The Cost of Capital
Estimating the Rate of Return for Public Utilities

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A Charles River Associates Study

The MIT Press
Cambridge, Massachusetts
London, England

would be honored on the downside as well as the up. There is also a question of which customers benefit and which investors pay. When rates rise, some customers benefit and some investors pay. When rates fall, a quite different group of customers and investors might divide the costs and benefits in the other direction. Even though this bargain may be fair on average, it usually would not be fair to all parties at all times.

On balance we believe that setting the allowed rate of return equal to the cost of capital is the policy that best meets the criterion of "fairness."

3. Use of the Market-to-Book Ratio as a Guide for Regulators

Our second approach to developing the reasons that the cost of capital should serve as the basis of the allowed rate of return is indirect: we examine the proposition that regulators' actions should make the ratio of a regulated stock's market value to its book value (slightly more than[19]) one. This prescription is frequently heard, but not always agreed to. It turns out to be simply another way of saying that the allowed rate of return should equal the cost of capital. It is worth approaching the topic from this direction because understanding this proposition's premises yields additional insights into the nature of the cost of capital and the "fairness" of alternative policies. It also shows that failure to follow the prescription may prove very costly in the long run.

Why Choose a Market-to-Book Ratio of One?

The market-to-book ratio expresses the market value of the firm's outstanding common stock to the book value of its equity. If the two are equal, the expected return on the book will equal the expected return on the market value of the company, which in turn will equal the cost of capital for a company of that degree of risk.

The Basic Argument

To demonstrate the point, we first must define the determinants of the market value of a company. We start by defining the concept of the present value of a stream of future cash flows. A present-value calculation discounts future expected returns back to the present. The

basic formula is

$$PV = \sum_{y=1}^{Y} \left[\frac{CF_y}{(1 + r)^y} \right], \tag{2.1}$$

which translates as

$$\text{Present value of a stream of future cash flows} = \text{Sum, over all future years (running from 1 to } Y\text{) in which a cash flow is expected, of} \left(\frac{\text{Cash flow expected in year } y}{\text{Sum of one plus the discount rate raised to the } y\text{th power}} \right)$$

By definition, the appropriate discount rate in a present-value calculation is the cost of capital. As discussed earlier, the cost of capital depends on business and financial risk and may change over time, depending on such factors as the state of the economy or the rate of inflation.

The market value of a stock, which we shall call MV, equals the present value of the expected cash flows to stockholders, discounted at the current cost of capital appropriate for the stock's risk. These cash flows equal the expected dividends per share, which in turn are determined by the expected earnings of the firm. In principle the cash flows extend into the indefinite future (i.e., Y is replaced by infinity in [2.1]).[20] Changes in the market value of a firm may arise from changes in either its expected cash flows or its cost of capital.

At this point we make two simplifying assumptions: (1) The firm is in a no-growth steady state, so that forecasted earnings and dividends can be treated as perpetual annuities. This assumption is for convenience only; our conclusions would follow for any growth pattern. (2) Rate base equals net book value.

If investors forecast dividends as a perpetual annuity, then equation (2.1) simplifies to $PV = CF/r$, so that $MV = CF/r$.

The expected earnings, E, of a company subject to rate-of-return regulation equal its allowed rate of return, ROR, times its rate base (which we assume equals net book value, BV), assuming other expenses and total sales are correctly forecasted in setting the rates charged to customers. Symbolically, $E = ROR \times BV$.

If the firm does not grow, all earnings can be paid out to investors. (Reinvested depreciation is sufficient to maintain the value of the rate base.) Then the cash flow received by investors equals earnings, so $CF = ROR \times BV$. The market value of the firm's stock is:

$$MV = \frac{CF}{r} = \frac{(ROR \times BV)}{r}. \tag{2.2}$$

The market-to-book ratio therefore equals the ratio of the allowed rate of return to the cost of capital:

$$\left(\frac{MV}{BV}\right) = \left(\frac{ROR}{r}\right) \tag{2.3}$$

Equation (2.3) of course reflects strong simplifying assumptions. But the qualitative conclusions we draw from it hold in most cases. If regulators allow the firm to expect to earn its cost of capital, market value will equal book value ($ROR = r$ implies $ROR/r = MV/BV = 1$, so that $MV = BV$). Conversely, if we observe $MV = BV$, we conclude that investors expect regulators to allow the firm to earn its cost of capital, at least on average. ($MV = BV$ implies $MV/BV = ROR/r = 1$, so that $ROR = r$.)

Possible Complications

These two conclusions hold under a variety of more general assumptions. Thus the assumed constancy of the rate of return, the rate base, and the cost of capital, and the assumed infinite cash flow horizon, are not important. If more general assumptions in these areas were made, the equations would grow more complicated but the same conclusions would be reached. However, some of the assumptions made do lead to important complications.

First, it is important that the *actual* rate of return investors expect the firm to earn on its rate base must equal its cost of capital, not just that the *allowed* rate of return equal the cost of capital. For example, if investors expect a systematic difference between allowed and realized rates of return (the so-called earnings attrition problem), the allowed rate of return would have to be adjusted to offset the expected difference if regulators desire to bring market value into equality with the firm's rate base.

So far we have equated rate base with net book value. This is essentially true with Original Cost regulation, although complications are often encountered.[21] For example, if only part of a firm's business is regulated, book value exceeds rate base. The firm's stock price may differ from book value per share because book value does not mea-

sure economic value for unregulated lines of business. The book value and the market value of an unregulated firm's equity may be very different. Thus a market-to-book ratio greater than one does not necessarily indicate superior profitability.

Even if all the firm's *activities* are regulated, there may be some book assets, such as construction work in progress (CWIP), that do not appear in the rate base.[22] This does not necessarily upset our interpretation of the market-to-book ratio, however. Commissions do allow return on CWIP by giving an allowance for funds used during construction (AFUDC). AFUDC is not immediately charged to consumers but reserved for later inclusion in the rate base. The market-to-book ratio will still equal one, however, as long as both the AFUDC rate and the allowed rate of return equal the cost of capital.[23]

Thus a commission might aim at equality of market and book value because they would then know that investors expected the regulated firm's actual average rate of return to equal its cost of capital (assuming Original Cost or equivalent Fair Value regulation). The market-to-book ratio is an indication of how nearly the market expects regulators to achieve this goal.

Does Undervaluation of Unregulated Stocks Imply Regulated Stocks Should Be Undervalued Too?

A number of stocks, particularly those of companies owning large amounts of natural resources such as petroleum, have sometimes been said to be "undervalued." Several explanations for this alleged widespread undervaluation have been offered in the economics literature, but the debate continues.[24] For regulators, the issue is whether such undervaluation implies that market values should be lower than book values for regulated companies as well. Is it "fair" for regulated stocks to be protected against undervaluation when unregulated stocks are not? A closer look at this argument shows that it should not be carried over to regulated firms.

Possible Reasons for Undervaluation

The explanations for undervaluation offered to date include: (1) inflation-induced errors in investors' evaluation of unregulated earnings, because of failure to recognize the increases in asset values due to inflation; (2) an increase in the effective tax rates on *real* corporate income, because taxable book income overstates real income when

inflation "renumbers" the dollars in which earnings are measured; (3) increased riskiness in all stocks relative to other investments, perhaps also because of inflation; and (4) a basic decline in the *average* pre-tax profitability of existing capital in the United States, because of changes such as the run-up of energy prices.

Examples may clarify these explanations. First, inflation makes conventionally reported book earnings very misleading. If the resale or replacement value of an asset increases from $1 million to $1.1 million during a year, the $100,000 difference is not reported as earnings. The first explanation is that investors simply do not recognize how valuable these hidden earnings are and so underprice stocks.

Second, income taxes are applied to book earnings, which rely on historical rather than current costs for capital assets. Straight-line, ten-year book depreciation of a $1-million asset is $100,000. But if the asset would cost $1.5 million new today, "using up" one tenth of its productive life this year represents a cost of $150,000. The extra $50,000 of true cost is not deducted as an expense in computing tax liability, so the company must pay taxes on it. Real tax rates have increased. (Note that the hidden real income from asset appreciation cuts against this argument.)

The third explanation is that stocks, for whatever reason, have proved to be poor inflation hedges, and rational investors consider this in choosing among investments. Money that went into the stock market in the 1960s was invested in houses, gold, stamps, and other nonfinancial assets in the '70s. The result has been a fall in the value of stocks.

The fourth explanation is that the physical assets the stockholders own were designed to use cheaper raw materials, especially energy. When energy prices rose dramatically, net profits using these now-inefficient assets fell, so their value (measured by their stock price) fell also. An example is the 1974 resale value of a 1973 "gas guzzling" car.

Applicability to Public Utilities

The key point for regulatory policy is that none of these explanations implies that undervaluation should be carried over to regulated stocks.

Asset values of regulated companies do not appreciate with inflation, at least under Original Cost or equivalent Fair Value rate bases. All of the inflation compensation investors are to receive comes in the rate of return underlying current earnings. If inflation-induced errors

are responsible, such errors would not occur for regulated companies' stocks.

Under cost-based regulation, taxes are treated as an expense to be recovered from ratepayers. Equityholders do not benefit from a reduction in tax rates, because their revenue requirements are lowered by a like amount.[25] Therefore, it would be inconsistent to force them to bear the cost of an increase in effective tax rates, whether caused by inflation or legislation.

Finally, and in a similar vein, rate-of-return regulation is designed to deny utility equityholders the chance for extraordinary capital gains (from factors such as increased productivity or a decrease in the riskiness of all stocks) except during a limited period between regulatory proceedings. Each proceeding resets rates so that the expected rate of return equals the cost of capital. If utility stockholders are denied the chance for extraordinary gains, it would be inconsistent to require them to bear the extraordinary losses that unregulated companies might face from such changes.[26]

Even if one were certain that unregulated stocks were undervalued, there remains one more fundamental objection to allowing regulated stocks to remain undervalued just because unregulated stocks were. Even for unregulated companies, the undervaluation of the *average* assets underlying a stock does not imply an undervaluation of *incremental* assets (new investment). This safeguard does not apply for regulated firms forced to invest when market value is below book value.

Suppose average pre-tax profitability on old assets has declined for an unregulated firm. Managers require (or at least ought to require) that new investments have a positive net present value when the cash flows are discounted at the cost of capital. If this standard is met, the market value of any new assets will equal or exceed their cost. In other words, prudent managers only make a new investment when the implicit market-to-book ratio *for the new investment* is one or higher.

Under conventional regulation, however, the rate of return on both old and new assets is the same. To force the market value of a regulated firm below its book value, regulators must reduce the *average* allowed rate of return below the cost of capital. This in turn would force the firm to make any *new* investments at a substandard rate of return—a burden to which unregulated firms are never subjected. It is this burden that underlies the objection to "dilution" of a regulated

firm's stock when new equity is issued when market value is below book value.[27]

Thus although it may seem attractive to force regulated firms' market-to-book ratios to the levels of unregulated firms, this would often require allowed rates of return substantially above or below the cost of capital. If above, regulated firms would receive a windfall on each new investment; if below, they would suffer a capital loss. In either case the basic standard of cost-based regulation would be violated—and for what end? The *reasons* that unregulated firms' market and book values differ do not apply, or should not apply, to regulated firms.

The Implications of a Conscious Decision Not to Equate Market and Book Value

From the preceding discussion, it should be clear that a decision to permit market value to remain lower (or higher) than book value implies that the average expected rate of return will be lower (or higher) than the company's cost of capital.[28] The longer this condition persists, the more serious the consequences.

In recent years market value is most commonly below—often substantially below—book value. Data for three regulated industries are shown in figure 2.4 in ratio form and in figure 2.5 on a logarithmic scale.[29] Several reasons for the persistent shortfalls over the last decade are possible.

Real energy prices increased substantially during the 1970s, creating serious difficulty for people with lower incomes. During the same period inflation and the cost of capital also increased substantially. Holding back the rate of growth of regulated prices would aid those with lower incomes, and one way to do so is to be slow to recognize the full increases in the cost of capital.

Second, compared to unregulated prices, the conventional rate-base approach requires exaggerated changes in regulated prices following a change in the rate of inflation or a large addition to the rate base.[30] Customers naturally object to such dramatic differences from the pattern of other prices.[31]

The cost of capital reached very high levels in recent years; some regulators may not have believed that such high rates of return were truly necessary to bring forth the capital needed for new investments. Alternatively, regulators may have believed that the cost of capital

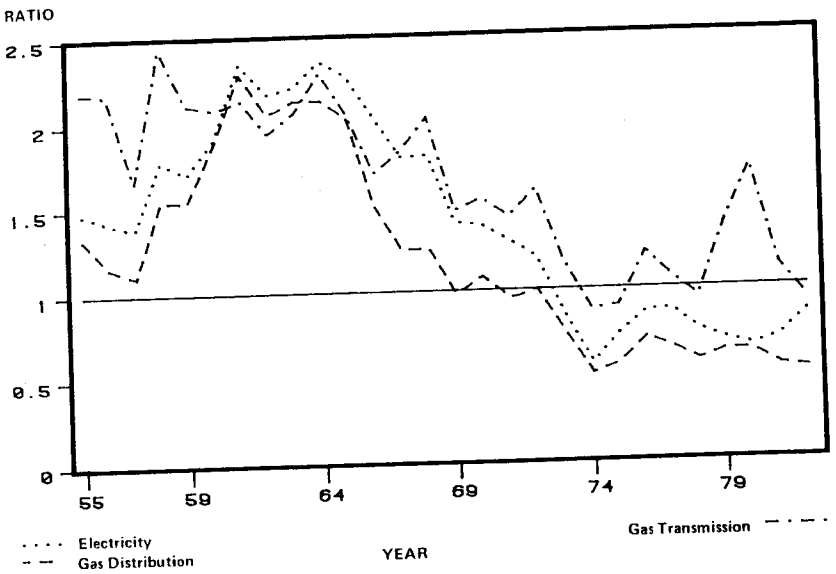

Figure 2.4
Market-to-Book Ratios for Gas and Electric Utilities
Source: Moody's Public Utility Manual.

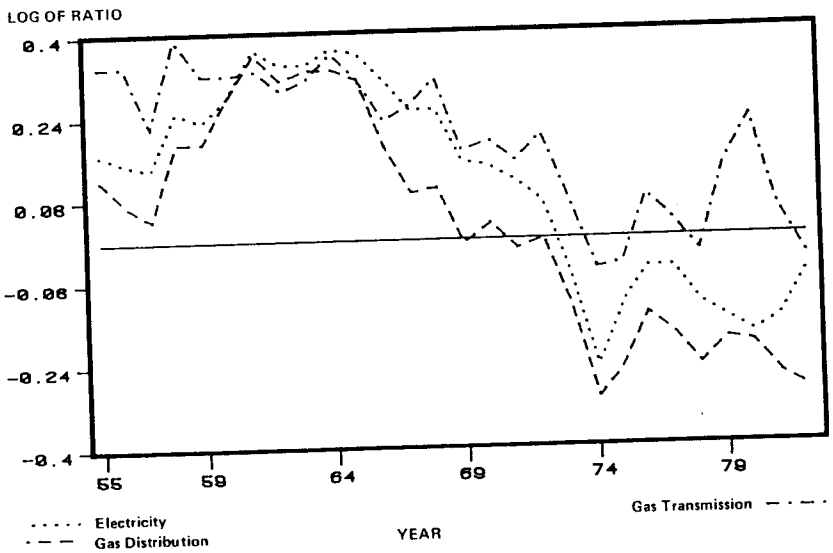

Figure 2.5
Market-to-Book Ratios for Gas and Electric Utilities: Logarithmic Scale

was truly as high as it appeared but may have been responding with a lag in order to smooth the rate of change of regulated prices. (As noted earlier, for this procedure to be "fair" to investors on average, regulators must also respond with a lag when the cost of capital declines; see Kolbe 1983.)

Finally, regulators may have consistently underestimated the cost of capital. In this view, the low market-to-book ratios are a mistake, not the consequence of a deliberate policy.

Regardless of the reasons that regulators might consciously allow market-to-book ratios to remain below one, such a decision implies either that the regulators are substituting their judgment for the market's in deciding how much return is truly required, or that regulators believe the costs of maintaining this policy to be lower than the costs of allowing rates of return high enough to equate market and book values. If the former, regulators must at least recognize that they cannot force the market to share their judgment. If the latter, regulators should recognize that the costs of failing to equate the rate of return with the cost of capital will grow larger the longer the policy persists.[32]

The costs of the policy are the mirror image of the benefits of equating the cost of capital and the rate of return discussed earlier. Given an inadequate rate of return, the value of outstanding stock will fall to where the expected rate return on the lower purchase price equals the cost of capital. Existing shareholders will pay for this fall through a capital loss. If the policy is maintained, new investors are likely to be aware of the chance for such losses to recur, and to require a higher expected rate of return as a result. Also, utility managers can make new investments only by penalizing their existing stockholders, which they will be increasingly unwilling to do as the condition persists. Managers will look for ways to reduce shareholder losses, including deferral of investments and a preference for small investments even if larger investments would be much more efficient.

Utimately, the costs of the policy will be split between the original shareholders and future ratepayers. The short-run benefits will go to current ratepayers.

In our view, the arguments in favor of equating the allowed rate of return with the cost of capital, at least on average, are overwhelming. The remaining chapters assume that this goal is accepted, and turn to the narrower question of how to estimate the cost of capital.