AN AUTOMATIC COST OF CAPITAL ADJUSTMENT MODEL FOR REGULATING PUBLIC UTILITIES

DAVID A. WEST and
ARTHUR A. EUBANK, JR.

Dr. West is Professor of Finance at the University of Missouri-Columbia and has published numerous articles and books related to the capital markets with a special emphasis on investor attitudes toward risk. Within the past five years, he has directed his research efforts specifically toward the financial problems of regulated firms, has participated in six public utility conferences, and has prepared testimony for two public utility rate proceedings. Dr. Eubank is Assistant Professor of Finance at the University of Missouri-Columbia. He has conducted a number of research projects to determine appropriate risk adjusted rates of return for public utilities, and during the past 3 years has been awarded two research grants to fund his investigations in this area.

Introduction

This paper proposes an Automatic Cost of Capital Adjustment Model (ACCAM) that would facilitate a more timely regulatory response to changing capital market conditions. Considerable technological change in the area of computer based risk return analysis could enable regulatory commissions to respond immediately, within controlled limits, to cost of capital changes without the cost and delays associated with generating information through adversary proceedings. This could be made possible through the authorization of automatic cost of capital rate adjustments on the basis of only a few statistically significant financial variables.

The implementation of this technique would be analogous to the automatic utility rate adjustments which now occur in response to changing fuel costs. In a 1974 statement concerning the electric utilities, the Federal Power Commission states that "consideration should also be given to expanding the concept of automatic adjustments to costs affecting production and operation other than fuel" [8, p. 29]. Since then, considerable effort has been and currently is being directed toward that end [9, 12, 13, 18]. The proposed ACCAM would be an expanded use of the automatic rate adjustment clause concept, and would represent an entirely new approach to cost of capital regulation. Its implementation would enable the determination of a fair rate of return for regulated firms based upon a risk-return analysis comparing regulated and unregulated firms, and would facilitate controlled rate adjustments, either up or down.

Regulating appropriate rates of return for utilities is an extremely difficult task given any rapidly changing risk-return environment. At the present time, however, the problem is further complicated by the fact that the utilities' risk-return status has so deteriorated over the past decade as a result of increased inflation and regulatory lag that investors have lost much of the confidence they once had in the regulatory process. Consequently, the utilities now find it much more difficult and expensive to attract investors' capital, particularly equity capital. Although the current problem is one of deterioration, the experience of the late 1950's and early 1960's could well be repeated when utilities' rates of return were at least adequate and often excessive.

The proposed ACCAM would reduce regulatory lag, restore confidence in the regulatory process, improve the risk-return status of regulated firms, maintain their financial integrity, enhance their ability to attract capital on competitive terms, reduce the need for utilizing excessive resources in the preparation of endless interim and permanent rate proceedings, improve the efficiency of the regulatory commissions, reduce the cost of the regulatory process, and reduce the cost of providing services to the consuming public. Furthermore, such an approach would enable legislators and regulators to establish a process whereby some portion of an appropriate rate adjustment could occur automatically, thereby providing rates more nearly optimal with regard to all parties: customers, employees, and investors. Such a technique would reduce utilities' cost of capital, increase economic productivity and increase the overall social effectiveness and equity of regulation.

Determining a Fair Rate of Return

Theoretically, the utilities should charge prices that enable them to provide adequate services of a satisfactory quality. To produce their services efficiently, they must be able to cover their total costs of production and attract sufficient resources, including capital, on competitive terms. To do so they must be allowed to earn a fair rate of return on that capital, which in regulated industry is the rate of return that will be earned over time in competitive industry adjusted for risk. In establishing rates of return for regulated utilities, the criteria of efficient resource allocation and equitable treatment of consumers and producers require the determination of a benchmark of historical and prospective rates of return in the non-regulated, more competitive market [10, 17].

Any other rate of return would not be fair; a higher rate would be unfair to customers; a lower rate would be unfair to investors because they would not be adequately compensated for their contributions to the production of utility services. A lower rate of return would also be unfair to utilities' customers, however, since it would inhibit the utilities' ability to attract capital as the investment opportunities in the non-regulated sector became more attractive. Over time, utility customers would experience "shortages" of utility services in the sense that many would be unable to purchase the quantities of service desired at existing prices. Furthermore, a less than optimal quantity of resources would be devoted to producing utility services, thereby producing a less valuable total output to consumers than would have been produced with a more optimal allocation of economic resources. Resources allocated to the production process in the regulated sector should have the opportunity to earn as much as they could earn in their best alternative in the non-regulated sector with appropriate consideration given to relative risks. If suppliers of utilities' resources are not allowed to earn such amounts, they will divert their capital to better opportunities; but when resources are so shifted, the economic growth pattern and the effective employment of resources as a whole suffer as a consequence.

Traditionally, regulatory commissions, both federal and state, have utilized the 3 standards of fair return identified in the Bluefield and Hope cases: (1) The return allowed to investors should be comparable to that being earned on investments in other business undertakings with corresponding risks and uncertainties. (2) The return should assure confidence in the financial integrity of investments in the enterprise. (3) The return should facilitate capital attraction by the firm on reasonable terms.

The *comparable earnings* standard is clear in concept but difficult to apply. Nevertheless, the poor performance of utility shares in the past ten years as compared with the performance of investment alternatives suggests clearly that utility shareholders have not received a return comparable to that available in other investments with corresponding risks and uncertainties, and this experience now affects their expectations.

The second standard, *financial integrity*, refers to fair treatment of capital already committed to a business. In its most extreme form, this standard would mean that rates of return should not be so low that a utility must default on debt obligations incurred in good faith; that is, the company should not have to incur bankruptcy. In addition, equity capital committed to the firm in good faith is entitled to the opportunity to earn a fair rate of return. The maintenance of financial integrity is essential if the utility must raise funds in the capital markets; and under conditions of higher interest rates, the rate of return on total capital must increase if the return on equity is not to decline.

The third standard, *capital attraction*, requires that a company be able to compete effectively in the capital markets for needed funds. In order to meet all its obligations and provide a fair rate of return to its common shareholders, and in order for a firm to expand, replace existing facilities, or improve its quality of service through the introduction of modern facilities, the firm must be able to earn a fair rate of return and demonstrate an adequate level of financial integrity in order to attract both the debt and the equity capital required to finance these projects.

Because the ability to attract capital and the cost of capital are contingent upon maintaining investor confidence, the cost of capital will be higher whenever regulators do not allow adequate earnings for a company, and this higher cost must be reflected ultimately in higher rates to the consuming public. During the past decade, the price level has been inflated dramatically and the relative risks faced by utility investors have increased substantially, but rates of return on utilities' common equity have declined. Although capital market conditions have changed significantly, the regulatory commissions have continued to employ the traditional adversary techniques for generating information. Numerous long and expensive rate proceedings have resulted, thereby increasing the utilities' cost of capital. Consequently, the utilities in general have lost considerable investor confidence, which continues to restrict the ability to attract capital. Unless some new approach is developed whereby more appropriate rates of return can be allowed and earned, even higher costs of capital will be required, and even higher charges for customer services will be necessary.

If private utilities are to attract investors' capital in the future, a greater understanding of the utilities' risk-return status relative to alternatives in the capital markets must be developed, and pricing policies more appropriate to their risk-return status must be established. The continued delays on the part of regulators, both federal and state, to grant adequate rate relief since 1964, are viewed by investors as a gradual, unrelenting confiscation of private property. Rates of return have been too low over the past compared to alternative investment opportunities in the unregulated sector of the economy. Unless this situation is alleviated, utilities' services to their customers will necessarily deteriorate.

The Proposed Automatic Cost of Capital Adjustment Model

The development of an ACCAM requires the selection of various measures of return and risk in order to appropriately adjust a utility's allowed rate of return in response to changes in the capital markets. There are many alternative measures that could be used; however, the discussion in this paper will be limited to 3 widely used measures of return and two commonly used risk measures.

Measures of Return

The first and most widely used measure of return to common equity is the *average rate of return on average common book equity*. This measure is neither an actual nor an expected rate of return to shareholders; rather, it is an accounting measure of return. The formula for its determination is given below:

$$\bar{R}^b = \frac{\sum_{t=1}^{T} \frac{E_t}{V_t}}{T} \tag{1}$$

where E_t = earnings per share in period t, V_t = average per share book value of common equity in period t, and T = number of periods used in the calculation of $\bar{R}_b$. This measure is widely used by regulatory commissions to determine fair rates of return for utilities. Three major criticisms of its use are that (1) there is no companion risk measure, (2) it may not adequately reflect the replacement value of the per share common equity, and (3) it ignores the actual rate of return which the common shareholder receives from his investment.

The second return measure, *discounted cash flow* (DCF), is also widely used in rate proceedings. The DCF determines an expected rate of return to common stockholders based upon the firm's expected dividend, its expected dividend growth rate, and its current common stock price. It is determined as follows:

$$k_e = D_1/P_o + g, \tag{2}$$

where D_1 = expected annual dividend assumed to be received at the end of the year, P_o = current price of a share of common stock, and g = expected annual growth rate of the cash dividend per share of common stock. The DCF method assumes that the future growth rate in dividends per share can be estimated by using the historical growth rate adjusted, for example, by analysts' projections. This growth rate is usually treated as a constant. Further, the current price of the firm's common stock is implicitly assumed to be in equilibrium, and thus is used in equation (2) for determining k_e, the appropriate or expected DCF rate of return to common equity.

The use of the DCF return in rate proceedings has been criticized for its use of historical data for estimating the growth rate component of k_e and the assumption that the estimated "g" will remain constant. A further criticism is that the k_e value is determined at one point in time using the common stock price at that particular time to estimate a future expected or appropriate rate of return to common shareholders. If the point chosen falls within a declining market, a higher expected or appropriate return is indicated; whereas if the point chosen falls within a rising stock market, a lower expected or appropriate return to equity is indicated. In fact, the usefulness of the DCF method in rate-setting is greatly diminished by its dependence upon stock market movements, particularly during periods of rapidly changing capital market conditions. However, an average of several past DCF returns for different periods might be used to provide additional insights when determining an appropriate return.

The third measure, *realized rate of return* on the market value of a share of common stock for a particular holding period, is based upon per share price changes (appreciation or depreciation) and per share cash dividends for various holding periods. Typically, the realized rate of return is calculated for several past periods and averaged to obtain an arithmetic mean return for the holding periods examined. The single holding period return, R_t, for period t can be determined by equation (3):

$$R_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}} \quad (3)$$

where P_t = the price of a share of common stock at the end of period t, P_{t-1} = the price of a share of common stock at the end of period t−1, and D_t = the cash dividend per share during period t, while the arithmetic mean holding period return, $\bar{R}$, for T periods is defined as:

$$\bar{R} = \frac{\sum_{t=1}^{T} R_t}{T} \quad (4)$$

The mean holding period measures the actual, realized return received by a firm's common shareholders. It provides, however, a different result than either of the two methods described above. The average return on average common book equity is more directly a function of the firm's rate base and rate structure, whereas the average realized rate of return to common shareholders is substantially influenced by such exogenous factors as regulatory lag, inflation, stock market conditions, and interest rate levels, as well as by the firm's rate base and rate structure. The average realized rate of return is also related to the DCF return; however, the relationship is often inverse; i.e., during a declining stock market, the former will often be negative, and the latter will be increasing due to the increase in the D_1/P_0 term in equation (2) caused by the decrease of P_0.

Although it is quite apparent that the realized rate of return is not a useful measure for determining a fair rate of return to common equity when establishing an equitable rate structure, it is useful from two entirely different but, nevertheless, important viewpoints. First, it provides an indication of the effectiveness and efficiency of the regulatory process. For example, extreme fluctuations in realized rates of return or unreasonably high or low actual returns associated with the common stock of a regulated firm for an extended period of time would indicate that the responsible regulatory commission was not performing satisfactorily. Second, a set of historical holding period returns provides the basis for determining the risk associated with the common stock of a particular company. This aspect of actual or realized returns makes this return measure especially important because of the need for making risk comparisons between regulated and unregulated firms. Two measures of risk will be examined for use in the development of the proposed ACCAM.

Measures of Risk

The *standard deviation* method of risk measurement measures dispersion about the mean holding period return, and provides information concerning the downside risk and the upside potential associated with the returns of a particular stock. The standard deviation of return for an individual stock, σ_i, is calculated about the arithmetic mean holding period return as follows:

$$\sigma_i[\Sigma(R_{it} - \bar{R}_i)^2/T]^{1/2} \quad (5)$$

where R_{it} = the holding period return for the i-th firm in period t, $\bar{R}_i$ = the mean holding period return over T periods, and T = the number of periods used in the computation of σ_i. Although the standard deviation of returns is widely used as a measure of risk, it measures the total risk or variability of actual returns to equity holders and does not consider the diversification potential of individual stocks when combined in portfolios. Despite its wide use as a measure of risk, therefore, the standard deviation is theoretically less appropriate than the systematic risk measure.

The second risk measure, *systematic risk* of the returns to the common shareholders, is defined as the ratio of the convariance of a set of actual holding period returns of an individual stock with a set of holding period returns from a broad-based market index to the variance of the market index. The appropriateness of using systematic risk, also referred to as undiversifiable risk, is based upon the assumption that an individual stock's variability of returns or total risk is unimportant in determining its appropriate cost of equity capital. This is because investors can hold that stock in a well-diversified portfolio and thereby eliminate all of the stock's variability of returns except for the variability associated with its covariability with the market index.

The systematic risk of a stock can be determined by the following regression equation:

$$(R_{it} - R_{ft}) = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \epsilon_{it} \quad (6)$$

where R_{it} = the holding period return of the i-th firm in period t, R_{ft} = the "risk-free" rate in period t, α_i = the estimated intercept term of the regression equation for the i-th firm, β_i = the systematic risk or beta coefficient as estimated by the slope coefficient of the regression equation, R_{mt} = the holding period return of the market index in period t, and ϵ_{it} = the error term of the regression equation in period t.

The Automatic Adjustment Framework

Since the return and risk measures discussed above are subject to the vagaries of market psychology as well as to management-initiated adjustments of earnings and book values through changes in accounting and depreciation methods, the proposed ACCAM should not be entirely dependent upon those measures, but should be based upon their underlying determinants. While the appropriate rates of return to equity would be determined automatically in order to respond quickly to changing capital market conditions, these rates would not be permitted to fluctuate as rapidly as the actual holding period returns to common shareholders. Instead, regression models based upon data from regulated and unregulated firms would be used to determine the significant financial determinants of the 5 measures of return and risk discussed in this paper. These variables could then be used to determine the appropriate return to equity based upon the predicted utility risk as determined by samples of unregulated (and perhaps regulated) firms.

The authors are currently developing and testing an ACCAM that will initially use a set of 5 separate regression equations using each of the 3 return measures and 2 risk measures as the dependent variables for each regression equation. A number of independent variables will be used in step-wise regressions to select those sets of independent variables which are significant determinants of the 5 dependent variables. Most of the independent variables used may be applicable to both regulated and unregulated firms. Among those to be tested are growth rate of earnings per share, variability of the growth rate of earnings per share, market price to book value ratio, variability of the market price to book value ratio, price earnings ratio, variability of the price earnings ratio, debt ratio, and interest coverage ratio.

Included in the set of independent variables will be a subset of variables which reflect the risk characteristics of both regulated and unregulated firms. By using a large number of such variables, the 3 regression equations used to predict fair rates of return ($\bar{R}_b$, k_e, and $\bar{R}$) will contain implicit comparisons of risk levels for firms in both the regulated and unregulated sectors. Although these 3 predicted rates of return are *implicitly* adjusted for risk, pairs of predicted risk and return measures can be used in a "risk-equivalent" framework to suggest fair rates of return which *explicitly* reflect risk as measured by either σ or β.

Alternative Approaches To Implementing an ACCAM

Of the several approaches that could be taken to making an ACCAM operational, the 4 basic ones suggested here are: the best predictive equation method, the average predicted return method, the risk-equivalent σ return method, and the risk-equivalent β return method. Any approach to developing an operational ACCAM must adjust for risk differentials between the regulated and unregulated sectors, and must not only permit automatic changes in the allowed rate of return but also pass through to customers some portion of changes of operating costs in order to ensure that the earned rate of return approximates the allowed rate.

The first step in developing an ACCAM is to select the determinants or independent variables to be used in the 5 risk-return equations. This selection process requires both *a priori* and empirical considerations and may well change with changing market conditions, managerial decisions, accounting rules, and legal restrictions.

The second step, regardless of the approach or method used, is to identify the unique set of significant independent variables for each regression equation. The results of the regression analyses will then be used to determine alternative appropriate rates of return.

The third step is to examine alternative approaches to implementing an ACCAM. Among the approaches that should be considered are the 4 methods discussed in the remainder of this paper, i.e., the best predictive equation method, the average predicted return method, the risk-equivalent σ return method, and the risk-equivalent β return method. In addition to these approaches, there may well be others that offer equal or more promise that other researchers will want to pursue.

The fourth step is to establish one of those methods as superior on the basis of theoretical considerations, empirical testing, and acceptability to regulatory commissions. The ultimate implementation of an ACCAM, of course, would involve a detailed description of the operational aspects of the model.

The fifth step is to examine the impact of the model upon the regulatory environment, i.e., the cost of the regulatory process, the risk-return status of regulated firms, the ability of the regulated firms to attract capital on reasonable terms, and the social cost associated with a suboptimal allocation of resources to the regulated sector. The model's ultimate value, of course, will be a function of its impact upon investors' attitudes toward regulated earnings as compared to those available in the unregulated sector, upon the cost of capital investors require of regulated firms, and upon the consequent cost of service to utilities' customers.

The Best Predictive Equation Method

This method utilizes only the regression equation which explains the highest proportion of the variation of its respective return measure ($\bar{R}_b$, k_e, or $\bar{R}$). The dependent variable thus predicted by this equation is the fair rate of return predicted by the regression equation with the highest explanatory power, i.e., the highest R^2. The primary advantages of this method are its relative ease of understanding and application plus the possibility that one regression equation may be substantially superior to the other two in terms of explanatory power.

Confidence intervals at various levels of significance could be established about the fair rate of return predicted by the best predictive equation to determine whether the predicted fair rate of return is significantly different from the rate currently being allowed by the utility's regulatory commission. If the 2 rates are significantly different at some previously established level of significance, a cost of capital adjustment is indicated. The specific proportion of any indicated cost of capital adjustment that would be automatic might be a function of the previously established confidence interval or some other statistical measure (e.g., a moving average of predicted fair rates of return). If the 95% confidence interval were selected as the appropriate limit, for example, any allowed rate of return falling outside the 95% confidence interval about the predicted rate of return would be automatically raised or lowered to the predicted rate of return or to the nearest confidence interval limit [6].

The Average Predicted Return Method

This method utilizes an average, $\bar{R}_a$, of the 3 returns defined earlier ($\bar{R}_b$, k_e, and $\bar{R}$) as the dependent variable in a fourth regression equation using the same set of independent variables as those used in the first regression equations described above. The use of the average predicted return, $\bar{R}_a$, has a potential advantage of reducing or eliminating the estimation errors associated with the determination of each of the individual returns. Upon determining the predicted $\bar{R}_a$, confidence intervals at various levels of significance could be established about $\bar{R}_a$ to determine if the utility's allowed rate of return was significantly different from the predicted $\bar{R}_a$. As in the case of the "best predictive equation method," if the two rates were significantly different, a cost of capital adjustment would be indicated, some portion of which could be allowed automatically on some previously established basis.

The use of an average rate of return as the dependent variable also has the potential advantage of reducing the effects of temporary market fluctuations. When the actual return decreases, the DCF return increases due to the drop in price associated with the lower actual return; this inverse relationship should provide a more stable estimation of the target return.

The Risk-Equivalent σ Return Method

The risk-equivalent σ return approach determines a risk-return relationship for a sample of unregulated firms which is used as the basis for establishing the fair rate of return for an individual regulated firm with a given risk as measured by σ. The predicted rate of return of the industrial sample might be $\bar{R}_b$, k_e, $\bar{R}$, or an average of the 3, $\bar{R}_a$. In any case, however, the unregulated sample return is paired with the σ for the sample of unregulated firms. The σ of a specific utility is used to establish a risk-equivalent framework whereby the fair rate of return for an individual utility can be determined as a function of its respective σ. As is shown in Exhibit 1, a capital market line (CML) framework can be used to determine risk-equivalent fair rates of return [15]. The slope of the CML is defined as:

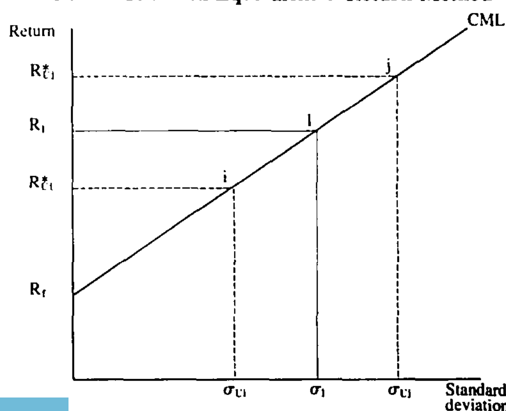
$$\frac{R_I - R_f}{\sigma_I}, \tag{7}$$

where R_I = the average rate of return for the sample of unregulated industrial firms, R_f = the average risk-free rate of return, and σ_I = the standard deviation of the sample of unregulated firms.

Given the CML and the standard deviations for the i-th and the j-th utilities, σ_{Ui} and σ_{Uj}, the risk-equivalent returns for the i-th and the j-th firms are R^*_{Ui} and R^*_{Uj}, respectively, as demonstrated in Exhibit 1. These risk-equivalent values have the same reward per unit of risk as the sample of unregulated industrials used to establish the risk-equivalent framework, measuring risk by use of σ. The formula for calculating the risk-equivalent return for the i-th utility is given below:

$$R^*_{Ui} = R_f + \frac{\sigma_{Ui}}{\sigma_I}(R_I - R_f). \tag{8}$$

Exhibit 1. The Risk-Equivalent σ Return Method



As in the case of the previous two methods, confidence intervals about the standard deviation for an individual firm could be used to determine the confidence interval about the risk-equivalent return. Subsequently, if the risk-equivalent rate of return and the allowed rate of return were determined to be significantly different, a cost of capital adjustment would be indicated, some portion of which could be allowed automatically according to a previously established formula. This method, however, has the advantage of reflecting risk explicitly in determining a fair rate of return comparable to the risk-adjusted returns being earned by unregulated firms.

Although determining the CML presents a significant empirical challenge, capital market theory has already been used in numerous rate proceedings. As additional refinements and applications of this theory occur, greater understanding of the theory and confidence in its results should be forthcoming. Also, although 3-month Treasury bills have been and can be used as a proxy for the risk-free rate [13], recent empirical evidence suggests that in a capital asset pricing model framework, the usual assumption of borrowing and lending at the risk-free rate may not hold; instead, the return on a zero-beta portfolio may be more appropriate as a proxy for R_f in a 2-factor model. For a discussion of this treatment, see for example, Black, Jensen, and Scholes [2], Blume and Friend [3], and Fama and MacBeth [7].

The Risk-Equivalent β Return Method

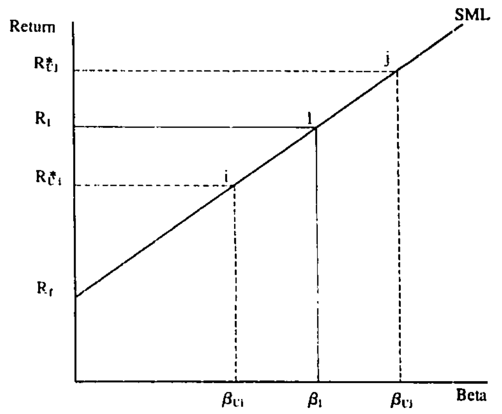
The risk-equivalent β return approach determines a risk-return level for a sample of unregulated firms that is used as the basis for establishing a fair rate of return for an individual regulated utility with a given risk as measured by β. The predicted rate of return for the industrial sample might be any of the 4 rates of return, $\overline{R}_b$, k_e, $\overline{R}$, or $\overline{R}_a$. As in the case of the risk-equivalent σ return method, a risk-equivalent framework can be used to determine risk-equivalent rates of return for individual utilities, but in this approach β is used as the measure of risk [15].

The security market line (SML) is used in this framework. The slope of the SML is defined as:

$$\frac{R_I - R_f}{\beta_I}, \tag{9}$$

where R_I = the average rate of return for the sample of unregulated industrial firms, R_f = the average risk-free rate of return, and β_I = the systematic risk of the sample of unregulated firms. Given the SML and the β's for the i-th and the j-th firms, the risk-equivalent returns for the i-th and j-th firms are R^*_{Ui} and R^*_{Uj}, respectively, as demonstrated in Exhibit 2. These risk-equivalent values have the same reward per unit of risk as the sample of unregulated industrials used to establish the risk-equivalent

Exhibit 2. The Risk-Equivalent β Return Method



framework measuring risk by use of β. The formula for calculating the risk-equivalent return for the i-th utility is given below:

$$R^*_{Ui} = R_f + \frac{\beta_{Ui}}{\beta_I}(R_I - R_f). \tag{10}$$

As in the case of the 3 methods previously discussed, confidence intervals about the beta for an individual firm could be used to determine the confidence interval about the risk-equivalent return in an SML framework, and cost of capital adjustments would be indicated when risk-equivalent and allowed rates of return are determined to be significantly different. Some portion of an indicated cost of capital adjustment, therefore, could be allowed automatically in accordance with some previously established basis. Because this approach reflects only the undiversifiable risk in the risk-equivalent framework, it is theoretically superior to the previous method, which utilizes total risk as measured by the standard deviation.

Regardless of which of these or other specific methods may be used to implement an ACCAM, however, the model must be based upon data from both the regulated and unregulated sectors and must adjust for risk implicitly or, preferably, explicitly. A great deal of research is needed in this area to test these and other methods as to their explanatory power, reliability and acceptability to regulatory commissions.

Illustrating Automatic Rate Adjustments

In order to demonstrate the application of an ACCAM, 2 numerical illustrations are presented below. The first example addresses the question of changing a utility's allowed rate of return as a function of changes in the underlying financial variables which affect its predicted appropriate rate of return. This example demonstrates the use of a predicted appropriate book return and its associated confidence interval for reevaluating and changing, if necessary, the allowed book rate of return.

Given a calculated value of 14% for a predicted appropriate (allowed) book return with 95% confidence interval upper and lower limits of 16% and 12%, respectively, an adjustment would be indicated if the currently allowed rate were sufficiently different from the predicted appropriate return of 14%. This adjustment could be a function of a set of pre-established criteria; for example, alternative criteria might be as follows: (1) If the currently allowed rate of return is outside the confidence interval, adjust it to the nearest confidence limit, e.g., if it is 11%, adjust it to 12%, or if it is 17%, adjust it to 16%. (2) If the currently allowed rate of return is outside the confidence interval, adjust it by moving it a given percentage, say 50%, of the distance toward the predicted value, e.g., if it is 11%, adjust it to 12.5%, or if it is 17%, adjust it to 15.5%. (3) If the currently allowed rate of return is outside the confidence interval, adjust it to the predicted value, e.g., if it is 11%, adjust it to 14%, or if it is 17%, adjust it to 14%. (4) If the currently allowed rate of return is within the confidence interval, then no adjustment would be indicated.

The second example demonstrates in a similar manner the risk-equivalent method of determining the appropriate allowed rate of return. Equation 10 can be used to determine the appropriate predicted (allowed) rate of return and its associated 95% confidence interval limits. Assume that an industrial sample has calculated beta and return values of 1.0 and 14%, respectively, and the risk-free rate is 6%. If during the same time period a utility's beta were .9 with upper and lower 95% confidence interval limits of 1.0 and .8, respectively, the utility's predicted allowed rate of return would be 13.2%, and its upper and lower confidence limits would be 14.0% and 12.4%, respectively. An adjustment would be indicated if the currently allowed rate were sufficiently different from the predicted appropriate return of 14%. Adjusting the allowed rate could be a function of previously established criteria as illustrated in the preceding example.

A partial implementation of an ACCAM has been ordered by the New Mexico Public Service Commission in the case of the Public Service Company of New Mexico. In this case the allowed rate of return does not adjust automatically in response to changed risk-return conditions in the capital markets. However, the earned rate of return continuously approximates the established allowed rate of return, as a cost of service factor is adjusted automatically in response to changes in such operating costs as labor, interest, supplies and equipment. After a full rate proceeding was conducted, the New Mexico P.S.C. determined that the fair rate of return on common book equity was 14.0%, and, therefore, 14.0% was ordered as the allowed rate of return. In the written order, however, the New Mexico P.S.C. declared that if the Company should earn less than 13.5% rate of return on common book equity in any given quarter, customer charges should be automatically increased to permit a 13.5% rate of return; conversely, if the rate of return should rise above 14.5% in any given quarter, charges should be decreased automatically to permit no more than a 14.5% return. In this way, the Public Service Company of New Mexico is assured of a 13.5% rate of return on common book equity with no more than a 3 month lag; while at the same time the New Mexico Public Service Commission has created a full 1.0% incentive (14.5% less 13.5%) for the Company to operate efficiently. Although this experiment involves only one company to date and is not designed to reflect changing capital market conditions, and although some regulatory commissions might want to provide companies with more than a 1.0% incentive differential, this new approach to rate of return regulation is a partial implementation of an automatic cost of capital adjustment framework.

Implications and Conclusions

Until an automatic cost of capital adjustment model becomes effective, the problem remains of efficiently financing sufficient plant capacity to provide adequate service in the future. Public utilities' common stock prices have recovered somewhat from their lows during the 1973–74 bear market partly because some stock analysts have recommended them as depressed issues and partly because some regulatory commissions have responded to their financial plight with partial rate relief. In a number of jurisdictions, inflation and regulatory lag are being mitigated through the use of the fuel adjustment clause, partial or full future test periods, rate changes subject to refund, and the increasing adoption of construction work in progress in the rate base. Nonetheless, the utilities' basic problems of inflation, regulatory lag and a seriously deteriorated risk-return status have not been solved. Utilities' common stock prices, price-earnings ratios, interest coverage ratios and market-to-book ratios are approximately one-half what they were a decade ago. Although some regulatory lag may be desirable [1, 9], the lag since 1965 has been excessive [4, 5].

Clearly, some innovative regulatory technique must be developed whereby regulated rates of return can be made more responsive to changing risk-return patterns in the capital markets. One such approach is the proposed ACCAM, whereby regulators could respond quickly to market changes, could assure timely, although controlled, responses to changing capital market conditions, and could so regulate rates of return on capital invested in utilities as to maintain their ability to attract capital on reasonable terms. Such a model would restore investor confidence in the regulatory process, improve the risk-return status of firms in the regulated sector of the economy, and thereby, lower their cost of capital. As suggested previously, however, only a portion of any indicated change in target rate of return should occur automatically in order to assure an incentive on the part of the utilities to increase operational and managerial efficiency. In this way, the cost of regulation and the cost of capital would be reduced, and the utilities would be assured access to the capital markets. At the same time, however, the utilities would have an incentive to limit costs because not all of the higher costs of service could be recovered except as a result of a full rate proceeding.

REFERENCES

1. E. Bailey and R. Coleman, "The Effect of Lagged Regulation in an Averch-Johnson Model," *The Bell Journal of Economics and Management Science* (Spring 1971), pp. 278–292.

2. Fischer Black, Michael C. Jensen, and Myron Scholes, "The Capital Asset Pricing Model: Some Empirical Results," in Michael C. Jensen, editor, *Studies in the Theory of Capital Markets*, New York, Praeger Publishers, Inc., 1972, pp. 79–121.

3. Marshall Blume and Irwin Friend, "A New Look at the Capital Asset Pricing Model," *Journal of Finance* (March 1973), pp. 19–33.

4. E. Brigham and R. Pettway, "Capital Budgeting by Utilities," *Financial Management* (Autumn 1973), pp. 11–22.

5. T. Brophy, "The Utility Problem of Regulatory Lag," *Public Utilities Fortnightly* (January 30, 1975), pp. 21–27.

6. A. Eubank and G. Pinches, "The Capital Asset Pricing Model and Appropriate Rates of Return," *Regulatory Information Systems Conference Proceedings*, St. Louis, Missouri Public Service Commission, 1974.

7. Eugene F. Fama and James D. MacBeth, "Risk, Return and Equilibrium: Some Empirical Tests," *Journal of Political Economy* (May-June 1973), pp. 607–636.

8. Federal Power Commission Office of Accounting and Finance, "A Study of Electric Utility Industry" (September 1974).

9. J. Kendrick, "Efficiency Incentives and Cost Factors in Public Utility Automatic Revenue Adjustment Clauses," *The Bell Journal of Economics* (Spring 1975), pp. 299–313.

10. H. Leland, "Regulation of Natural Monopolies and the Fair Rate of Return," *The Bell Journal of Economics and Management Science* (Spring 1974), pp. 3–15.

11. S. Myers, "The Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science* (Spring 1972), pp. 58–97.

12. R. Sarikas, "What is New in Adjustment Clauses," *Public Utilities Fortnightly* (January 19, 1975), pp. 32–36.

13. D. Schiffel, "Electric Utility Regulation: An Overview of Fuel Adjustment Clauses," *Public Utilities Fortnightly* (January 19, 1975), pp. 23–31.

14. W. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *The Journal of Finance* (September 1964), pp. 425–442.

15. W. Sharpe, *Portfolio Theory and Capital Markets*, New York, McGraw-Hill Book Company, 1974.

16. W. Sharpe, "Risk Adjusted Measures of Security and Portfolio Performance," in R. H. Howard, editor, *Risk and Regulated Firms*, East Lansing, Michigan State University Business Studies, 1973, pp. 5–17.

17. G. Stigler, "The Theory of Economic Regulation," *The Bell Journal of Economics and Management Science* (Spring 1971), pp. 3–21.

18. D. West and A. Eubank, "Automatic Cost of Capital Model," *Public Utilities Fortnightly* (May 22, 1975), pp. 27–32.