The model is analogous to the standard CAPM, but with the return on a minimum risk portfolio that is unrelated to market returns, R_Z, replacing the risk-free rate, R_F. The model has been empirically tested by Black, Jensen, and Scholes (1972), who find a flatter than predicted SML, consistent with the model and other researchers' findings. An updated version of the Black-Jensen-Scholes study is available in Brealey, Myers, and Allen (2017) and reaches similar conclusions.

The zero-beta CAPM cannot be literally employed to estimate the cost of capital, since the zero-beta portfolio is a statistical construct difficult to replicate. Attempts to estimate the model are formally equivalent to estimating the constants, a and b, in Equation 7-2. A practical alternative is to employ the Empirical CAPM, to which we now turn.

7.3 Empirical (Morin) CAPM

As discussed in Section 7-1, there have been countless empirical tests of the CAPM to determine to what extent security returns and betas are related in the manner predicted by the CAPM. The results of the tests support the idea that beta is related to security returns, that the risk-return tradeoff is positive, and that the relationship is linear. The contradictory finding is that the risk-return tradeoff is not as steeply sloped as the predicted CAPM. A CAPM-based estimate of cost of capital underestimates the return required from low-beta securities and overstates the return required from high-beta securities, based on the empirical evidence. This is one of the most well-known results in finance. It was displayed graphically on Figure 7-2.

As discussed in the previous section, several finance scholars have developed refined and expanded versions of the standard CAPM by relaxing the constraints imposed on the CAPM, such as dividend yield, size, and skewness effects. These enhanced CAPMs typically produce a risk-return relationship that is flatter than the CAPM prediction in keeping with the actual observed risk-return relationship. The Empirical CAPM ("ECAPM," "Morin CAPM") makes use of these empirical findings. The ECAPM estimates the cost of capital with the equation:

$$K = R_F + \acute{\alpha} + \beta x \,(MRP - \acute{\alpha}) \tag{7-5}$$

where $\acute{\alpha}$ is the "alpha" of the risk-return line, a constant, and the other symbols are defined as before. All the potential vagaries of the CAPM are telescoped into the constant ά, which must be estimated econometrically from market data.[21] Table 7-3 drawn from Villadsen, Vilbert, et. al. (2017) summarizes the empirical evidence on the magnitude of alpha.[22]

For an alpha in the range of 1% – 2% and for reasonable values of the MRP and the risk-free rate, Equation 7-5 reduces to the following more pragmatic form:

$$K = R_F + 0.25\ (R_M - R_F) + 0.75\ b(R_M - R_F) \tag{7-6}$$

Using reasonable data inputs for the risk-free rate and the MRP, Equation 7-6 produces results that are indistinguishable from the ECAPM of Equation 7-5.[23]

An alpha range of 1% - 2% is somewhat lower than that estimated empirically. The use of a lower value for alpha leads to a lower estimate of the cost of capital for low-beta stocks such as regulated utilities. This is because the use of a long-term risk-free rate rather than a short-term risk-free rate already incorporates some of the desired effect of using the ECAPM. That is, the long-term risk-free rate version of the CAPM has a higher intercept and a flatter slope than the short-term risk-free version which has been tested. Thus, it is reasonable to apply a conservative alpha adjustment.

21. The technique is formally applied by Litzenberger, Ramaswamy, and Sosin (1980) to public utilities in order to rectify the CAPM's basic shortcomings. Not only do they summarize the criticisms of the CAPM insofar as they affect public utilities, but they also describe the econometric intricacies involved and the methods of circumventing the statistical problems. Essentially, the average monthly returns over a lengthy time period on a large cross-section of securities grouped into portfolios, are related to their corresponding betas by statistical regression techniques; that is, Equation 6-4 is estimated from market data. The utility's beta value is substituted into the equation to produce the cost of equity figure. Their results demonstrate how the standard CAPM underestimates the cost of equity of public utilities because of utilities' high dividend yield and return skewness.
22. Table 7-3 is drawn from Villadsen, B., Vilbert, M. J., Harris, D., and Kolbe, A. L., "Risk and Return for Regulated Industries," The Brattle Group, Elsevier Academic Press, 2017.
23. Typical of the empirical evidence on the validity of the CAPM is a study by Morin (1989) who found that the relationship between the expected return on a security and beta over the period 1926-1984 was given by:

$$\text{Return} = 0.0829 + 0.0520$$

Given that the risk-free rate over the estimation period was approximately 6% and that the MRP was 8% during the period of study, the intercept of the observed relationship between return and beta exceeds the risk-free rate by about 2%, or 1/4 of 8%, and that the slope of the relationship is close to 3/4 of 8%. Therefore, the empirical evidence suggests that the expected return on a security is related to its risk by the following approximation:

$$K = R_F + x\ (R_M - R_F) + (1 - x)\ b(R_M - R_F)$$

where x is a fraction to be determined empirically. The value of x that best explains the observed relationship Return = 0.0829 + 0.0520 is between 0.25 and 0.30. If x = 0.25, the equation becomes:

$$K = R_F + 0.25\ (R_M - R_F) + 0.75\ b(R_M - R_F)$$

Table 7-3
Empirical Evidence On The Alpha Factor

Author	Range of alpha
Black (1993)	-3.6% to 3.6%
Black, Jensen and Scholes (1972)	-9.61% to 12.24%
Fama and McBeth (1972)	4.08% to 9.36%
Fama and French (1992)	10.08% to 13.56%
Litzenberger and Ramaswamy (1979)	5.32% to 8.17%
Litzenberger, Ramaswamy and Sosin (1980) Sosin (1980)	1.63% to 5.04%
Pettengill, Sundaram and Mathur (1995)	4.6%
Morin (1989)	2.0%

Source: Villadsen et. al. (2017)

To illustrate the application of the ECAPM, assume a risk-free rate of 4%, a MRP of 7%, and a beta of 0.80. The Empirical CAPM equation (7-6) above yields a cost of equity estimate of 11.0% as follows:

$$K = 4\% + 0.25\,(12\% - 5\%) + 0.75 \times 0.80\,(12\% - 5\%)$$
$$= 4.0\% + 1.8\% + 4.2 = 10.0\%$$

As an alternative to specifying alpha in Equation 7-5, see Example 7-1.

EXAMPLE 7-1

The actual historical relationship between risk premiums and the risk of a large population of common stocks can be observed over a long time period and used to estimate the appropriate risk premium for a given utility. The utility's cost of equity can then be estimated as the yield on long-term Treasury bonds plus the estimated risk premium. To execute this method, monthly rates of return for all common stocks listed on the New York Stock Exchange from 1926 to the present can be obtained from the University of Chicago's Center for Research in Security Prices (CRISP) on-line data base. Five-year adjusted betas are then computed for each month for each company. For each month, the securities are assigned to one of 10 portfolios on the basis of ranked betas, from the lowest to the highest beta. Monthly returns for each of the portfolios are compounded to produce annual rates of return on each of the 10 portfolios from 1931 to the present. Historical risk premiums for each of the 10 portfolios are calculated for the period 1931 to the present by averaging the difference