as Program Director for several executive education programs, including the Advanced Management Program, Competitive Strategies in Telecommunications, and the Duke Program for Manager Development for managers from the former Soviet Union. He is now retired from his teaching responsibilities at Duke.

As an expert financial economist and industry expert, Dr. Vander Weide has participated in approximately five hundred regulatory and legal proceedings, appearing in U.S. courts and federal and state or provincial proceedings in the United States and Canada. He has testified as an expert witness on the cost of capital, competition, risk, incentive regulation, forward-looking economic cost, economic pricing guidelines, valuation, and other financial and economic issues. His clients include investor-owned electric, gas, and water utilities, natural gas pipelines, oil pipelines, telecommunications companies, and insurance companies.

<u>Publications</u>

Dr. Vander Weide has written research papers on such topics as portfolio management, capital budgeting, investments, the effect of regulation on the performance of public utilities, and cash management. His articles have been published in *American Economic Review, Journal of Finance, Journal of Financial and Quantitative Analysis, Management Science, Financial Management, Journal of*

Portfolio Management, International Journal of Industrial Organization, Journal of Bank Research, Journal of Accounting Research, Journal of Cash Management, Atlantic Economic Journal, Journal of Economics and Business, and *Computers and Operations Research*. He has written a book entitled *Managing Corporate Liquidity: An Introduction to Working Capital Management* published by John Wiley and Sons, Inc.; and he has written a chapter titled "Financial Management in the Short Run" for *The Handbook of Modern Finance*, and a chapter titled "Principles for Lifetime Portfolio Selection: Lessons from Portfolio Theory" for *The Handbook of Portfolio Construction: Contemporary Applications of Markowitz Techniques. The Handbook of Portfolio Construction* is a peer-reviewed collection of research papers by notable scholars on portfolio optimization, published in 2010 in honor of Nobel Prize winner Harry Markowitz.

Professional Consulting Experience

Dr. Vander Weide has provided financial and economic consulting services to firms in the electric, gas, insurance, oil and gas pipeline, telecommunications, and water industries for more than thirty years. He has testified on the cost of capital, competition, risk, incentive regulation, forward-looking economic cost, economic pricing guidelines, valuation, and other financial and economic issues in more than five hundred cases before the Federal Energy Regulatory Commission, the National Energy Board (Canada), the Federal Communications Commission, the Canadian Radio-Television and Telecommunications Commission, the National Telecommunications and Information Administration, the United States Tax Court, the public service commissions of forty-five states and the District of Columbia, four Canadian provinces, the insurance commissions of five states, the Iowa State Board of Tax Review, and the North Carolina Property Tax Commission. In addition, he has testified as an expert witness in proceedings before numerous federal district courts, including the U.S. District Court for the District of Nebraska; the U.S. District Court for the District of New Hampshire; the U.S. District Court for the District of Northern Illinois; the U.S. District Court for the Eastern District of North Carolina; the Montana Second Judicial District Court, Silver Bow County; the U.S. District Court for the Northern District of California; the Superior Court, North Carolina; the U.S. Bankruptcy Court for the Southern District of West Virginia; the U. S. District Court for the Eastern District of Michigan; and the Supreme Court of the State of New York. Dr. Vander Weide testified in thirty states on issues relating to the pricing of unbundled network elements and universal service cost studies and consulted with Bell Canada, Deutsche Telekom, and Telefónica on similar issues. Dr. Vander Weide has provided consulting and expert witness testimony to the following companies:

ELECTRIC, GAS, PIPELINE, WATER COMPANIES	
Alcoa Power Generating, Inc.	MidAmerican Energy and subsidiaries
Alliant Energy and subsidiaries	National Fuel Gas
AltaLink, L.P.	Nevada Power Company
Ameren	Newfoundland Power Inc.
American Water Works and subsidiaries	NICOR
Atmos Energy and subsidiaries	North Carolina Natural Gas
BP p.l.c.	North Shore Gas
Buckeye Partners, L.P.	Northern Natural Gas Company
Central Illinois Public Service	NOVA Gas Transmission Ltd.
Citizens Utilities	PacifiCorp
Consolidated Edison and subsidiaries	Peoples Energy and its subsidiaries
Consolidated Natural Gas and subsidiaries	PG&E
Dominion Resources and subsidiaries	Plains All American Pipeline, L.P.
Duke Energy and subsidiaries	Progress Energy and subsidiaries
Empire District Electric and subsidiaries	PSE&G
EPCOR Distribution & Transmission Inc.	Public Service Company of North Carolina
EPCOR Energy Alberta Inc.	Sempra Energy/San Diego Gas and Electric
FortisAlberta Inc.	South Carolina Electric and Gas
FortisBC Utilities	Southern Company and subsidiaries
Hope Natural Gas	Spectra Energy
Iberdrola Renewables	Tennessee-American Water Company
Interstate Power Company	The Peoples Gas, Light and Coke Co.
Iowa Southern	Trans Québec & Maritimes Pipeline Inc.
Iowa-American Water Company	TransCanada
Iowa-Illinois Gas and Electric	Union Gas
Kentucky Power Company	United Cities Gas Company
Kentucky-American Water Company	Virginia-American Water Company
Kinder Morgan Energy Partners	West Virginia-American Water Company
Maritimes & Northeast Pipeline	Westcoast Energy Inc.
	Wisconsin Energy Corporation
	Xcel Energy

TELECOMMUNICATIONS COMPANIES	
ALLTEL and subsidiaries	Phillips County Cooperative Tel. Co.
Ameritech (now AT&T new)	Pine Drive Cooperative Telephone Co.
AT&T (old)	Roseville Telephone Company (SureWest)
Bell Canada/Nortel	SBC Communications (now AT&T new)
BellSouth and subsidiaries	Sherburne Telephone Company
Centel and subsidiaries	Siemens
Cincinnati Bell (Broadwing)	Southern New England Telephone
Cisco Systems	Sprint/United and subsidiaries
Citizens Telephone Company	Telefónica

TELECOMMUNICATIONS COMPANIES	
Concord Telephone Company	Tellabs, Inc.
Contel and subsidiaries	The Stentor Companies
Deutsche Telekom	U S West (Qwest)
GTE and subsidiaries (now Verizon)	Union Telephone Company
Heins Telephone Company	United States Telephone Association
JDS Uniphase	Valor Telecommunications (Windstream)
Lucent Technologies	Verizon (Bell Atlantic) and subsidiaries
Minnesota Independent Equal Access Corp.	Woodbury Telephone Company
NYNEX and subsidiaries (Verizon)	
Pacific Telesis and subsidiaries	

INSURANCE COMPANIES
Allstate
North Carolina Rate Bureau
United Services Automobile Association (USAA)
The Travelers Indemnity Company
Gulf Insurance Company

Other Professional Experience

Dr. Vander Weide has conducted in-house seminars and training sessions on topics such as creating shareholder value, financial analysis, competitive strategy, cost of capital, real options, financial strategy, managing growth, mergers and acquisitions, valuation, measuring corporate performance, capital budgeting, cash management, and financial planning. Among the firms for whom he has designed and taught tailored programs and training sessions are ABB Asea Brown Boveri, Accenture, Allstate, Ameritech, AT&T, Bell Atlantic/Verizon, BellSouth, Progress Energy/Carolina Power & Light, Contel, Fisons, GlaxoSmithKline, GTE, Lafarge, MidAmerican Energy, New Century Energies, Norfolk Southern, Pacific Bell Telephone, The Rank Group, Siemens, Southern New England Telephone, TRW, and Wolseley Plc. Dr. Vander Weide has also hosted a nationally prominent conference/workshop on estimating the cost of capital. In 1989, at the request of Mr. Fuqua, Dr. Vander Weide designed the Duke Program for Manager Development for managers from the former Soviet Union, the first in the United States designed exclusively for managers from Russia and the former Soviet republics.

Early in his career, Dr. Vander Weide helped found University Analytics, Inc., one of the fastest growing small firms in the country at that time. As an officer at University Analytics, he designed cash management models, databases, and software used by most major U.S. banks in consulting with their corporate clients. Having sold his interest in University Analytics, Dr. Vander Weide now concentrates on strategic and financial consulting, academic research, and executive education.

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JAMES H. VANDER WEIDE

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APPENDIX 2
DERIVATION OF THE QUARTERLY DCF MODEL

The simple DCF Model assumes that a firm pays dividends only at the end of each year. Since firms in fact pay dividends quarterly and investors appreciate the time value of money, the annual version of the DCF Model generally underestimates the value investors are willing to place on the firm's expected future dividend stream. In these workpapers, we review two alternative formulations of the DCF Model that allow for the quarterly payment of dividends.

When dividends are assumed to be paid annually, the DCF Model suggests that the current price of the firm's stock is given by the expression:

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \ldots + \frac{D_n + P_n}{(1+k)^n} \quad \textbf{(1)}$$

where

P_0	=	current price per share of the firm's stock,
$D_1, D_2, \ldots, D_n$	=	expected annual dividends per share on the firm's stock,
P_n	=	price per share of stock at the time investors expect to sell the stock, and
k	=	return investors expect to earn on alternative investments of the same risk, i.e., the investors' required rate of return.

Unfortunately, expression (1) is rather difficult to analyze, especially for the purpose of estimating k. Thus, most analysts make a number of simplifying assumptions. First, they assume that dividends are expected to grow at the constant rate g into the indefinite future. Second, they assume that the stock price at time n is simply the present value of all dividends expected in periods subsequent to n. Third, they assume that the investors' required rate of return, k, exceeds the expected dividend growth rate g. Under the above simplifying assumptions, a firm's stock price may be written as the following sum:

$$P_0 = \frac{D_0(1+g)}{(1+k)} + \frac{D_0(1+g)^2}{(1+k)^2} + \frac{D_0(1+g)^3}{(1+k)^3} + \ldots, \qquad \textbf{(2)}$$

where the three dots indicate that the sum continues indefinitely.

As we shall demonstrate shortly, this sum may be simplified to:

$$P_0 = \frac{D_0(1+g)}{(k-g)}$$

First, however, we need to review the very useful concept of a geometric progression.

Geometric Progression

Consider the sequence of numbers 3, 6, 12, 24,…, where each number after the first is obtained by multiplying the preceding number by the factor 2. Obviously, this sequence of numbers may also be expressed as the sequence 3, 3 x 2, 3 x 2^2, 3 x 2^3, etc. This sequence is an example of a geometric progression.

Definition: A geometric progression is a sequence in which each term after the first is obtained by multiplying some fixed number, called the common ratio, by the preceding term.

A general notation for geometric progressions is: a, the first term, r, the common ratio, and n, the number of terms. Using this notation, any geometric progression may be represented by the sequence:

$$a, ar, ar^2, ar^3, \ldots, ar^{n-1}.$$

In studying the DCF Model, we will find it useful to have an expression for the sum of n terms of a geometric progression. Call this sum S_n. Then

$$S_n = a + ar + \ldots + ar^{n-1} . \qquad (3)$$

However, this expression can be simplified by multiplying both sides of equation (3) by r and then subtracting the new equation from the old. Thus,

$$rS_n = ar + ar^2 + ar^3 + \ldots + ar^n$$

and

$$S_n - rS_n = a - ar^n \ ,$$

or

$$(1 - r)\, S_n = a\,(1 - r^n) \ .$$

Solving for S_n, we obtain:

$$S_n = \frac{a(1 - r^n)}{(1 - r)} \qquad (4)$$

as a simple expression for the sum of n terms of a geometric progression. Furthermore, if $|r| < 1$, then S_n is finite, and as n approaches infinity, S_n approaches $a \div (1-r)$. Thus, for a geometric progression with an infinite number of terms and $|r| < 1$, equation (4) becomes:

$$S = \frac{a}{1 - r} \qquad (5)$$

Application to DCF Model

Comparing equation (2) with equation (3), we see that the firm's stock price (under the DCF assumption) is the sum of an infinite geometric progression with the first term

$$a = \frac{D_0(1+g)}{(1+k)}$$

and common factor

$$r = \frac{(1+g)}{(1+k)}$$

Applying equation (5) for the sum of such a geometric progression, we obtain

$$S = a \bullet \frac{1}{(1-r)} = \frac{D_0(1+g)}{(1+k)} \bullet \frac{1}{1-\frac{1+g}{1+k}} = \frac{D_0(1+g)}{(1+k)} \bullet \frac{1+k}{k-g} = \frac{D_0(1+g)}{k-g}$$

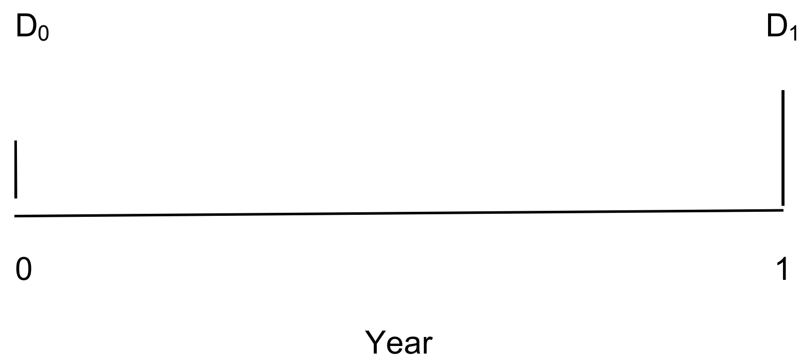
as we suggested earlier.

<u>Quarterly DCF Model</u>

The Annual DCF Model assumes that dividends grow at an annual rate of g% per year (see Figure 1).

Figure 1

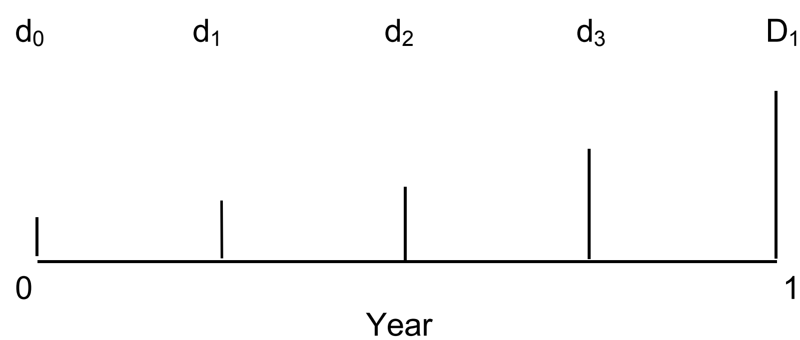
Annual DCF Model



$D_0 = 4d_0$ $\qquad$ $D_1 = D_0(1 + g)$

Figure 2

Quarterly DCF Model (Constant Growth Version)



$d_1 = d_0(1+g)^{.25}$ $\qquad$ $d_2 = d_0(1+g)^{.50}$

$d_3 = d_0(1+g)^{.75}$ $\qquad$ $d_4 = d_0(1+g)$

In the Quarterly DCF Model, it is natural to assume that quarterly dividend payments differ from the preceding quarterly dividend by the factor $(1 + g)^{.25}$, where g is expressed in terms of percent per year and the decimal .25 indicates that the growth has only occurred for one quarter of the year. (See Figure 2.) Using this assumption, along with the assumption of constant growth and ***k*** > ***g***, we obtain a new expression for the firm's stock price, which takes account of the quarterly payment of dividends. This expression is:

$$P_0 = \frac{d_0(1+g)^{\frac{1}{4}}}{(1+k)^{\frac{1}{4}}} + \frac{d_0(1+g)^{\frac{2}{4}}}{(1+k)^{\frac{2}{4}}} + \frac{d_0(1+g)^{\frac{3}{4}}}{(1+k)^{\frac{3}{4}}} + \ldots \qquad \textbf{(6)}$$

where d_0 is the last quarterly dividend payment, rather than the last annual dividend payment. (We use a lower case d to remind the reader that this is not the annual dividend.)

Although equation (6) looks formidable at first glance, it too can be greatly simplified using the formula [equation (4)] for the sum of an infinite geometric progression. As the reader can easily verify, equation (6) can be simplified to:

$$P_0 = \frac{d_0(1+g)^{\frac{1}{4}}}{(1+k)^{\frac{1}{4}} - (1+g)^{\frac{1}{4}}} \qquad (7)$$

Solving equation (7) for *k*, we obtain a DCF formula for estimating the cost of equity under the quarterly dividend assumption:

$$k = \left[\frac{d_0(1+g)^{\frac{1}{4}}}{P_0} + (1+g)^{\frac{1}{4}}\right]^4 - 1 \qquad (8)$$

An Alternative Quarterly DCF Model

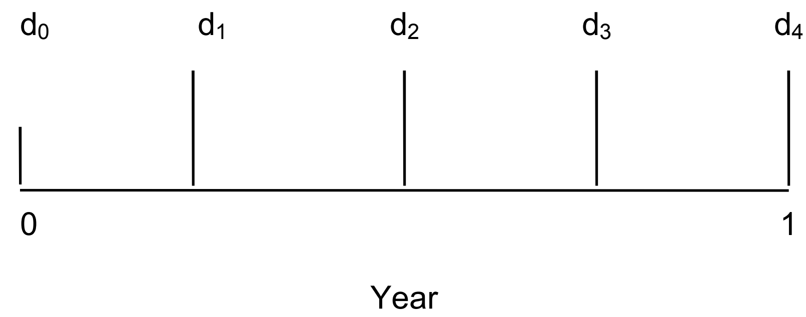
Although the constant growth Quarterly DCF Model [equation (8)] allows for the quarterly timing of dividend payments, it does require the assumption that the firm increases its dividend payments each quarter. Since this assumption is difficult for some analysts to accept, we now discuss a second Quarterly DCF Model that allows for constant quarterly dividend payments within each dividend year.

Assume then that the firm pays dividends quarterly and that each dividend payment is constant for four consecutive quarters. There are four cases to consider, with each case distinguished by varying assumptions about where we are evaluating the firm in relation to the time of its next dividend increase. (See Figure 3.)

Figure 3

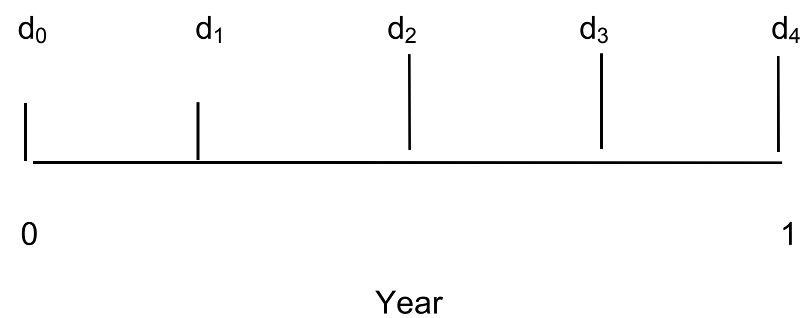
Quarterly DCF Model (Constant Dividend Version)

Case 1



$$d_1 = d_2 = d_3 = d_4 = d_0(1+g)$$

Case 2

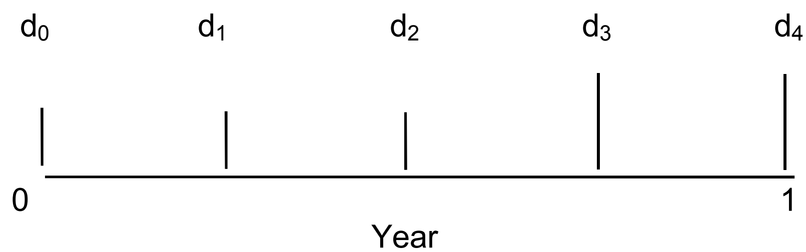


$$d_1 = d_0$$

$$d_2 = d_3 = d_4 = d_0(1+g)$$

<u>Figure 3</u> (continued)

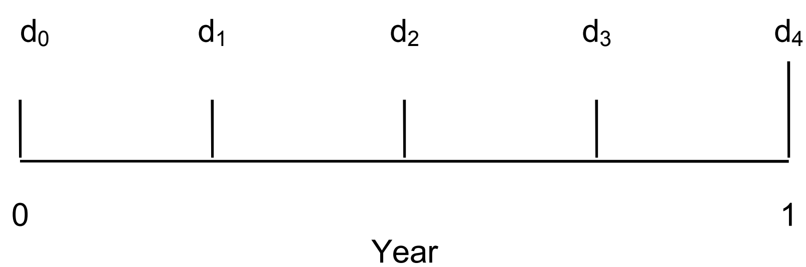
<u>Case 3</u>



$d_1 = d_2 = d_0$

$d_3 = d_4 = d_0(1+g)$

<u>Case 4</u>



$d_1 = d_2 = d_3 = d_0$

$d_4 = d_0(1+g)$

If we assume that the investor invests the quarterly dividend in an alternative investment of the same risk, then the amount accumulated by the end of the year will in all cases be given by:

$$D_1^* = d_1\,(1+k)^{3/4} + d_2\,(1+k)^{1/2} + d_3\,(1+k)^{1/4} + d_4$$

where d_1, d_2, d_3 and d_4 are the four quarterly dividends. Under these new assumptions, the firm's stock price may be expressed by an Annual DCF Model of the form (2), with the exception that:

$$D_1^* = d_1\,(1 + k)^{3/4} + d_2\,(1 + k)^{1/2} + d_3\,(1 + k)^{1/4} + d_4 \qquad \textbf{(9)}$$

is used in place of $D_0(1+g)$. But, we already know that the Annual DCF Model may be reduced to:

$$P_0 = \frac{D_0\,(1 + g)}{k - g}$$

Thus, under the assumptions of the second Quarterly DCF Model, the firm's cost of equity is given by:

$$k = \frac{D_1^*}{P_0} + g \qquad (10)$$

with D_1^* given by (9).

Although equation (10) looks like the Annual DCF Model, there are at least two very important practical differences. First, since D_1^* is always greater than $D_0(1+g)$, the estimates of the cost of equity are always larger (and more accurate) in the Quarterly Model (10) than in the Annual Model. Second, since D_1^* depends on k through equation (9), the unknown "k" appears on both sides of (10), and an iterative procedure is required to solve for k.

APPENDIX 3
ADJUSTING FOR FLOTATION COSTS IN DETERMINING A PUBLIC UTILITY'S ALLOWED RATE OF RETURN ON EQUITY

I. Introduction

Regulation of public utilities is guided by the principle that utility revenues should be sufficient to allow recovery of all prudently incurred expenses, including the cost of capital. As set forth in the 1944 *Hope Natural Gas* Case [*Federal Power Comm'n v. Hope Natural Gas Co*. 320 U. S. 591 (1944) at 603], the U. S. Supreme Court states:

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

Since the flotation costs arising from the issuance of debt and equity securities are an integral component of capital costs, this standard requires that the company's revenues be sufficient to fully recover flotation costs.

Despite the widespread agreement that flotation costs should be recovered in the regulatory process, several issues still need to be resolved. These include:

1. How is the term "flotation costs" defined? Does it include only the out-of-pocket costs associated with issuing securities (e. g., legal fees, printing costs, selling and underwriting expenses), or does it also include the reduction in a security's price that frequently accompanies flotation?
2. What should be the time pattern of cost recovery? Should a company be allowed to recover flotation costs immediately, or should flotation costs be recovered over the life of the issue?
3. For the purposes of regulatory accounting, should flotation costs be included as an expense? As an addition to rate base? Or as an additional element of a firm's allowed rate of return?
4. Do existing regulatory methods for flotation cost recovery allow a firm ***full*** recovery of flotation costs?

In this paper, I review the literature pertaining to the above issues and discuss my own views regarding how this literature applies to the cost of equity for a regulated firm.

II. Definition of Flotation Cost

The value of a firm is related to the future stream of net cash flows (revenues minus expenses measured on a cash basis) that can be derived from its assets. In the process of acquiring assets, a firm incurs certain expenses which reduce its value. Some of these expenses or costs are directly associated with revenue production in one period (e. g., wages, cost of goods sold), others are more properly associated with revenue production in many periods (e. g., the acquisition cost of plant and equipment). In either case, the word "cost" refers to any item that reduces the value of a firm.

If this concept is applied to the act of issuing new securities to finance asset purchases, many items are properly included in issuance or flotation costs. These include: (1) compensation received by investment bankers for underwriting services, (2) legal fees, (3) accounting fees, (4) engineering fees, (5) trustee's fees, (6) listing fees, (7) printing and engraving expenses, (8) SEC registration fees, (9) Federal Revenue Stamps, (10) state taxes, (11) warrants granted to underwriters as extra compensation, (12) postage expenses, (13) employees' time, (14) market pressure, and (15) the offer discount. The finance literature generally divides these flotation cost items into three categories, namely, underwriting expenses, issuer expenses, and price effects.

III. Magnitude of Flotation Costs

The finance literature contains several studies of the magnitude of the flotation costs associated with new debt and equity issues. These studies differ primarily with regard to the time period studied, the sample of companies included, and the source of data. The flotation cost studies generally agree, however, that for large issues, underwriting expenses represent approximately one and one-half percent of the proceeds of debt issues and three to five percent of the proceeds of seasoned equity issues. They also agree that issuer expenses represent approximately 0.5 percent of both debt and equity issues, and that the difference between the offering price and the last reported sales price is at least two to three percent of the proceeds from the stock issue. (Underwriters set the public offering price at a value less than the most recent market price in order to reduce the risk that they would have to sell the equity at a loss.) Thus, total flotation costs represent approximately two percent[1] of the proceeds from debt issues,

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[1] The two percent flotation cost on debt only recognizes the cost of newly-issued debt. When interest rates decline, many companies exercise the call provisions on higher cost debt and reissue debt at lower rates. This process involves reacquisition costs that are not included in the academic studies. If reacquisition costs were included in the academic studies, debt flotation costs could increase significantly.

and five and one-half to eight and one-half percent of the proceeds of equity issues.

Lee *et. al.* [14] is an excellent example of the type of flotation cost studies found in the finance literature. The Lee study is a comprehensive study of the underwriting and issuer costs associated with debt and equity issues for both utilities and non-utilities. The results of the Lee *et. al.* study are reproduced in Tables 1 and 2. Table 1 demonstrates that the total underwriting and issuer expenses for the 1,092 debt issues in their study averaged 2.24 percent of the proceeds of the issues, while the total underwriting and issuer costs for the 1,593 seasoned equity issues in their study averaged 7.11 percent of the proceeds of the new issue. Table 1 also demonstrates that the total underwriting and issuer costs of seasoned equity offerings, as a percent of proceeds, decline with the size of the issue. For issues above $60 million, total underwriting and issuer costs amount to from three to five percent of the amount of the proceeds.

Table 2 reports the total underwriting and issuer expenses for 135 utility debt issues and 136 seasoned utility equity issues. Total underwriting and issuer expenses for utility bond offerings averaged 1.47 percent of the amount of the proceeds and for seasoned utility equity offerings averaged 4.92 percent of the amount of the proceeds. Again, there are some economies of scale associated with larger equity offerings. Total underwriting and issuer expenses for equity offerings in excess of 40 million dollars generally range from three to four percent of the proceeds.

The results of the Lee study for large equity issues are consistent with results of earlier studies by Bhagat and Frost [4], Mikkelson and Partch [17], and Smith [24]. Bhagat and Frost found that total underwriting and issuer expenses average approximately four and one-half percent of the amount of proceeds from negotiated utility offerings during the period 1973 to 1980, and approximately three and one-half percent of the amount of the proceeds from competitive utility offerings over the same period. Mikkelson and Partch found that total underwriting and issuer expenses average five and one-half percent of the proceeds from seasoned equity offerings over the 1972 to 1982 period. Smith found that total underwriting and issuer expenses for larger equity issues generally amount to four to five percent of the proceeds of the new issue.

The finance literature also contains numerous studies of the decline in price associated with sales of large blocks of stock to the public. These articles relate to the price impact of: (1) initial public offerings; (2) the sale of large blocks of stock from one investor to another; and (3) the issuance of seasoned equity issues to the general public. All of these studies generally support the notion that the announcement of the sale of large blocks of stock produces a decline in a company's share price. The decline in share price for initial public offerings is significantly larger than the decline in share price for seasoned equity offerings; and the decline in share price for public utilities is less than the decline in share price for non-public utilities. A comprehensive study of the magnitude of the decline in share price associated specifically with the sale of new equity by public utilities is reported in Pettway [19], who found the market pressure effect for a sample of 368 public utility equity sales to be in the range of two to three percent. This decline in price is a real cost to the utility, because the proceeds to the utility depend on the stock price on the day of issue.

In addition to the price decline associated with the announcement of a new equity issue, the finance literature recognizes that there is also a price decline associated with the actual issuance of equity securities. In particular, underwriters typically sell seasoned new equity securities to investors at a price lower than the closing market price on the day preceding the issue. The Rules of Fair Practice of the National Association of Securities Dealers require that underwriters not sell shares at a price above the offer price. Because the offer price represents a binding constraint to the underwriter, the underwriter tends to set the offer price slightly below the last reported market price to compensate for the risk that the price received by the underwriter may go down, but cannot increase.

In summary, the finance literature provides strong support for the conclusion that total underwriting and issuer expenses for public utility debt offerings represent approximately two percent of the amount of the proceeds, while total underwriting and issuer expenses for public utility equity offerings represent at least four to five percent of the amount of the proceeds. In addition, the finance literature supports the conclusion that the cost associated with the decline in stock price at the announcement date represents approximately two to three percent as a result of a large public utility equity issue.

IV. Time Pattern Of Flotation Cost Recovery

Although flotation costs are incurred only at the time a firm issues new securities, there is no reason why an issuing firm ought to recognize the expense only in the current period. In fact, if assets purchased with the proceeds of a security issue produce revenues over many years, a sound argument can be made in favor of recognizing flotation expenses over a reasonably lengthy period of time. Such recognition is certainly consistent with the generally accepted accounting principle that the time pattern of expenses match the time pattern of revenues, and it is also consistent with the normal treatment of debt flotation expenses in both regulated and unregulated industries.

In the context of a regulated firm, it should be noted that there are many possible time patterns for the recovery of flotation expenses. However, if it is felt that flotation expenses are most appropriately recovered over a period of years, then it should be recognized that investors must also be compensated for the passage of time. That is to say, the value of an investor's capital will be reduced if the expenses are merely distributed over time, without any allowance for the time value of money.

V. Accounting For Flotation Cost In A Regulatory Setting

In a regulatory setting, a firm's revenue requirements are determined by the equation:

Revenue Requirement = Total Expenses + Allowed Rate of Return x Rate Base

Thus, there are three ways in which an issuing firm can account for and recover its flotation expenses: (1) treat flotation expenses as a current expense and recover them immediately; (2) include flotation expenses in rate base and recover them over time; and (3) adjust the allowed rate of return upward and again recover flotation expenses over time. Before considering methods currently being used to recover flotation expenses in a regulatory setting, I shall briefly consider the advantages and disadvantages of these three basic recovery methods.

Expenses. Treating flotation costs as a current expense has several advantages. Because it allows for recovery at the time the expense occurs, it is not necessary to compute amortized balances over time and to debate which interest rate should be applied to these balances. A firm's stockholders are treated fairly, and so are the firm's customers, because they pay neither more nor less than the actual flotation expense. Since flotation costs are relatively small compared to the total revenue requirement, treatment as a current expense does not cause unusual rate hikes in the year of flotation, as would the introduction of a large generating plant in a state that does not allow Construction Work in Progress in rate base.

On the other hand, there are two major disadvantages of treating flotation costs as a current expense. First, since the asset purchased with the acquired funds will likely generate revenues for many years into the future, it seems unfair that current ratepayers should bear the full cost of issuing new securities, when future ratepayers share in the benefits. Second, this method requires an estimate of the underpricing effect on each security issue. Given the difficulties involved in measuring the extent of underpricing, it may be more accurate to estimate the average underpricing allowance for many securities than to estimate the exact figure for one security.

Rate Base. In an article in *Public Utilities Fortnightly*, Bierman and Hass [5] recommend that flotation costs be treated as an intangible asset that is included in a firm's rate base along with the assets acquired with the stock proceeds. This approach has many advantages. For ratepayers, it provides a better match between benefits and expenses: the future ratepayers who benefit from the financing costs contribute the revenues to recover these costs. For investors, if the allowed rate of return is equal to the investors' required rate of return, it is also theoretically fair since they are compensated for the opportunity cost of their investment (including both the time value of money and the investment risk).

Despite the compelling advantages of this method of cost recovery, there are several disadvantages that probably explain why it has not been used in practice. First, a firm will only recover the proper amount for flotation expenses if the rate base is multiplied by the appropriate cost of capital. To the extent that a commission under or over estimates the cost of capital, a firm will under or over recover its flotation expenses. Second, it is may be both legally and psychologically difficult for commissioners to include an intangible asset in a firm's rate base. According to established legal doctrine, assets are to be included in rate base only if they are "used and useful" in the public service. It is unclear whether intangible assets such as flotation expenses meet this criterion.

Rate of Return. The prevailing practice among state regulators is to treat flotation expenses as an additional element of a firm's cost of capital or allowed rate of return. This method is similar to the second method above (treatment in rate base) in that some part of the initial flotation cost is amortized over time. However, it has a disadvantage not shared by the rate base method. If flotation cost is included in rate base, it is fairly easy to keep track of the flotation cost on each new equity issue and see how it is recovered over time. Using the rate of return method, it is not possible to track the flotation cost for specific issues because the flotation cost for a specific issue is never recorded. Thus, it is not clear to participants whether a current allowance is meant to recover (1) flotation costs actually incurred in a test period, (2) expected future flotation costs, or (3) past flotation costs. This confusion never arises in the treatment of debt flotation costs. Because the exact costs are recorded and explicitly amortized over time, participants recognize that current allowances for debt flotation costs are meant to recover some fraction of the flotation costs on all past debt issues.

VI. Existing Regulatory Methods

Although most state commissions prefer to let a regulated firm recover flotation expenses through an adjustment to the allowed rate of return, there is considerable controversy about the magnitude of the required adjustment. The following are some of the most frequently asked questions: (1) Should an adjustment to the allowed return be made every year, or should the adjustment be made only in those years in which new equity is raised? (2) Should an adjusted rate of return be applied to the entire rate base, or should it be applied only to that portion of the rate base financed with paid-in capital (as opposed to retained earnings)? (3) What is the appropriate formula for adjusting the rate of return?

This section reviews several methods of allowing for flotation cost recovery. Since the regulatory methods of allowing for recovery of debt flotation costs is well known and widely accepted, I will begin my discussion of flotation cost recovery procedures by describing the widely accepted procedure of allowing for debt flotation cost recovery.

Debt Flotation Costs

Regulators uniformly recognize that companies incur flotation costs when they issue debt securities. They typically allow recovery of debt flotation costs by making an adjustment to both the cost of debt and the rate base (see Brigham [6]). Assume that: (1) a regulated company issues $100 million in bonds that mature in 10 years; (2) the interest rate on these bonds is seven percent; and (3) flotation costs represent four percent of the amount of the proceeds. Then the cost of debt for regulatory purposes will generally be calculated as follows:

$$\text{Cost of Debt} = \frac{\text{Interest expense} + \text{Amortization of flotation costs}}{\text{Principal value} - \text{Unamortized flotation costs}}$$

$$= \frac{\$7{,}000{,}000 + \$400{,}000}{\$100{,}000{,}000 - \$4{,}000{,}000}$$

$$= 7.71\%$$

Thus, current regulatory practice requires that the cost of debt be adjusted upward by approximately 71 basis points, in this example, to allow for the recovery of debt flotation costs. This example does not include losses on reacquisition of debt. The flotation cost allowance would increase if losses on reacquisition of debt were included.

The logic behind the traditional method of allowing for recovery of debt flotation costs is simple. Although the company has issued $100 million in bonds, it can only invest $96 million in rate base because flotation costs have reduced the amount of funds received by $4 million. If the company is not allowed to earn a 71 basis point higher rate of return on the $96 million invested in rate base, it will not generate sufficient cash flow to pay the seven percent interest on the $100 million in bonds it has issued. Thus, proper regulatory treatment is to increase the required rate of return on debt by 71 basis points.

Equity Flotation Costs

The finance literature discusses several methods of recovering equity flotation costs. Since each method stems from a specific model, (i. e., set of assumptions) of a firm and its cash flows, I will highlight the assumptions that distinguish one method from another.

Arzac and Marcus. Arzac and Marcus [2] study the proper flotation cost adjustment formula for a firm that makes continuous use of retained earnings and external equity financing and maintains a constant capital structure (debt/equity ratio). They assume at the outset that underwriting expenses and underpricing apply only to new equity obtained from external sources. They also assume that a firm has previously recovered all underwriting expenses, issuer expenses, and underpricing associated with previous issues of new equity.

To discuss and compare various equity flotation cost adjustment formulas, Arzac and Marcus make use of the following notation:

k	=	an investors' required return on equity
r	=	a utility's allowed return on equity base
S	=	value of equity in the absence of flotation costs
S_f	=	value of equity net of flotation costs
K_t	=	equity base at time t
E_t	=	total earnings in year t
D_t	=	total cash dividends at time t
b	=	$(E_t\text{-}D_t) \div E_t$ = retention rate, expressed as a fraction of earnings
h	=	new equity issues, expressed as a fraction of earnings
m	=	equity investment rate, expressed as a fraction of earnings, $m = b + h < 1$
f	=	flotation costs, expressed as a fraction of the value of an issue.

Because of flotation costs, Arzac and Marcus assume that a firm must issue a greater amount of external equity each year than it actually needs. In terms of the above notation, a firm issues $hE_t \div (1\text{-}f)$ to obtain hE_t in external equity funding. Thus, each year a firm loses:

Equation 1

$$L = \frac{hE_t}{1-f} - hE_t = \frac{f}{1-f} \cdot hE_t$$

due to flotation expenses. The present value, V, of all future flotation expenses is:

Equation 2

$$V = \sum_{t=1}^{\infty} \frac{fhE_t}{(1-f)(1+k)^t} = \frac{fh}{1-f} \cdot \frac{rK_0}{k-mr}$$

To avoid diluting the value of the initial stockholder's equity, a regulatory authority needs to find the value of r, a firm's allowed return on equity base, that equates the value of equity net of flotation costs to the initial equity base ($S_f = K_0$). Since the value of equity net of flotation costs equals the value of equity in the absence of flotation costs minus the present value of flotation costs, a regulatory authority needs to find that value of *r* that solves the following equation:

$$S_f = S - L.$$

This value is:

Equation 3

$$r = \frac{k}{1 - \frac{fh}{1 - f}}$$

To illustrate the Arzac-Marcus approach to adjusting the allowed return on equity for the effect of flotation costs, suppose that the cost of equity in the absence of flotation costs is 12 percent. Furthermore, assume that a firm obtains external equity financing each year equal to 10 percent of its earnings and that flotation expenses equal 5 percent of the value of each issue. Then, according to Arzac and Marcus, the allowed return on equity should be:

$$r = \frac{.12}{1 - \frac{(.05).(.1)}{.95}} = .1206 = 12.06\%$$

Summary. With respect to the three questions raised at the beginning of this section, it is evident that Arzac and Marcus believe the flotation cost adjustment should be applied each year, since continuous external equity financing is a fundamental assumption of their model. They also believe that the adjusted rate of return should be applied to the entire equity-financed portion of the rate base because their model is based on the assumption that the flotation cost adjustment mechanism will be applied to the entire equity financed portion of the rate base. Finally, Arzac and Marcus recommend a flotation cost adjustment formula, Equation (3), that implicitly excludes recovery of financing costs associated with financing in previous periods and includes only an allowance for the fraction of equity financing obtained from external sources.

Patterson. The Arzac-Marcus flotation cost adjustment formula is significantly different from the conventional approach (found in many introductory textbooks) which recommends the adjustment equation:

Equation 4

$$r = \frac{D_t}{P_{t-1}(1 - f)} + g$$

where P_{t-1} is the stock price in the previous period and g is the expected dividend growth rate. Patterson [18] compares the Arzac-Marcus adjustment formula to the conventional approach and reaches the conclusion that the Arzac-Marcus formula effectively expenses issuance costs as they are incurred, while the conventional approach effectively amortizes them over an assumed infinite life of the equity issue. Thus, the conventional formula is similar to the formula for the recovery of debt flotation costs: it is not meant to compensate investors for the flotation costs of future issues, but instead is meant to compensate investors for the flotation costs of previous issues. Patterson argues that the conventional approach is more appropriate for rate making purposes because the plant purchased with external equity funds will yield benefits over many future periods.

<u>Illustration</u>. To illustrate the Patterson approach to flotation cost recovery, assume that a newly organized utility sells an initial issue of stock for $100 per share, and that the utility plans to finance all new investments with retained earnings. Assume also that: (1) the initial dividend per share is six dollars; (2) the expected long-run dividend growth rate is six percent; (3) the flotation cost is five percent of the amount of the proceeds; and (4) the payout ratio is 51.28 percent. Then, the investor's required rate of return on equity is [k = (D/P) + g = 6 percent + 6 percent = 12 percent]; and the flotation-cost-adjusted cost of equity is [6 percent (1/.95) + 6 percent = 12.316 percent].

The effects of the Patterson adjustment formula on the utility's rate base, dividends, earnings, and stock price are shown in Table 3. We see that the Patterson formula allows earnings and dividends to grow at the expected six percent rate. We also see that the present value of expected future dividends, $100, is just sufficient to induce investors to part with their money. If the present value of expected future dividends were less than $100, investors would not have been willing to invest $100 in the firm. Furthermore, the present value of future dividends will only equal $100 if the firm is allowed to earn the 12.316 percent flotation-cost-adjusted cost of equity on its entire rate base.

<u>Summary</u>. Patterson's opinions on the three issues raised in this section are in stark contrast to those of Arzac and Marcus. He believes that: (1) a flotation cost adjustment should be applied in every year, regardless of whether a firm issues any new equity in each year; (2) a flotation cost adjustment should be applied to the entire equity-financed portion of the rate base, including that portion financed by retained earnings; and (3) the rate of return adjustment formula should allow a firm to recover an appropriate fraction of all previous flotation expenses.

VII. Conclusion

Having reviewed the literature and analyzed flotation cost issues, I conclude that:

Definition of Flotation Cost: A regulated firm should be allowed to recover both the total underwriting and issuance expenses associated with issuing securities and the cost of market pressure.

Time Pattern of Flotation Cost Recovery. Shareholders are indifferent between the alternatives of immediate recovery of flotation costs and recovery over time, as long as they are fairly compensated for the opportunity cost of their money. This opportunity cost must include both the time value of money and a risk premium for equity investments of this nature.

Regulatory Recovery of Flotation Costs. The Patterson approach to recovering flotation costs is the only rate-of-return-adjustment approach that meets the *Hope* case criterion that a regulated company's revenues must be sufficient to allow the company an opportunity to recover all prudently incurred expenses, including the cost of capital. The Patterson approach is also the only rate-of-return-adjustment approach that provides an incentive for investors to invest in the regulated company.

Implementation of a Flotation Cost Adjustment. As noted earlier, prevailing regulatory practice seems to be to allow the recovery of flotation costs through an adjustment to the required rate of return. My review of the literature on this subject indicates that there are at least two recommended methods of making this adjustment: the Patterson approach and the Arzac-Marcus approach. The Patterson approach assumes that a firm's flotation expenses on new equity issues are treated in the same manner as flotation expenses on new bond issues, i. e., they are amortized over future time periods. If this assumption is true (and I believe it is), then the flotation cost adjustment should be applied to a firm's entire equity base, including retained earnings. In practical terms, the Patterson approach produces an increase in a firm's cost of equity of approximately twenty to thirty basis points. The Arzac-Marcus approach assumes that flotation costs on new equity issues are recovered entirely in the year in which the securities are sold. Under the Arzac-Marcus assumption, a firm should not be allowed any adjustments for flotation costs associated with previous flotations. Instead, a firm should be allowed only an adjustment on future security sales as they occur. Under reasonable assumptions about the rate of new equity sales, this method produces an increase in the cost of equity of approximately six basis points. Since the Arzac-Marcus approach does not allow the company to recover the entire amount of its flotation cost, I recommend that this approach be rejected and the Patterson approach be accepted.

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Table 1
Direct Costs as a Percentage of Gross Proceeds for Equity (IPOs and SEOs) and Straight and Convertible Bonds Offered by Domestic Operating Companies 1990—1994[2]

Equities

		IPOs				SEOs			
Line No.	Proceeds ($ in millions)	No. of Issues	Gross Spreads	Other Direct Expenses	Total Direct Costs	No. of Issues	Gross Spreads	Other Direct Expenses	Total Direct Costs
1	2-9.99	337	9.05%	7.91%	16.96%	167	7.72%	5.56%	13.28%
2	10-19.99	389	7.24%	4.39%	11.63%	310	6.23%	2.49%	8.72%
3	20-39.99	533	7.01%	2.69%	9.70%	425	5.60%	1.33%	6.93%
4	40-59.99	215	6.96%	1.76%	8.72%	261	5.05%	0.82%	5.87%
5	60-79.99	79	6.74%	1.46%	8.20%	143	4.57%	0.61%	5.18%
6	80-99.99	51	6.47%	1.44%	7.91%	71	4.25%	0.48%	4.73%
7	100-199.99	106	6.03%	1.03%	7.06%	152	3.85%	0.37%	4.22%
8	200-499.99	47	5.67%	0.86%	6.53%	55	3.26%	0.21%	3.47%
9	500 and up	10	5.21%	0.51%	5.72%	9	3.03%	0.12%	3.15%
10	**Total/Average**	**1,767**	**7.31%**	**3.69%**	**11.00%**	**1,593**	**5.44%**	**1.67%**	**7.11%**

Bonds

		Convertible Bonds				Straight Bonds			
Line No.	Proceeds ($ in millions)	No. of Issues	Gross Spreads	Other Direct Expenses	Total Direct Costs	No. of Issues	Gross Spreads	Other Direct Expenses	Total Direct Costs
1	2-9.99	4	6.07%	2.68%	8.75%	32	2.07%	2.32%	4.39%
2	10-19.99	14	5.48%	3.18%	8.66%	78	1.36%	1.40%	2.76%
3	20-39.99	18	4.16%	1.95%	6.11%	89	1.54%	0.88%	2.42%
4	40-59.99	28	3.26%	1.04%	4.30%	90	0.72%	0.60%	1.32%
5	60-79.99	47	2.64%	0.59%	3.23%	92	1.76%	0.58%	2.34%
6	80-99.99	13	2.43%	0.61%	3.04%	112	1.55%	0.61%	2.16%
7	100-199.99	57	2.34%	0.42%	2.76%	409	1.77%	0.54%	2.31%
8	200-499.99	27	1.99%	0.19%	2.18%	170	1.79%	0.40%	2.19%
9	500 and up	3	2.00%	0.09%	2.09%	20	1.39%	0.25%	1.64%
10	**Total/Average**	**211**	**2.92%**	**0.87%**	**3.79%**	**1,092**	**1.62%**	**0.62%**	**2.24%**

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[2] Inmoo Lee, Scott Lochhead, Jay Ritter, and Quanshui Zhao, "The Costs of Raising Capital," *Journal of Financial Research* Vol 19 No 1 (Spring 1996) pp. 59-74.

Notes:

Closed-end funds and unit offerings are excluded from the sample. Rights offerings for SEOs are also excluded. Bond offerings do not include securities backed by mortgages and issues by Federal agencies. Only firm commitment offerings and non-shelf-registered offerings are included.
Gross Spreads as a percentage of total proceeds, including management fee, underwriting fee, and selling concession.
Other Direct Expenses as a percentage of total proceeds, including management fee, underwriting fee, and selling concession.
Total Direct Costs as a percentage of total proceeds (total direct costs are the sum of gross spreads and other direct expenses).

Table 2
Direct Costs of Raising Capital 1990—1994
Utility versus Non-Utility Companies[3]

Equities

	Non-Utilities	IPOs			SEOs		
Line No.	Proceeds ($ in millions)	No. of Issues	Gross Spreads	Total Direct Costs	No. Of Issues	Gross Spreads	Total Direct Costs
1	2-9.99	332	9.04%	16.97%	154	7.91%	13.76%
2	10-19.99	388	7.24%	11.64%	278	6.42%	9.01%
3	20-39.99	528	7.01%	9.70%	399	5.70%	7.07%
4	40-59.99	214	6.96%	8.71%	240	5.17%	6.02%
5	60-79.99	78	6.74%	8.21%	131	4.68%	5.31%
6	80-99.99	47	6.46%	7.88%	60	4.35%	4.84%
7	100-199.99	101	6.01%	7.01%	137	3.97%	4.36%
8	200-499.99	44	5.65%	6.49%	50	3.27%	3.48%
9	500 and up	10	5.21%	5.72%	8	3.12%	3.25%
10	**Total/Average**	1,742	7.31%	11.01%	1,457	5.57%	7.32%
11	**Utilities Only**						
12	2-9.99	5	9.40%	16.54%	13	5.41%	7.68%
13	10-19.99	1	7.00%	8.77%	32	4.59%	6.21%
14	20-39.99	5	7.00%	9.86%	26	4.17%	4.96%
15	40-59.99	1	6.98%	11.55%	21	3.69%	4.12%
16	60-79.99	1	6.50%	7.55%	12	3.39%	3.72%
17	80-99.99	4	6.57%	8.24%	11	3.68%	4.11%
18	100-199.99	5	6.45%	7.96%	15	2.83%	2.98%
19	200-499.99	3	5.88%	7.00%	5	3.19%	3.48%
20	500 and up	0			1	2.25%	2.31%
21	**Total/Average**	25	7.15%	10.14%	136	4.01%	4.92%

[3] Lee *et al, op. cit.*

Table 2 (continued)
Direct Costs of Raising Capital 1990—1994
Utility versus Non-Utility Companies[4]

Bonds

	Non- Utilities	Convertible Bonds			Straight Bonds		
Line No.	Proceeds ($ in millions)	No. of Issues	Gross Spreads	Total Direct Costs	No. of Issues	Gross Spreads	Total Direct Costs
1	2-9.99	4	6.07%	8.75%	29	2.07%	4.53%
2	10-19.99	12	5.54%	8.65%	47	1.70%	3.28%
3	20-39.99	16	4.20%	6.23%	63	1.59%	2.52%
4	40-59.99	28	3.26%	4.30%	76	0.73%	1.37%
5	60-79.99	47	2.64%	3.23%	84	1.84%	2.44%
6	80-99.99	12	2.54%	3.19%	104	1.61%	2.25%
7	100-199.99	55	2.34%	2.77%	381	1.83%	2.38%
8	200-499.99	26	1.97%	2.16%	154	1.87%	2.27%
9	500 and up	3	2.00%	2.09%	19	1.28%	1.53%
10	**Total/Average**	203	2.90%	3.75%	957	1.70%	2.34%
11	**Utilities Only**						
12	2-9.99	0			3	2.00%	3.28%
13	10-19.99	2	5.13%	8.72%	31	0.86%	1.35%
14	20-39.99	2	3.88%	5.18%	26	1.40%	2.06%
15	40-59.99	0			14	0.63%	1.10%
16	60-79.99	0			8	0.87%	1.13%
17	80-99.99	1	1.13%	1.34%	8	0.71%	0.98%
18	100-199.99	2	2.50%	2.74%	28	1.06%	1.42%
19	200-499.99	1	2.50%	2.65%	16	1.00%	1.40%
20	500 and up	0			1	3.50%	na[5]
21	**Total/Average**	8	3.33%	4.66%	135	1.04%	1.47%

Notes:
Total proceeds raised in the United States, excluding proceeds from the exercise of over allotment options.
Gross spreads as a percentage of total proceeds (including management fee, underwriting fee, and selling concession).
Other direct expenses as a percentage of total proceeds (including registration fee and printing, legal, and auditing costs).

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[4] Lee *et al, op. cit*.

[5] Not available because of missing data on other direct expenses.

Table 3
Illustration of Patterson Approach to Flotation Cost Recovery

LINE NO.	TIME PERIOD	RATE BASE	EARNINGS @ 12.32%	EARNINGS @ 12.00%	DIVIDENDS	AMORTIZATION INITIAL FC
1	0	95.00				
2	1	100.70	11.70	11.40	6.00	0.3000
3	2	106.74	12.40	12.08	6.36	0.3180
4	3	113.15	13.15	12.81	6.74	0.3371
5	4	119.94	13.93	13.58	7.15	0.3573
6	5	127.13	14.77	14.39	7.57	0.3787
7	6	134.76	15.66	15.26	8.03	0.4015
8	7	142.84	16.60	16.17	8.51	0.4256
9	8	151.42	17.59	17.14	9.02	0.4511
10	9	160.50	18.65	18.17	9.56	0.4782
11	10	170.13	19.77	19.26	10.14	0.5068
12	11	180.34	20.95	20.42	10.75	0.5373
13	12	191.16	22.21	21.64	11.39	0.5695
14	13	202.63	23.54	22.94	12.07	0.6037
15	14	214.79	24.96	24.32	12.80	0.6399
16	15	227.67	26.45	25.77	13.57	0.6783
17	16	241.33	28.04	27.32	14.38	0.7190
18	17	255.81	29.72	28.96	15.24	0.7621
19	18	271.16	31.51	30.70	16.16	0.8078
20	19	287.43	33.40	32.54	17.13	0.8563
21	20	304.68	35.40	34.49	18.15	0.9077
22	21	322.96	37.52	36.56	19.24	0.9621
23	22	342.34	39.77	38.76	20.40	1.0199
24	23	362.88	42.16	41.08	21.62	1.0811
25	24	384.65	44.69	43.55	22.92	1.1459
26	25	407.73	47.37	46.16	24.29	1.2147
27	26	432.19	50.21	48.93	25.75	1.2876
28	27	458.12	53.23	51.86	27.30	1.3648
29	28	485.61	56.42	54.97	28.93	1.4467
30	29	514.75	59.81	58.27	30.67	1.5335
31	30	545.63	63.40	61.77	32.51	1.6255
32	Present Value@12%		195.00	190.00	100.00	5.00

APPENDIX 4
EX ANTE RISK PREMIUM APPROACH

My ex ante risk premium method is based on studies of the DCF expected return on proxy companies compared to the interest rate on Moody's A-rated utility bonds. Specifically, for each month in my study period, I calculate the risk premium using the equation,

$$RP_{PROXY} = DCF_{PROXY} - I_A$$

where:

RP_{PROXY}	=	the required risk premium on an equity investment in the proxy group of companies,
DCF_{PROXY}	=	average DCF estimated cost of equity on a portfolio of proxy companies; and
I_A	=	the yield to maturity on an investment in A-rated utility bonds.

For my ex ante risk premium analysis, I begin with my comparable group of natural gas companies. Previous studies have shown that the ex ante risk premium tends to vary inversely with the level of interest rates, that is, the risk premium tends to increase when interest rates decline, and decrease when interest rates go up. To test whether my studies also indicate that the ex ante risk premium varies inversely with the level of interest rates, I perform a regression analysis of the relationship between the ex ante risk premium and the yield to maturity on A-rated utility bonds, using the equation,

$$RP_{PROXY} = a + (b \times I_A) + e$$

where:

RP_{PROXY} = risk premium on proxy company group;

I_A = yield to maturity on A-rated utility bonds;

e = a random residual; and

a, b = coefficients estimated by the regression procedure.

Regression analysis assumes that the statistical residuals from the regression equation are random. My examination of the residuals reveals that there is a significant probability that the residuals are serially correlated (non-zero serial correlation indicates that the residual in one time period tends to be correlated with the residual in the previous time period). Therefore, I make adjustments to my data to correct for the possibility of serial correlation in the residuals.

The common procedure for dealing with serial correlation in the residuals is to estimate the regression coefficients in two steps. First, a multiple regression analysis is used to estimate the serial correlation coefficient, *r*. Second, the estimated serial correlation coefficient is used to transform the original variables into new variables whose serial correlation is approximately zero. The regression coefficients are then re-estimated using the transformed variables as inputs in the regression equation. Based on my knowledge of the statistical relationship between the yield to maturity on A-rated utility bonds and the required risk premium, my estimate of the ex ante risk premium on an investment in my proxy natural gas company group as compared to an investment in A-rated utility bonds is given by the equation:

$$RP_{PROXY} = 8.52 \quad -0.580 \times I_A.$$
$$(15.50) \quad (-6.38)$$ [6]

Using a 5.8 percent forecasted yield to maturity on A-rated utility bonds at June 2017,[7] the regression equation produces an ex ante risk premium based on the natural gas proxy group equal to 5.2 percent (8.52 – .580 x 5.8= 5.2).

To estimate the cost of equity using the ex ante risk premium method, one may add the estimated risk premium over the yield on A-rated utility bonds to the forecasted yield to maturity on A-rated utility bonds. As described above, my analyses produce an estimated risk premium over the yield on A-rated utility bonds equal to 5.2 percent. Adding an estimated risk premium of 5.2 percent to the 5.8 percent forecasted yield to maturity on A-rated utility bonds produces a cost of equity estimate of 11.0 percent using the ex ante risk premium method.

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[6] The t-statistics are shown in parentheses.

[7] As described in my testimony, I obtain the expected yield to maturity on A-rated utility bonds, 5.8 percent, by averaging forecast data from Value Line and the U.S. Energy Information Administration (EIA). Value Line Selection & Opinion (June 2, 2017) projects a Aaa-rated Corporate bond yield equal to 5.5 percent. The June 2017 average spread between A-rated utility bonds and Aaa-rated Corporate bonds is 26 basis points (A-rated utility, 3.94 percent, less Aaa-rated Corporate, 3.68 percent, equals 26 basis points). Adding 26 basis points to the 5.5 percent Value Line Aaa Corporate bond forecast equals a forecast yield of 5.76 percent for the A-rated utility bonds. The EIA forecasts a AA-rated utility bond yield equal to 5.71 percent. The average spread between AA-rated utility and A-rated utility bonds at June 2, 2017 is 12 basis points (3.82 percent less 3.94 percent). Adding 12 basis points to EIA's 5.71 percent AA-utility bond yield forecast equals a forecast yield for A-rated utility bonds equal to 5.83 percent. The average of the forecasts (5.76 percent using Value Line data and 5.83 percent using EIA data) is 5.8 percent.

APPENDIX 5
EX POST RISK PREMIUM APPROACH

Source

Stock price and yield information is obtained from Standard & Poor's Security Price publication. Standard & Poor's derives the stock dividend yield by dividing the aggregate cash dividends (based on the latest known annual rate) by the aggregate market value of the stocks in the group. The bond price information is obtained by calculating the present value of a bond due in thirty years with a $4.00 coupon and a yield to maturity of a particular year's indicated Moody's A-rated utility bond yield. The values shown in the schedules are the January values of the respective indices.

Calculation of Stock and Bond Returns

Sample calculation of "Stock Return" column:

$$\text{Stock Return (2016)} = \left[\frac{\text{Stock Price (2017)} - \text{Stock Price (2016)} + \text{Dividend (2016)}}{\text{Stock Price (2016)}}\right]$$

where Dividend (2016) = Stock Price (2016) x Stock Div. Yield (2016)

Sample calculation of "Bond Return" column:

$$\text{Bond Return (2016)} = \left[\frac{\text{Bond Price (2017)} - \text{Bond Price (2016)} + \text{Interest (2016)}}{\text{Bond Price (2016)}}\right]$$

where Interest = $4.00.