probability of downside returns to investors under adverse supply conditions, but essentially no probability of correspondingly large positive returns. That is, these water utilities' future profitability is constrained by both the regulatory process and by a negatively skewed water supply. Hence, measures of variability and covariability, such as standard deviation and beta, are likely to provide downward-biased estimates of the true risk relative to that of unregulated firms and other utilities.

Another example is provided by some regulatory incentive plans where the risks of potential losses are borne exclusively by shareholders due to an absence of any return floor and the presence of a limit on the allowable recovery of cost increases. The benefits of added efficiencies and productivity gains achieved by the company over and above the allowed return are absorbed totally by ratepayers. Such lack of symmetry ("heads I win, tails you lose") clearly increases risk and results in a deterioration of the regulatory climate and higher capital costs.

In both of these examples, the implication is that an additional risk premium must be added to the business-as-usual return on equity to compensate for the added risks. The lack of symmetry in investor returns must be considered. A risk premium sufficient to compensate investors for the limited upside returns/unlimited downside returns versus comparable risk companies and other utilities is required. For example, prior deregulation of the telecommunications industry, a 50 basis point increment was added to the benchmark ROE in order to compensate telecom companies for the lack of symmetry in California's New Regulatory Framework.

Size Effect

Investment risk increases as company size diminishes, all else remaining constant. Small companies have very different returns than large ones, and on average they have been higher. Figure 7-5 displays the relationship between return and risk for both large-capitalization and small-capitalization companies.

23	$179	2.2529	1.31	26.24%	16.41%	19.32%	11.76%	11.03%
24	$124	2.0934	1.31	26.75%	16.57%	19.61%	12.05%	11.53%
25	$44	1.6435	1.39	33.24%	18.63%	22.88%	15.32%	12.93%
MEAN	**$5,149**	**3.1131**	**1.12**	**21.14%**	**13.92%**	**15.91%**	**8.35%**	**8.35%**

Source: Grabowski & King (1999)

The implication of the Grabowski and King study is that investors in small-cap stocks should add 0.23% (*i.e.*, 15.17% – 14.98% = 0.19%) to the CAPM-derived cost of equity when estimating the required return of a company with a market capitalization similar to that of portfolio #10, about $2,000 million.

In a 2019 paper, published in three parts with the National Association of Certified Valuators And Analysts (NACVA), Roger Grabowski reviewed the size effect, potential reasons why one observes the size effect, and addresses criticisms of the size premium.[17] Using different measures of size, including market capitalization, Grabowski provides considerable empirical evidence of the size effect over the last forty years.

In addition to earning the highest average rates of return, small stocks also have the highest volatility, as measured by the standard deviation of returns. Duff & Phelps define small stocks as those in the lowest size decile (10%) among NYSE stocks, with size defined as the dollar value of shares outstanding. The size trigger point occurs approximately at a market value of $200 million.

The beta risk measures are typically higher, and the stock quality ratings of small firms are typically less than those of large firms. Figure 7-7 contrasts the various risk measures of small versus large capitalization stocks. All risk measures of small-cap stocks exceed those of large-cap stocks. Large-cap stocks (first decile of companies ranked in descending order of market value of equity) have an average beta of 0.98 versus 1.21 for the small-cap stocks (bottom decile). As far as investment safety is concerned, the large cap category has an average Value Line Safety Rank of 2.0 (on a scale of 1 to 5, with 1 being the highest quality), versus 3.7 for the small-cap category. As far as volatility of returns is concerned, measured by the standard deviation of returns, the large cap category has an average standard deviation of 24.0 versus 47.4 for the small-cap category. Earnings Predictability and Price Stability measures of large-cap companies exceed those of small-cap companies. Finally, as far as Financial Strength is concerned, the large cap category has an average Value Line Financial Strength rating of 2.1 (on a scale of 1 to 10, with 1 being the highest quality), versus 6.1 for the small-cap category.

17. Grabowski, R., "The Size Effect Continues to be Relevant," QuickRead National Association of Certified Valuators And Analysts, 2019.

Figure 7-7

Risk Measures Large- vs Small-Cap Companies

	Safety Rank	Beta	Std Dev	Earnings Predict.	Price Stability	Financial Strength
Avg. Large-Cap	2.0	0.98	24.0	68	79	2.7
Avg. Small-Cap	3.7	1.21	47.4	34	28	6.1

Although much research effort has gone into investigating the size effect, the economic rationale for the size effect is difficult to unravel.[18] Size is a significant factor that increases both business risk and financial risk and, therefore, the cost of capital. Smaller companies are less able to deal with significant events that affect revenues and cash flows than large companies. For example, the loss of sales from a few large customers would exert a far greater effect on a small company that on a larger company with a large customer base. Presumably, small stocks provided less utility to the investor, and require a higher return. The size effect may be a statistical mirage, whereby size is proxying for the effect of different economic variables. Small firms may have low price-earnings ratios or low market prices, for example. It is also plausible that the size effect mainly reflects a risk effect, and that a significant part of the latter is not caught by the usual beta and variance measures.

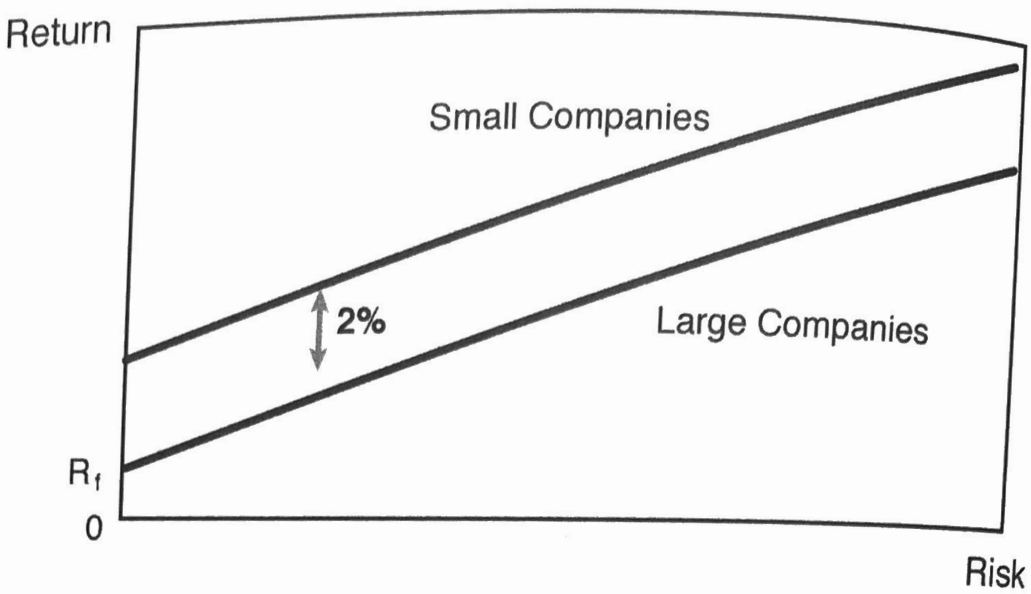
The size effect is most likely the result of a liquidity premium, whereby investors in small stocks demand greater returns as compensation for lack of marketability and liquidity. Investors prefer high to low liquidity, and demand higher returns from less liquid investments, holding other factors constant. Another plausible explanation for the size effect is the higher information search costs incurred by investors for small companies relative to large companies.

The bottom line is that the CAPM understates the risk of smaller utilities, and a cost of equity based purely on a CAPM beta will therefore produce too low an estimate for these small companies. A size premium must therefore be added to the estimated cost of equity for smaller companies. For example, let us say that small-cap stocks have earned about 1% more than large stocks over the past decade. In order to estimate the cost of equity for a small-cap stock with a beta of 0.70, a risk-free rate of 4% and a MRP of 7%, you would perform the following calculation:[19]

$$
\begin{aligned}
K &= R_F + \beta(MRP) + \text{Small size premium} \\
&= 4\% + 0.70\,(7\%) + 1\% \\
&= 9.9\%
\end{aligned}
$$

18. See Roll (1981).
19. This procedure opens the door to a whole series of similar adjustments reflecting numerous market inefficiencies (*e.g.* dividend yield, skewness, low M/B ratio, etc.). In order to resist this temptation, a superior alternative to considering the size premium explicitly is to identify the economic reasons for the premium and develop more direct measures of risk. For example, if the higher risk of small water utilities comes from the higher operating leverage associated with their operations relative to larger utilities, the betas could be adjusted for operating leverage and use these higher betas for small-cap utilities.

Figure 7-5
CAPM and Company Size



The size phenomenon is well-documented in the finance literature. Empirical studies by Banz (1981) and Reinganum (1981A) have found that investors in small-capitalization stocks require higher returns than predicted by the standard CAPM. Reinganum (1981A) examined the relationship between the size of the firm and its P/E ratio, and found that small firms experienced average returns greater than those of large firms that were of equivalent systematic risk (beta). He found that small firms produce greater returns than could be explained by their risks. These results were confirmed in a separate test by Banz (1981) who examined stock returns over the much longer 1936-1975 period, finding that stocks of small firms earned higher risk-adjusted abnormal returns than those of large firms. Fama and French (1992, 1993, 1997) find that company size and the reciprocal of the M/B ratio are significantly related to stock returns (cost of equity). The Fama-French asset pricing model is discussed later in this chapter. Market size is measured by a company's market capitalization which is the stock price times the number of shares outstanding.

The relationship between firm size and return cuts across the entire size spectrum but is most evident among smaller companies that have higher returns than larger ones on average. The gist of the empirical literature is that over the last forty years, smaller companies have experienced returns that are not fully explainable by their higher betas, and that the excess return of that predicted by the CAPM increases as size decreases, suggesting that the cost of equity for small stocks is larger than for large capitalization stocks. In short, adjustments to the CAPM are required. Duff & Phelps' online Cost of Capital Navigator platform[14] provides estimates of the size premium required to be added to the basic CAPM cost of equity.

To illustrate the size effect, Table 7-1 displays beta-adjusted size premiums over the CAPM's predictions as of December 2016 for mid-cap, low-cap, and micro-cap

14. Available at dpcostofcapital.com