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Many utilities have recently begun to diversify into non-regulated lines of business, both to increase profitability and to enhance capital appreciation potential for their shareholders. However, such diversification has created a new issue that must be addressed as a part of the regulatory process:

> Is there a difference between the required return on equity invested in the utility business versus that on equity invested in diversified operations?

If the answer is "yes," then the company's market-determined cost of equity may not be appropriate for regulatory purposes.

A secondary issue also arose during our investigation, namely, how do investors regard the relative riskiness of gas distribution operations versus electric operations? This issue is important to combination electric/gas utilities and their regulators, for it may indicate that different returns should be allowed on gas versus electric rate bases.

Our conclusions can be summarized as follows:

1. Nonutility diversification, at least based on the types and investment levels currently being pursued, has had a very minor impact on total company cost of equity. What evidence there is suggests

that, to the extent any differences exist, utility operations are regarded as being riskier than nonutility operations, and hence the direction of any adjustment should be to increase the cost of equity for utility equity over total company equity.

2. Gas distribution is perceived as being riskier than electric operations. This is reflected in lower market to book ratios, higher required returns, and lower earnings-price ratios for utilities with larger gas operations.

The PURC Model

The Public Utility Research Center has developed a cost of capital model which was derived from the constant growth discounted cash flow (DCF) model,

$$k = D_1/P_0 + g,$$

where

P_0 = current price of a firm's stock;

k = the firm's cost of equity capital;

D_1 = dividends per share expected during the next period; and

g = expected future growth rate in dividends. g is "expectationally constant," meaning that while investors know that the growth rate will actually vary from year to year, the current expectation of the growth rate for any future year is the same as for any other year (that is, $g_t = g_{t+1}$ for all values of t).

To use the DCF model, one merely calculates D_1/P_0, the dividend yield term, and adds to it an estimate of the growth term, g.

Although the basic model can be used to estimate the cost of equity, it is in some respects better to rewrite it in a different form for use in testing for the effects of diversification. Here we first transform the model to price/book ratio (P/B) form, and then we develop the P/B ratio as a function of the rate of return on book equity:

1. According to the constant growth model,

$$P_0 = \frac{D_1}{k - g}. \tag{1}$$

2. Expected earnings per share in any future year t, E_t, is equal to the expected rate of return, ROE, times the book value at the beginning of the period, B_{t-1}:

$$E_t = ROE(B_{t-1}). \tag{2}$$

3. If a constant fraction of earnings, b, is retained, then the dividend payout ratio, PO, will be equal to (1 - b), and expected dividends per share in any year t can be estimated as follows:

$$D_t = (1 - b)(E_t) = (1 - b)(ROE)(B_{t-1}). \tag{3}$$

4. The expected growth rate in earnings, dividends and share prices, assuming that b and ROE are constant and that no new stock will be sold at prices substantially different from book value, is found as follows:

$$g = b(ROE). \tag{4}$$

5. Letting t = 1 and substituting Equations (3) and (4) into Equation (1), we see that

$$P = \frac{D_1}{k - g} = \frac{(1 - b)(ROE)(B_0)}{k - b(ROE)}. \tag{5}$$

Transposing the B term produces this expression for P/B:

$$\frac{P_0}{B_0} = \frac{P}{B} = \frac{(1 - b)(ROE)}{k - b(ROE)}. \tag{6}$$

Equation 6 has some interesting and useful implications for rate cases. Note (1) that if commissioners actually identify the true cost of equity, k, and then allow utilities to earn this rate of return on their book equity, then (2) investors will use the allowed ROE as the expected future ROE, and (3) the P/B ratio will be equal to 1.0. If the allowed ROE is below k, then the P/B ratio will be less than 1.0, while if the allowed ROE exceeds k, P/B will be greater than 1.0.[1]

Equation 6 forms the theoretical basis for one of the empirical regression models which we use to estimate the cost of equity. First, note that the relationship between P/B and ROE as expressed in Equation 6 is nonlinear; the exact relationship is graphed in Figure 1. In the figure, we assume for illustrative purposes that k = 17% and b = 30%. The shape of the graph will vary somewhat depending on the values of k and b, and it will also be different if we assume that new stock is sold at prices significantly different from the book value. However, as a generalization, the graph is not very sensitive to these factors so long as they stay within reasonable bounds.[2]

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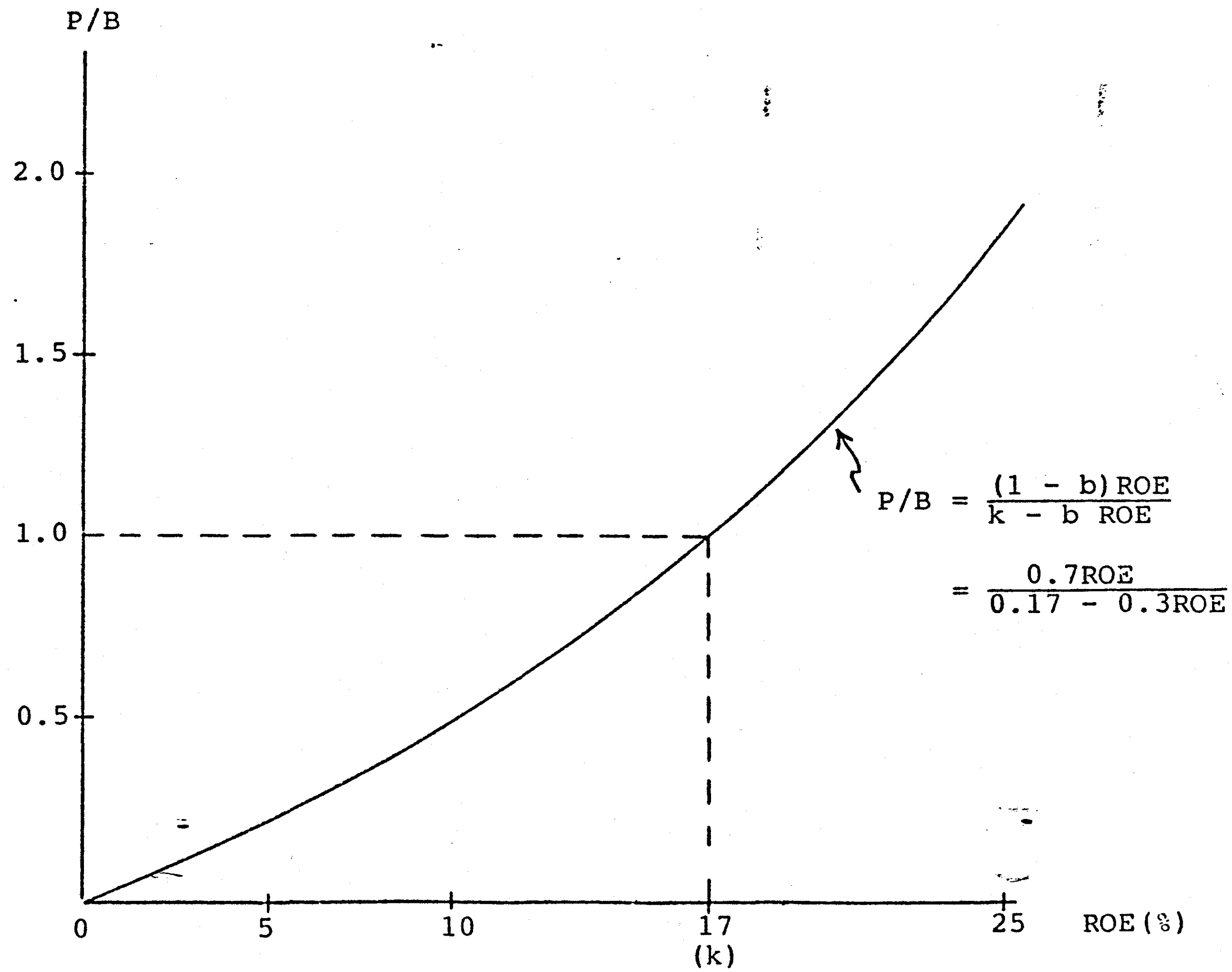
[1]Actually, because of flotation cost adjustments, commissions should set rates which will produce a target P/B ratio in the range of 1.05 to 1.10.

[2]The curve would be slightly steeper if the retention rate were higher than 30 percent, less steep if it were lower, but it would still pass through the point P/B = 1.0, ROE = 17%. The effect of a change in the retention rate depends on the level of ROE; changes of 10 percent or less in the retention rate have very little effect on the curve when ROE is in the range 15 to 19 percent. It should also be noted that, if the company is expected to issue stock, then the P/B ratio will be less than 1.0 if ROE = k, with the decline depending on (1) the percentage flotation cost and (2) the amount of stock expected to be sold. Selling stock also causes the curve to be steeper, indicating lower P/B ratios if k > ROE but higher P/B ratios if ROE > k.

Figure 1

Relationship between P/B and the Allowed Rate of Return (Assumes k = 17%, b = 30%)



Even though the exact relationship between P/B and ROE is non-linear, the curve is, for all practical purposes, linear for values of ROE within a reasonable range around the appropriate value of k, that is, if ROE is in the range 10 to 20 percent. This being the case, it is appropriate to assume, for purposes of fitting the regression model, that P/B is linearly related to the allowed rate of return. Assuming that a linear approximation is appropriate, we could run a regression of P/B against ROE such as the following:

$$P/B = a_0 + a_1(ROE).$$

Whereas Figure 1 is theoretically correct, Figure 2 shows how the empirical relationship between P/B and rates of return would look under realistic conditions. The points would plot around a linear regression line, but deviations from the line would occur for these reasons:

1. Earned returns do not match up exactly with commission specified allowed rates of return, so it is not possible to measure exactly the rate of return the average investor expects a utility to earn in the future. One could use as a proxy for this expected future return the company's actual earned return in the recent past, an average of returns earned over some longer past period, the rate of return allowed in the latest rate case, rates of return earned by other utilities, analysts' forecasts of future ROE, or any combination of these returns. Still, the true expected return for many of the companies will be measured with some degree of error, and this will cause actual P/B ratios to deviate from their predicted values.[1]

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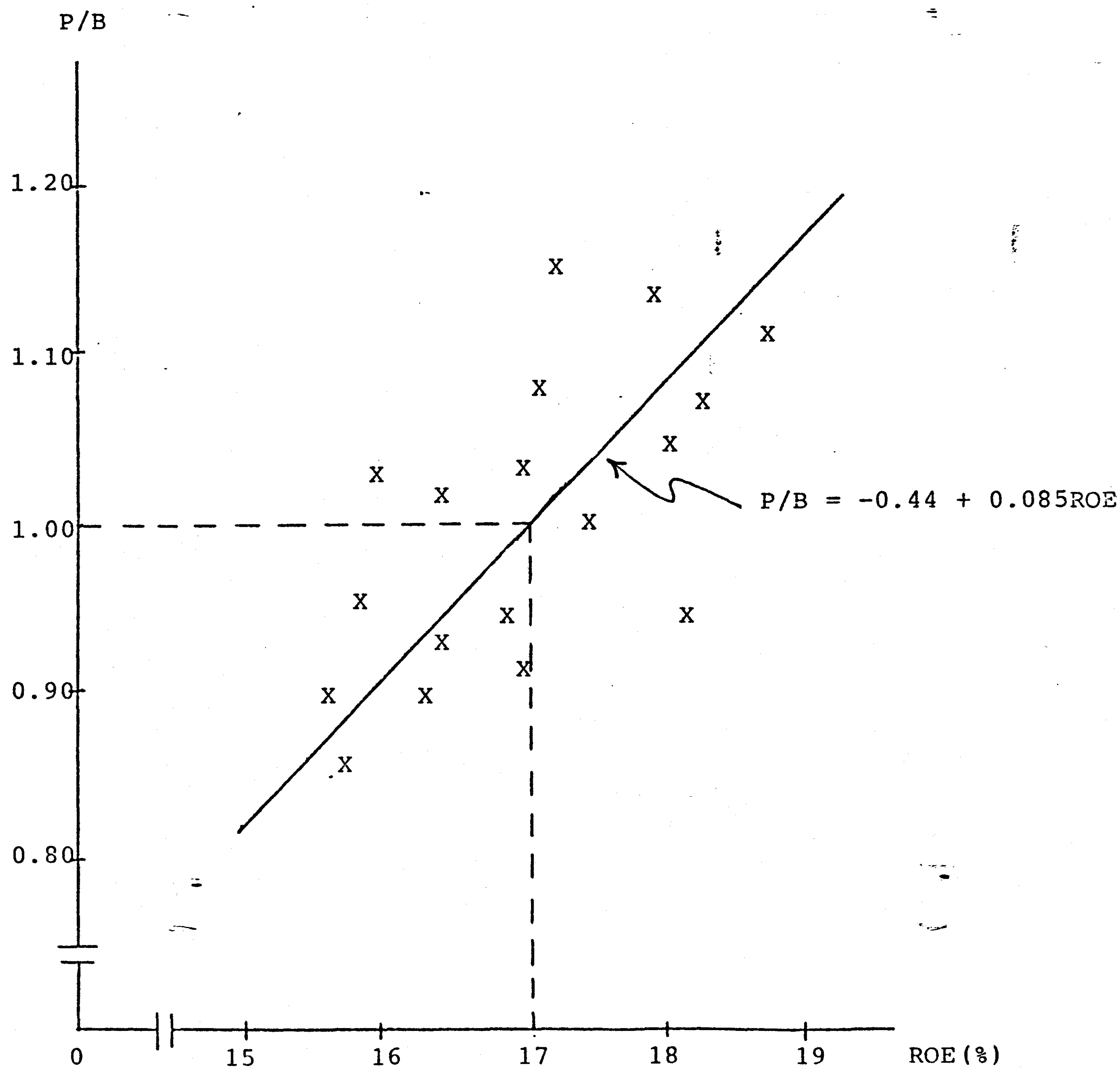
[1] If errors in measuring expected ROE are randomly distributed, then there will be no problem with the estimate of the relationship between P/B and ROE as derived from the regression. However, if the errors are not random, then there will be a problem. For example, suppose some event occurred which caused the ROEs of many or all utilities to fall sharply to some level below the true values of k for the different companies. However, suppose investors think the decline in ROE is temporary and that when the current problem is over, ROEs will return to

(Footnote continued)

Figure 2

Linear Relationship between P/B and ROE
(Assumes k = 17%, b = 30%)



2. The companies in the sample will differ in their riskiness as viewed by investors. This, in turn, will cause the true cost of equity, k, to differ among firms. If one company had a high equity ratio, a strong bond rating, conservative accounting methods, and a commission which operates without undue lags, then a given rate of return on equity would produce a relatively high P/B ratio, and the "X" representing this company would plot above the regression line. Opposite conditions would result in a low P/B ratio, and the company's "X" would plot below the regression line.

3. It is often argued that people who invest in utility stocks are more interested in current dividend income than in future capital gains. If this were true (and it has never been proven), then companies that have a high payout ratio would, other things held constant, have high P/B ratios and plot above the regression line in Figure 2.

4. Companies that have significant amounts of unregulated as well as regulated assets could have P/B ratios that are above or below the regression line, depending on the profitability and risk of these other assets.

Because of these factors, and perhaps others, it is apparent (1) that measuring the expected ROE is an important step in the analysis, and (2) that the basic model must be expanded to include risk variables. When the risk variables are included, then our regression model will be in this form:

$$\frac{P}{B} = a_0 + a_1(\text{ROE}) + \sum_{i=2}^{n+1} a_i X_i.$$

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a "normal" level. In this event, the regression line in Figure 2 would be shifted to the left. If this shifted regression line were used as the basis for setting the allowed rate of return, then it would <u>not</u> produce the desired P/B ratio--the P/B would end up below the target P/B.

In our past statistical models, we have used average values over the past 5 years in an effort to eliminate this problem. Unfortunately, we could never be sure whether the problem was present or not, for if there were a systematic understatement in the data, we could obtain high R^2 and t values yet still have problems with the model.

There are actually reasons to think the problem does exist for analyzing the utilities in recent years. Regulatory lag has held earned rates of return below authorized levels, and to the extent that investors expect this gap to be closed, then earned ROEs understate expected future ROEs. In this paper, we use an average of analysts' expected ROEs and the latest earned ROE to at least partially offset the problem described above.

Here X_i represents the n risk variables. We analyzed a number of risk variables, including (1) equity ratios, (2) Moody's bond ratings, (3) percentage of gas revenues to total revenues, (4) percentage of nuclear generation, (5) betas, (6) levels of nonutility diversification, and (7) commission rankings.

In an earlier study, we also considered a number of ways of estimating the expected ROEs.[1] First, we calculated past realized rates of return over various time periods and then used these values as proxies for current expectations. For example, we looked at last year's ROE as a proxy for expected future ROEs, and at the averages of the last 2, 3, 4, and 5 years, both unweighted and weighted to give more weight to the most recent data. In addition, we looked at commission-authorized ROEs. In our present study, we measure expected ROE as a simple average of the most recently earned ROE and the ROE projected for 1987 by Value Line on the grounds that investors probably give weight to both current and projected future levels of earned returns.

We used the model to test these three hypotheses:

Hypothesis I: Nonregulated lines of business have an impact on the market/book ratios of electric, electric/gas combination, and gas distribution utilities.

Hypothesis II: Nonregulated lines of business have an impact on the DCF cost of equity of electric, electric/gas combination, and gas distribution utilities.

Hypothesis III: Nonregulated lines of business have an impact on the earnings/price ratios of electric, electric/gas combination, and gas distribution utilities.

[1]Eugene F. Brigham, Dilip K. Shome, and Thomas A. Bankston, "An Econometric Model for Estimating the Cost of Capital for a Public Utility." PURC working paper, May 1979.

Each of these hypotheses is essentially a restatement of the same question: How does diversification affect a utility's risk as viewed by investors, and, consequently, its cost of equity capital? Although it is somewhat redundant, we have analyzed the effects of diversification on each of the three dependent variables in hopes of reducing the effects of a particular choice of model specification. We believe the market to book version to be the most useful in the sense that our measurement of M/B is subject to less error than either the measurement of k or that of E/P. However, we also anticipated that the effects of the diversification variable would be consistent across models.

Our initial tests, therefore, were conducted on the expanded models as follows:

Electric and combination companies:

M/B,k,E/P = f(diversification, percentage gas revenues, percentage nuclear generation, equity ratio, Moody's bond rating, expected ROE, beta, regulatory rank).

Gas distribution companies:

M/B,k,E/P = f(percentage gas revenues, equity ratio, Moody's bond rating, expected ROE, beta).

The differences in the electric and gas models are due primarily to differences in accounting conventions for the two industries, and also to the impact of nuclear generation on the electric utility industry. For the gas distribution utilities, diversification was measured by the percentage of gas distribution revenues relative to total company revenues. For the electrics and combination electrics, diversification into nonregulated businesses was measured through the use of a qualitative variable that has the value of 1 if the firm is highly diversified and the value 0 otherwise. Also, for the electrics and combination electrics, the percentage of gas distribution revenues was used to measure the amount of regulated gas operations relative to total regulated operations, and the percentage of nuclear generation is included as an additional risk control variable.

Sample Selection

We obtained data on the 99 electric and electric/gas combination companies that are followed by both Value Line and Salomon Brothers in October 1983, and on the 27 natural gas distribution companies Value Line followed during the same period. For a complete listing of the companies included in our samples, see Attachments A and B.[1]

Definitions of the Dependent Variables

The three dependent variables were defined and measured as follows for purposes of testing the hypotheses:

1. Market/Book ratio (M/B). For each of the electric and gas companies, we used market prices as of October 1, 1983, and the latest book values as reported by Salomon Brothers (electrics/combination companies) and Value Line (gas) in their October 1983 publications.
2. DCF cost of equity (k). This variable was obtained by solving the following equation for k:

$$P_0 = \sum_{t=1}^{4} \frac{D_t}{(1 + k)^t} + \left(\frac{D_t(1 + g)}{k - g}\right)\left(\frac{1}{k}\right)^4 ,$$

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[1]Our preliminary studies also included companies whose primary business is gas transmission, but which had some regulated gas distribution operations. These companies were found to be extremely heterogeneous, so we discarded them from the sample because they confused rather than clarified the issues at hand.

where the D_t value projections were obtained from Value Line for the period 1984 to 1987; g was found as g = b(ROE), using Value Line's projections for 1987; and P_0 was the price as of October 1, 1983. This procedure is discussed at length in Brigham and Shome, "Equity Risk Premiums in the 1980's," in Earnings Regulation under Inflation (Washington, D.C.: Institute for the Study of Regulation, 1981).

3. Price/Earnings ratio (P/E). The P/E ratio was found as the October 1, 1983, price divided by Value Line's 1983 projected earnings. Under certain circumstances, it would be better to use some type of normalized earnings, and perhaps we should have done so, but 1983 seemed to us to be a "reasonably normal" year for the utilities, as most of them are selling at close to their book values.

Electric and Combination Gas/Electric Company Risk Variables

In this section, we discuss the risk variables that were used only in the electric and combination gas/electric company model. In the following two sections, we describe specific gas company variables and variables used in both gas and electric/gas combination company models.

Percentage gas distribution (PCGAS). This variable is used in the regression studies for electrics and combination gas/electrics to identify potential differences which may exist in riskiness between the two regulated businesses. We also examined the impact of steam heat, water distribution, and transportation revenues in some preliminary studies, but we found that these regulated businesses were generally immaterial and, hence, had no measurable effect. The actual measurement of PCGAS is the 1982 total gas revenues divided by 1982 total utility operating revenues.

Level of diversification (DIVER). This factor was treated as a qualitative (dummy) variable that takes the value 1 if the firm is "highly" diversified into nonregulated businesses and takes the value 0 otherwise. We have based this variable on conversations with security analysts who follow the electric utility industry. Attempts to measure DIVER from historic accounting data were unsuccessful due to the data format used in the Compustat Utilities tapes.[1]

Percentage nuclear generation (NUKE). Recent studies have shown that companies with high levels of nuclear generation are generally regarded as being riskier by investors. We used the Salomon Brothers estimate of the 1983 percentage of total generation attributable to nuclear facilities as a measure of this risk variable.[2]

Regulatory ranking (RR). A number of security analysts have developed ranking systems for regulatory commissions. These rankings attempt to consolidate differences in various regulatory actions and policies into a single qualitative measure. Most of the recent empirical work we have seen has produced mixed results regarding the inclusion of a regulatory rank variable as an independent measure of risk. We used the Value Line rankings of above average (+1), average (0), and below average (-1) as our measure of this variable. Since Value Line does not furnish regulatory rankings for the gas distribution companies,

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[1]The diversified electrics were Houston Industries, Montana Dakota Utilities, Montana Power, Pacific Power and Light, Public Service of New Mexico, TECO Energy, Tucson Electric, and Washington Water Power.

[2]A better variable would be one that also considers the risks inherent in a nuclear construction program as well as those in on-line nuclear operations. However, we did not attempt to improve on this variable.

we used the RR variable only in the electric/gas combination company regressions.

Gas Company Variables

Percentage gas distribution revenues (GASPC). This variable is defined as the percentage of gas to total revenues for gas utilities, and it measures the gas utilities' level of diversification. It is taken from the 1982 edition of Natural Gas Industry Review, published by Edward D. Jones and Company.

Variables Common to Both Electric/Combination and Gas Company Models

Equity ratio (EQRAT). The amount of common equity relative to total permanent capital is a measure of the financial risk faced by a firm. For the electrics, we used the most recently available equity ratio as published in the October 3, 1983, Salomon Brothers Electric Utility Monthly. For the gas companies, we used the data from the October 14, 1983, edition of Value Line.

Moody's bond rating (MOODYS). Many empirical studies have shown that the credit rating of a firm is also an important variable when one is measuring the riskiness of its equity. We have developed a discrete numerical transformation of the current alphanumeric ratings assigned by Moody's Investors Service. This results in a range of variable values from 1 to 16, with 1 representing the lowest rating (B3) and 16 representing the highest rating (Aaa). For holding companies, we constructed a weighted average of the ratings of the subsidiaries' debt, where necessary, based on revenues.

Beta. The beta coefficient is a theoretical measure of the systematic risk of a firm's equity when it is held by an investor in a well-diversified portfolio. The concept of beta requires a measurement of investors' ex ante expectations. In practice, a statistical (ex post) beta coefficient is often calculated from historic holding period returns for a stock and for an index of stocks. There is evidence that betas do not truly capture the riskiness of a firm's equity, and this is especially true for utility stocks. Nevertheless, we included the beta variable for completeness, using Value Line betas.

Results

The equations we actually estimated took the following forms:

Electric I:

$$M/B = a_0 + a_1PCGAS + a_2DIVER + a_3NUKE + a_4EQRAT + a_5EROE + a_6RR + a_7BETA + a_8MOODYS.$$

Electric II:

$$k_{DCF} = a_0 + a_1PCGAS + a_2DIVER + a_3NUKE + a_4EQRAT + a_5EROE + a_6RR + a_7BETA + a_8MOODYS.$$

Electric III:

$$E/P = a_0 + a_1PCGAS + a_2DIVER + a_3NUKE + a_4EQRAT + a_5EROE + a_6RR + a_7BETA + a_8MOODYS.$$

Gas I:

$$M/B = b_0 + b_1GASPC + b_2EQRAT + b_3EROE + b_4BETA + b_5MOODYS.$$

Gas II:

$$k_{DCF} = b_0 + b_1GASPC + b_2EQRAT + b_3EROE + b_4BETA + b_5MOODYS.$$

Gas III:

$$E/P = b_0 + b_1GASPC + b_2EQRAT + b_3EROE + b_4BETA + b_5MOODYS.$$

Here a_0 to a_8 and b_0 to b_5 are the estimated regression coefficients, and

PCGAS = Percentage of gas revenues to total utility revenues.

DIVER = Level of nonutility diversification.

NUKE = Percentage of generation from nuclear plants.

EQRAT = Equity to total capital.

EROE = Expected rate of return on equity.

RR = Regulatory rank.

BETA = Value Line beta coefficient.

MOODYS = Moody's bond rating, scaled from 1 for B3 to 16 for Aaa.

GASPC = Percentage of gas revenues to total company revenues.

Table 1 presents the results for the electrics and combination companies. For the M/B regression, the estimated coefficient of the variable DIVER is a positive 0.06356, indicating that the market to book ratios for electrics and combination electrics with relatively high levels of nonutility diversification are about 6 percent higher, on average, than the market to book ratios of comparable nondiversified electrics and combination electrics. However, when we apply the general rule of thumb that only those coefficients with associated t-statistics whose absolute values are greater than 2 are in any meaningful way significant, we must reject the hypothesis that nonutility operations impact the market to book ratios of the firms. Where the DCF cost of equity estimate is the dependent variable, the estimated coefficient of DIVER suggests that capital costs increase with diversification, but the effect is not statistically different from zero. Finally, an examination of the

Table 1

Electric and Combination Companies

Explanatory Variables	Coefficient Symbol	Dependent Variable = M/B		Dependent Variable = k_{DCF}		Dependent Variable = E/P	
		Estimated Coefficient	t-Statistic	Estimated Coefficient	t-Statistic	Estimated Coefficient	t-Statistic
PCGAS	a_1	-0.00208	-3.169	0.02147	2.856	0.03022	2.337
DIVER	a_2	0.06356	1.559	0.21082	0.451	-2.4423	-3.041
NUKE	a_3	-0.00103	-1.661	0.00581	0.815	0.00564	0.461
EQRAT	a_4	-0.00017	-0.049	-0.02105	-0.545	0.03259	0.491
EROE	a_5	0.03293	4.535	0.25331	3.045	0.44206	3.090
RR	a_6	-0.00988	-0.511	0.45682	2.064	0.19356	0.508
BETA	a_7	-0.03792	-0.180	0.32820	0.136	-4.88320	-1.178
MOODYS	a_8	0.02770	5.379	-0.28245	-4.788	-0.35086	-3.459
INTERCEPT	a_0	0.33315	1.837	14.47202	6.964	13.40420	3.751
R^2:		0.5227		0.3091		0.3012	

coefficient a_2 for the E/P ratio indicates that diversification exerts a significant negative effect. This is consistent with the results of the market/book model, since a negative effect on the E/P ratio is an indication of a lower overall required return on equity for the highly diversified companies.

In sum, the regressions generally indicate that investors regard a diversified utility as being less risky than one which has only regulated assets. This is reflected in higher market to book ratios and a lower total company cost of equity (as measured by the E/P ratio) for the diversified electrics. However, these effects are, on balance, weak, so it is safest to state that diversification does not seem to raise a company's cost of equity.

Table 2 shows the regression results for the gas distribution utilities. Recall that the variable GASPC measures the ratio of gas distribution revenues to total company revenues, and it therefore reflects the level of nonutility diversification for these companies. In the M/B regressions, the estimated coefficient is negative, but insignificant, suggesting that nonutility operations exert minimal impacts on the market to book ratios of these gas companies. The coefficient in the DCF k model is also insignificant. However, as with the electric and combination companies, the estimated coefficient of the diversification variable for the E/P model is negative and significant, thus indicating a lower cost of equity for the more highly diversified gas companies.

In an overall sense, considering the results of nonutility diversification for both sets of companies, we find that the estimated coefficient of the diversification variable was statistically insignificant

Table 2

Gas Distribution Companies

Explanatory Variables	Coefficient Symbol	Dependent Variable = M/B Estimated Coefficient	Dependent Variable = M/B t-Statistic	Dependent Variable = k_{DCF} Estimated Coefficient	Dependent Variable = k_{DCF} t-Statistic	Dependent Variable = E/P Estimated Coefficient	Dependent Variable = E/P t-Statistic
GASPC	b_1	-0.00464	-0.521	-0.03147	-1.056	0.13648	2.417
EQRAT	b_2	-0.008406	-0.650	-0.04343	-1.006	0.08464	1.034
EROE	b_3	0.086007	2.078	0.08934	0.646	0.58531	2.233
BETA	b_4	0.82241	1.447	0.052413	0.028	-5.8864	-1.635
MOODYS	b_5	-0.00505	-0.150	-0.10849	-0.961	0.19710	0.921
INTERCEPT	b_0	0.2753	0.231	20.38224	5.110	-10.8267	-1.432
R^2:		0.3823		0.1563		0.5533	

in four of the six models. Only when the E/P ratio was used as the dependent variable did we obtain significant coefficients for either set of companies. The signs of these significant estimates suggest that the cost of capital is lower for the more diversified firms. On balance, it appears that investors view nonutility diversification favorably, but we are really unable to detect any important differences in the cost of equity among companies.

An examination of Table 1 also reveals that gas distribution operations are generally regarded as being more risky than electric operations. In each of the three models, the coefficient associated with the percentage of gas distribution revenues is significant, and in all cases the sign indicates a higher cost of equity capital for those companies with larger gas operations.

As part of our tests, we examined the degree of correlation between the explanatory variables. For both the electric/combination and gas models, the correlations were extremely low (less than 0.3). This indicates that the explanatory variables are essentially independent of one another and that, therefore, we can drop insignificant variables without materially altering the descriptive properties of the estimated models. The estimated coefficients for the reduced electric models are shown in Table 3. No significant changes from the conclusions reached earlier were observed.

Summary and Conclusion

We have examined the effects of nonutility diversification on the required rates of return on equity capital for both electric and gas

Table 3

Electric and Combination Companies:
Reduced Equations

Explanatory Variables	Dependent Variable = M/B Estimated Coefficient	t-Statistic	Dependent Variable = k_{DCF} Estimated Coefficient	t-Statistic	Dependent Variable = E/P Estimated Coefficient	t-Statistic
PCGAS	-0.00214	-3.383	0.02115	2.909	0.03106	2.544
DIVER					-2.65850	-3.678
EROE	0.03442	5.091	0.23921	3.109	0.47517	3.611
RR			0.41692	1.964		
MOODYS	0.02638	6.143	-0.29357	-5.637	-0.32866	-3.964
INTERCEPT	0.28942	2.982	14.25920	12.305	10.89760	5.801
R^2:	0.4852		0.3005		0.2848	

utilities. Our sample consisted of 99 electric and combination gas/ electric companies and 27 gas distribution utilities, which in total represents virtually the entirety of the regulated electric and gas distribution industries. Using the standard econometric technique of multiple linear regression analysis, we conducted tests of the effects of diversification on market/book ratios, estimates of DCF costs of equity, and earnings/price ratios for our sample groups. The multiple regression technique allowed us to control for differential risk factors such as bond ratings, regulatory rank, nuclear generation, equity ratios, betas, expected rates of return, and the level of natural gas distribution operations. This, in effect, allowed us to control for the effects of these factors.

In four of the six models we tested, the estimated coefficients of the diversification variable were statistically insignificant. This indicates that investors perceive little if any difference in the risk of the regulated versus the nonregulated operations. However, in two of the six models, the estimated coefficients of the diversification variables were significant. In both cases, the sign of the estimated coefficient indicated that investors regarded the nonutility activities as being less risky, and that, hence, they required a lower rate of return on the stock of diversified firms. Our explanation for these results is as follows:

1. The levels of nonutility operations are generally small, so they have little impact on the overall financial condition of the firm, which makes it difficult to pick up any effects that might truly be present.

2. Because the types of nonutility businesses being pursued are closely aligned with the regulated energy sector, there are no substantial differences in their risk characteristics.

3. To the extent that unsystematic as well as systematic risk affects stock prices and the cost of capital, and to the extent that diversification into non-utility areas reduces unsystematic risk, then diversification could lower a utility's investment risk and consequently its cost of equity. In view of the importance of regulatory risk, this could be a significant benefit to diversification.

On balance, we concluded that the evidence indicates little if any difference between the costs of equity associated with utility and with nonutility operations.

We also found that natural gas distribution operations are viewed as being more risky than electric operations. This result suggests that combination companies should, at this time, be authorized to earn slightly higher returns on their gas than on their electric rate bases.

Although we were unable to test for it because of data limitations, we suspect that the results of a study such as this one are sensitive to the time period being examined. Other studies have found that the relative riskiness of utilities vis-a-vis industrial companies as perceived by investors varies over time. In part these perceived differences reflect the "defensive" characteristics of utilities, and in part they reflect the "regulatory risk" utilities face in getting permission to charge prices which reflect costs during inflationary periods. In any event, we believe that any company or commission that is examining possible cost of capital differentials for internal or regulatory purposes should use up-to-date data in the analysis.

Attachment A
Electric and Combination Gas/Electric Utilities

Allegheny Power
American Electric Power
Arizona Public Service
Atlantic City Electric
Baltimore Gas & Electric
Boston Edison
Carolina Power & Light
Central Hudson Gas & Electric
Central Illinois Light
Central Illinois Public Service
Central Maine Power
Central & Southwest
Central Vermont Public Service
Cincinnati Gas & Electric
Cleveland Electric
Commonwealth Edison
Commonwealth Energy
Consolidated Edison
Consumers Power
Dayton Power & Light
Delmarva Power & Light
Detroit Edison
Duke Power
Duquesne Light
Eastern Utilities
El Paso Electric
Empire District Electric
Florida Power & Light
Florida Progress
Gulf States Utilities
Hawaiian Electric
Houston Industries
Idaho Power
Illinois Power
Indianapolis Power & Light
Interstate Power
Iowa Electric Light & Power
Iowa-Illinois Gas & Electric
Iowa Public Service
Iowa Resources
Iowa Southern Utilities
Kansas City Power & Light
Kansas Gas & Electric
Kansas Power & Light
Kentucky Utilities
Long Island Lighting
Louisville Gas & Electric
Madison Gas & Electric
Middle South Utilities
Minnesota Power & Light
Missouri Public Service
Montana Dakota Utilities
Montana Power
Nevada Power
New England Electric
New York State Electric & Gas
Niagara Mohawk
Northeast Utilities
Northern Indiana Public Service
Northern States Power
Northwestern Public Service
Ohio Edison
Oklahoma Gas & Electric
Orange & Rockland
Otter Tail Power
Pacific Gas & Electric
Pacific Power & Light
Pennsylvania Power & Light
Philadelphia Electric
Portland General Electric
Potomac Electric Power
Public Service Electric & Gas
Public Service of Colorado
Public Service of Indiana
Public Service of New Hampshire
Public Service of New Mexico
Puget Sound Power & Light
Rochester Gas & Electric
San Diego Gas & Electric
Savannah Electric
Sierra Pacific Power
South Carolina Electric & Gas
Southern California Edison
Southern Company
Southern Indiana Gas & Electric
Southwestern Public Service
TECO Energy
Texas-New Mexico Power
Texas Utilities
Toledo Edison
Tucson Electric Power
Union Electric
United Illuminating
Utah Power & Light
Virginia Electric & Power
Washington Water Power
Wisconsin Electric Power
Wisconsin Power & Light
Wisconsin Public Service

Attachment B
Natural Gas Distribution Utilities

Alagasco, Inc.
Arkla, Inc.
Atlanta Gas Light Co.
Bay State Gas
Brooklyn Union Gas Co.
Cascade Natural Gas Corp.
Columbia Gas
Connecticut Natural Gas Corp.
Consolidated Natural Gas
Diversified Energies, Inc.-Del
Entex, Inc.
Equitable Gas
Gas Service Co.
Indiana Gas Co.
KN Energy
Laclede Gas Co.
LA General Services
Mountain Fuel
National Fuel Gas Co.
NUI Corp.
Nicor, Inc.
Northwest Natural Gas Co.
Pacific Lighting Corp.
Piedmont Natural Gas Co.
UGI Corp.
Washington Gas Light Co.
Wicor, Inc.