Exhibit No.:	
Issues:	Return on Equity
Witness:	Pauline M. Ahern
Exhibit Type:	Surrebuttal
Sponsoring Party:	Missouri-American Water Company
Case No.:	WR-2008-0311
Date:	October 16, 2008

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2008-0311

SURREBUTTAL TESTIMONY

OF

PAULINE M. AHERN, CRRA

ON BEHALF OF

MISSOURI AMERICAN WATER COMPANY

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF MISSOURI-AMERICAN WATER COMPANY FOR AUTHORITY TO FILE TARIFFS REFLECTING INCREASED RATES FOR WATER AND SEWER SERVICE	**)))))**	**CASE NO. WR-2008-0311 CASE NO. SR-2008-0312**

AFFIDAVIT OF PAULINE M. AHERN

Pauline M. Ahern, being first duly sworn, deposes and says that she is the witness who sponsors the accompanying testimony entitled "Surrebuttal Testimony of Pauline M. Ahern"; that said testimony and schedules were prepared by her and/or under her direction and supervision; that if inquires were made as to the facts in said testimony and schedules, she would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of her knowledge.

Pauline M. Ahern [signature]

Pauline M. Ahern

State of New Jersey
County of Burlington
SUBSCRIBED and sworn to
Before me this 7th day of October 2008.

Sharon M Keefe [signature]

Notary Public

My commission expires:

SHARON M. KEEFE
NOTARY PUBLIC OF NEW JERSEY
MY COMMISSION EXPIRES JULY 9, 2011

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I. INTRODUCTION

Q. Please state your name, occupation and business address.

A. My name is Pauline M. Ahern and I am a Principal of AUS Consultants. My business address is 155 Gaither Drive, Suite A, Mt. Laurel, New Jersey 08054.

Q. Are you the same Pauline M. Ahern who previously submitted direct and rebuttal testimonies in this proceeding?

A. Yes, I am.

Q. What is the purpose of this testimony?

A. The purpose of this testimony is to respond to the true-up direct and rebuttal testimonies of Matthew J. Barnes, witness for the Missouri Public Service Commission Staff (the Staff). Specifically, I will respond to his comments on my recommended common equity cost rate.

I will also address the rebuttal testimony of Missouri Industrial Energy Consumers (MIEC) Witness Brian A. Janous regarding his comments on my recommended common equity cost rate.

Q. Have you prepared schedules which support your rebuttal testimony?

A. Yes, I have. They have been marked for identification as Schedules PMA-24 through PMA-27.

II. SUMMARY

Q. Please briefly summarize your surrebuttal testimony.

A. This testimony first demonstrates that Mr. Barnes' criticism of the need for a small size risk adjustment and my use of the arithmetic mean equity risk premium in the Risk Premium Model (RPM) and Capital Asset Pricing Model

(CAPM) are misplaced.

In addition, I address Mr. Janous' comments regarding my recommended common equity cost rate. Specifically, I will address his comments regarding recently authorized returns on equity; his criticisms of my use of the single-stage growth DCF and earnings per share (EPS) growth forecasts; his criticisms of my use of projected bond yields in my RPM and CAPM analysis; and his misunderstanding of the RPM, ECAPM and CEM.

III. COMMON EQUITY COST RATE

A. Staff Witness Matthew J. Barnes' Comments

Q. Mr. Barnes criticizes your use of arithmetic means in your RPM and CAPM analyses on page 7 of his rebuttal testimony. Please comment.

A. On page 8, lines 4-12 of his rebuttal testimony, Mr. Barnes provides an example to support his contention that using the arithmetic mean is questionable. However, Mr. Barnes' mathematical example is questionable because it does not take into account the probability of each outcome, i.e., an increase of 50% in one year and a decrease of 50% in another. As noted in my rebuttal testimony, at page 12, lines 2-5, the financial literature is quite clear that risk is measured by the variability of expected returns, i.e., the probability distribution of returns. The arithmetic mean return and not the geometric mean return provides insight into risk in the form of the variance and standard deviation of returns, without which investors cannot meaningfully evaluate prospective risk. An example, similar to Mr. Barnes' is given on page 4 of Schedule PMA-15 which demonstrates that the proper expected value is predicted by compounding the arithmetic mean and not the geometric mean. In other words, it is the arithmetic mean which must be compounded over a period of time in order to achieve the terminal wealth value which gives rise to the compound average or geometric return. As noted on page 4 of Schedule PMA-15, "[t]he arithmetic mean equates the expected future value with the present value; it is therefore the appropriate discount rate." Using the geometric mean to estimate the equity risk premium, is tantamount to reading the first and last page of a complete history of the Civil War and presuming to know what happened during the Civil War.

Q. On page 7 of his direct testimony at lines 10 through 15, Mr. Barnes maintained that the studies cited by Company witnesses relative to size "were not based on an analysis of the regulated utility industry, but on all of the stocks in the New York Stock Exchange, the American Stock Exchange and the Nasdaq National Market, which are not comparable." Please comment.

A. Mr. Barnes' statement is misplaced. While it is true that the Ibbotson size premia study is based upon a study of the entire universe of NYSE/AMEX/NASDAQ listed securities, it can be readily seen from the information on page 1 of Schedule PMA-24 that <u>all</u> the companies in the proxy groups of all witnesses in this proceeding are listed on either the NYSE, AMEX or NASDAQ. Thus, these LDCs were included in the Ibbotson study.

Moreover, SBBI is clear when it states on page 153 (see page 3 of Schedule PMA-24) the following:

> One question regularly raised concerning the size premium is whether it is relevant for specific industries. In the past there

> has been no concrete evidence to counter the contention that a size effect exists for the economy as a whole but may not be relevant to a specific industry. The problem of supporting a size premia for a specific industry has been made difficult by a lack of data for companies in individual industries.
>
> We have attempted to answer this question by performing an industry-specific size effect study. . . . The results of the sturdy can be found in Table 7-14. *Note that a large majority of industries exhibit returns where small company stocks outperform large company stocks over extended periods.* (italics added for emphasis)
>
> * * * *
>
> Table 7-14 only provides evidence that smaller companies have generally outperformed larger companies across industries.

Notwithstanding SBBI's caveat that the excess returns presented in Table 7-14 on pages 4 and 5 of Schedule PMA-24 do not represent size premia, it should be noted that for SIC Code 49, i.e., Electric, Gas & Sanitary Service, within which LDCs and water utilities fall, the difference between the arithmetic mean return from 1926-2007 of the small companies in the group, 14.11%, and the arithmetic mean return, 11.10%, for the large companies in the group over the same period 1926 through 2007 was 3.02%, or 27.21% greater. Thus, a size adjustment is indeed appropriate for utility companies, such as MAWC.

Q. On page 7, lines 18-22 of his rebuttal testimony, Mr. Barnes criticizes your use of historical data to estimate the risk premia in your RPM and CAPM. How do you respond?

A. While investors are not buying or selling shares every year, it is the inherent volatility, measured by the standard deviation of the returns over the 1926-2007 period, that provides the investors with the necessary information with which to make informed decisions concerning their required return rate on common equity, consistent with the basic principle of risk and return.

Moreover, as the CAPM is a single-period, additive model, in which the cost of capital is the sum of the model's components, the arithmetic mean of single-period equity risk premia is appropriate for cost of capital purposes (see page 2 of Schedule PMA-15).

B. MIEC Witness Brian A. Janous' Comments

Q. At page 2 of his rebuttal testimony, Mr. Janous discusses why he believes that recently authorized returns on equity for electric and gas utilities do not support your recommended common equity cost rate. Please comment.

A. Schedule PMA-18 accompanying my rebuttal testimony is a summary of regulatory awards made to electric and gas distribution companies during the period January 1, 2008 through June 30, 2008 derived from Regulatory Research Associates. As stated in my rebuttal testimony at page 16, lines 5-9, "[a]lthough Regulatory Research Associates does not report authorized ROEs [returns on common equity] for water companies, the authorized ROEs for electric and gas distribution companies are relevant to the instant proceeding as MAWC, indeed, all water utilities, compete in the same marketplace for capital as do electric and gas distribution utilities." The average authorized ROE in all litigated cases shown on Schedule PMA-18 is 10.50% relative to a 49.53% common equity ratio, only slightly higher than MAWC's proposed common equity ratio of 47.65% shown on Schedule SWR-1, page 1. MAWC's

47.65% proposed common equity ratio is also nearly identical to the average common equity ratios of 48.15% and 48.79% for electric and gas companies as shown on Schedule BAJ-1 accompanying his rebuttal testimony. Thus, Mr. Janous' statement that "there is a discernable difference in the common equity component of capital structure for Missouri-American relative to gas utilities" is incorrect.

Mr. Janous also states that the "recent awards for water, electric and gas utilities ... show that fair compensation for Missouri American in this proceeding is closer to the 10.03% return on equity" he is recommending. My Schedule PMA-18 indicates otherwise. The average spread between the ROEs awarded in litigated cases from January 2008 through June 2008 and the concurrent average yield on Moody's A rated public utility bonds was 4.40%. Adding this 4.40% spread to a recent (September 1, 2008) prospective yield on Moody's A rated public utility bonds of 6.59% yields an ROE of 10.99% which supports my recommended common equity cost rate of 11.25% and does not support Mr. Janous' recommended 10.03%.

Q. At page 9, line 10-17 of his rebuttal testimony, Mr. Janous criticizes your use of analysts' forecasts of earnings per share (EPS) growth in your application of the DCF model. Please comment.

A. My rebuttal testimony, at page 18, line 16 through page 19, line 25 sets forth some of the wealth of empirical and academic literature which support the superiority of analysts' forecasts of EPS as measures of investor expectations. My rebuttal testimony cites an article by John G. Cragg and Burton G. Malkiel (page 18 of the rebuttal testimony) who note that analysts' forecasts are more precise than other growth estimates and whose results support the notion that "analysts' forecasts are needed even when calculated growth rates are available."[1] Also cited is an article by James H. Vander Weide and Willard T. Carleton whose studies affirmed the superiority of analysts' forecasts for use in cost of capital studies. Finally, my rebuttal testimony cites Dr. Myron Gordon who stated in a speech given before the Institute of Quantitative Research in Finance held in Palm Beach, Florida in March 1990 that "estimates by security analysts available from sources such as IBES are far superior to the data available to Malkiel and Cragg. Secondly, the estimates by security analysts must be superior to the estimates derived solely from financial statements."

Therefore, there is no need to reject the empirical evidence of the proven reliability of analysts' forecasts of EPS by turning to a two-stage DCF model as also discussed in my rebuttal testimony.

Q. At page 9, line 21 through page 10, line 21 of his rebuttal testimony, Mr. Janous continues to advocate the use of one or more multi-stage DCF models. Please comment.

A. As discussed in my rebuttal testimony at page 21, lines 1 through page 25, line 13, Mr. Janous has provided no empirical evidence that the analysts' forecasted growth in EPS for either the water or gas groups will subside after the next five years or so. There is also no empirical evidence that EPS would grow at the average growth of the economy, or GDP growth. In his rebuttal

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1 Expectations and the Structure of Share Prices, John G. Cragg and Burton G. Malkiel, The University of Chicago Press, 1982, Chapter 4.

testimony, he continues to base his support for the two- and three-stage DCF upon his belief that analysts' forecasted growth rates in EPS, especially for water companies, are "abnormally high". However, based upon the wealth of empirical and academic support for the use of analysts' growth forecasts in EPS in the DCF model as outlined previously in my rebuttal testimony as well as the evidence that water utility infrastructure investment is not expected to decline in the near future and is thus not temporarily biasing current earnings growth upward. To undertake a two- or three-stage DCF analysis is inconsistent with both the empirical evidence as well as Mr. Janous' direct testimony as noted on page 18 of my rebuttal testimony.

Moreover, as also discussed in my rebuttal testimony on pages 25, the results of his two- and three-stage DCF analyses fail a common sense test as they are inconsistent with the range of ROEs shown on Schedule PMA-18 as well as those shown on Schedule BAJ-1 accompanying his rebuttal testimony.

Q. At page 6, line 22 through page 6, line 6 of his rebuttal testimony, Mr. Janous discusses the "major issues" he has with your analysis. Please comment.

A. Mr. Janous' first issue relates to the growth rates I utilized in my DCF analysis. Previously, in both the surrebuttal and my rebuttal testimony, I have addressed in detail why such growth rates are reasonable.

Q. What is Mr. Janous' second issue?

A. Mr. Janous' second issue relates to both my application of the ECAPM and historical market premium. On page 18, line 13 through page 19, line 10 of his rebuttal testimony, Mr. Janous criticizes your use of the ECAPM. Mr. Janous has confused the adjustment of beta with the ECAPM. As previously discussed in my rebuttal testimony and my direct testimony, there is considerable academic and regulatory support for the use of the ECAPM. As explained in my direct testimony at page 49, lines 13-36 and page 54, line 9 through page 56, line 6, it is essential to take into account the reality that the empirical Security Market Line (SML) described by the traditional CAPM is not as steeply sloped as the predicted SML. The ECAPM is thus a return adjustment which accounts for this reality and is not an adjustment to beta which is an x-axis adjustment accounting for regression bias. Schedule PMA-26 is an excerpt from New Regulatory Finance (2006) by Roger A. Morin which summarizes the empirical research on the CAPM and in which he states on page 7 of the Schedule[2]:

> Some have argued that the use of the ECAPM is inconsistent with the use of adjusted betas, such as those supplied by Value Line and Bloomberg. This is because the reason for using the ECAPM is to allow for the tendency of betas to regress toward the mean value of 1.00 over time, and, since Value Line betas are already adjusted for such trend [sic], an ECAPM analysis results in double-counting. This argument is erroneous. Fundamentally, the ECAPM is not an adjustment, increase or decrease, in beta. This is obvious from the fact that the expected return on high beta securities is actually lower than that produced by the CAPM estimate. The ECAPM is a formal recognition that the observed risk-return tradeoff is flatter than predicted by the CAPM based on myriad empirical evidence. The ECAPM and the use of adjusted betas comprised two separate features of asset pricing. Even if a company's beta is estimated accurately, the CAPM still understates the return for low-beta stocks. Even if the ECAPM is used, the return for low-beta securities is understated if the betas are understated. Referring back to Figure 6-1, the ECAPM is a return (vertical axis) adjustment and not a beta (horizontal axis) adjustment. Both adjustments are necessary.

[2] Id., at p. 191.

In addition, Schedule PMA-27 is an excerpt from Financial Management – Theory and Practice, in which Eugene F. Brigham discusses the confusion over the ECAPM and adjusted betas when he states[3]:

> The slope of the SML reflects the degree of risk aversion in the economy – the greater the average investor's aversion to risk, then (1) the steeper is the slope of the line, (2) the greater is the risk premium for any risky asset, and (3) the higher is the required rate of return on risky assets.[12]
>
> [12]Students sometimes confuse beta with the slope of the SML. This is a mistake. As we saw earlier in connection with Figure 6-8, and as is developed further in Appendix 6A, beta does represent the slope of a line, but *not* the Security Market Line. This confusion arises partly because the SML equation is generally written, in this book and throughout the finance literature, as $k_i = R_F + b_i(k_M - R_F)$, and in this form b_i looks like the slope coefficient and $(k_M - R_F)$ the variable. It would perhaps be less confusing if the second term were written $(k_M - R_F)b_i$, but this is not generally done.

Hence, there is no basis for Mr. Janous' criticism of my use of the ECAPM. The ECAPM is a return adjustment which accounts for the reality that the empirical SML described by the traditional CAPM is not as steeply sloped as the predicted SML and not a beta adjustment which accounts for regression bias.

Regarding his criticism that my historical market equity risk premiums severely flawed, it was clearly demonstrated in my rebuttal testimony at page 7, line 8 through page 8, line 26 and again on page 11, line 8 through page 14, line 11 as well as on Schedule PMA-16, that the arithmetic mean historical market equity risk premium is not "severely flawed" and is appropriate for cost

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[3] Eugene F. Brigham, Financial Management – Theory and Practice, 4th Ed., The Dryden Press, 1985, p. 203.

of capital purposes.

Q. What is Mr. Janous' third issue?

A. Mr. Janous' third issue relates to what he claims is my "use of [a] corporate bond yield as a risk-free rate." Nowhere in my testimony do I claim that the corporate bond yield used in the RPM is the risk-free rate. My direct testimony is clear on this issue at page 38, line 17 through page 39, line 12 where it states:

> Q. Some analysts state that the RPM is another form of the CAPM. Do you agree?
>
> A. While there are some similarities, there is a very significant distinction between the two models. The RPM and CAPM both add a "risk premium" to an interest rate. However, the beta approach to the determination of an equity risk premium in the RPM should not be confused with the CAPM. Beta is a measure of systematic, or market, risk, a relatively small percentage of total risk (the sum of both non-diversifiable systematic and diversifiable unsystematic risk). Unsystematic risk is fully captured in the RPM through the use of the prospective long-term bond yield as can be shown by reference to pages 3 through 9 of Schedule PMA-2, which confirm that the bond rating process involves an assessment of all business risks. In contrast, the use of a risk-free rate of return in the CAPM does not, and by definition cannot, reflect a company's specific i.e., unsystematic risk. Consequently, a much larger portion of the total common equity cost rate is reflected in the company-specific bond yield (a product of the bond rating) than is reflected in the risk-free rate in the CAPM, or indeed even by the dividend yield employed in the DCF model. Moreover, the financial literature recognizes the RPM and CAPM as two separate and distinct cost of common equity models as discussed previously.

Quite possibly, Mr. Janous believes my use of a corporate / public utility bond yield "as a risk-free rate" is based on my use of beta to apportion the market equity risk premium to reflect the risk of the two proxy groups of water companies. Roger A. Morin provides the rationale for such risk apportionment (see Schedule PMA-25) when he states[4]:

> The risk premium estimates derived from a composite market index must be adjusted for any risk differences between the equity market index employed in deriving the risk premium and a specified utility common stock. Several methods can be used to effect the proper risk adjustment.
>
> * * *
>
> First, the beta risk measure for the subject utility or the beta of a group of equivalent risk companies can service as an adjustment device. The market risk premium, RP_M, is multiplied by the beta of the utility, β_i, to find the utility's own risk premium, RP_i:
>
> $$RP_i = \beta_i RP_M$$
>
> And the beta-adjusted risk premium is added to the bond yield to arrive at the utility's own cost of equity capital.

Clearly, Mr. Janous is mistaken in his recommendation that my "use of [a] corporate bond yield as a risk-free rate and applying it to the group average beta . . . should be rejected."

Q. What is Mr. Janous' fourth issue?

A. Mr. Janous' fourth issue relates to my application of the CEM model. At page 20, line 8 through page 21, line 3 of his rebuttal testimony, Mr. Janous criticizes my application of the CEM. First, Mr. Janous states at lines 11-15 on page 20 of his rebuttal testimony that "[t]he accounting-based return does not measure the current cost of capital necessary to attract capital in the market place. An accounting return is not derived from the market valuation of security prices.

4 Id., at pp. 119-120.

Consequently, it does not measure investors' return requirements." The same can be said for the accounting measures of growth utilized by rate of return analysts such as Mr. Janous and myself. As stated previously, analysts forecasts of EPS growth are based upon their consensus of accounting based earnings per share. Such accounting measures are independent of investor expectations and therefore they do not measure investors' return requirements, rather they serve as a proxy for them.

Moreover, regulation is a substitute for the competition of the marketplace. Consequently, it is entirely appropriate to select companies comparable in total investment risk to price regulated utilities. As discussed in my direct testimony at pages 58 through 61, the bases of selection makes the non-price regulated companies comparable in both non-diversifiable, systematic, risk as well as diversifiable, unsystematic, risk. Hence, because they are comparable in total risk, the returns on their book values are relevant to the returns on book values of price regulated companies and hence appropriate for setting an authorized return rate on common equity. Again, Mr. Janous' criticisms are unfounded and should be disregarded.

Q. Does this conclude your surrebuttal testimony?

A. Yes, it does.

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Issues:	Return on Equity
Witness:	Pauline M. Ahern
Exhibit Type:	Surrebuttal
Sponsoring Party:	Missouri American Water Company
Case No.:	WR-2008-0311
Date:	October 16, 2008

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2008-0311

EXHIBIT

TO ACCOMPANY THE

SURREBUTTAL TESTIMONY

OF

PAULINE M. AHERN, CRRA

ON BEHALF OF

MISSOURI AMERICAN WATER COMPANY

Missouri American Water Company
American Stock Exchange Affiliation of Proxy Companies

	Stock Exchange
Based Upon MoPSC Staff Witness Barnes' Four Comparable Water Utility Companies	
American States Water Co.	NYSE
Aqua America, Inc.	NYSE
California Water Service Group	NYSE
Middlesex Water Company	NDQ
MIEC Witness Janous' Water Proxy Group	
American States Water Co.	NYSE
Aqua America, Inc.	NYSE
California Water Service Group	NYSE
Connecticut Water Services, Inc.	NDQ
Middlesex Water Company	NDQ
SJW Corp.	NYSE
Southwest Water Company	NDQ
York Water Company	NDQ
MIEC Witness Janous' Gas Distribution Proxy Group	
AGL Resources, Inc.	NYSE
Atmos Energy Corp.	NYSE
Laclede Group, Inc.	NYSE
New Jersey Resources Corp.	NYSE
NICOR Inc.	NYSE
Northwest Natural Gas Company	NYSE
Piedmont Natural Gas Co., Inc.	NYSE
South Jersey Industries, Inc.	NYSE
Southwest Gas Corporation	NYSE
WGL Holdings, Inc.	NYSE
Proxy Group of Six AUS Utility Reports Water Companies	
American States Water Co.	NYSE
Aqua America, Inc.	NYSE
Artesian Resources Corp.	NDQ
California Water Services Group	NYSE
Connecticut Water Service Inc.	NDQ
York Water Company	NDQ
Proxy Group of Four Value Line (Standard Edition) Water Companies	
American States Water Co.	NYSE
Aqua America, Inc.	NYSE
California Water Services Group	NYSE
Southwest Water Company	NDQ

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Market Results for
Stocks, Bonds, Bills, and Inflation
1926–2007

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The Size Phenomena Across Industries

One question regularly raised concerning the size premium is whether it is relevant for specific industries. In the past there has been no concrete evidence to counter the contention that a size effect exists for the economy as a whole but may not be relevant to a specific industry. The problem of supporting a size premia for a specific industry has been made difficult by a lack of data for companies in individual industries.

We have attempted to answer this question by performing an industry-specific size effect study. The study uses the Center for Research in Security Prices (CRSP) database and the following methodology:

1. Industries are defined at the two-digit SIC (Standard Industrial Classification) code level. Companies are sorted into industries using the CRSP SIC code classification system. In order to be included in the study, an industry must have a minimum of ten companies for all periods. Any industry containing less than 30 years of data was not included in the study.
2. On a calendar year-end basis, companies are ranked by market capitalization within each industry from largest to smallest. Each industry is split into a "large" and a "small" portfolio with an equal number of companies.
3. A capitalization-weighted return series is calculated for each "large" and "small" portfolio. The excess return for each industry is represented by the "small" portfolio arithmetic return less the "large" portfolio arithmetic return.

The results of the study can be found in Table 7-14. Note that a large majority of industries exhibit returns where small company stocks outperform large company stocks over extended periods.

The excess returns presented in this table should not be construed as size premia. Due to limited data, we have defined size in rather general terms. In addition, the population of companies in most industries is very small. Table 7-14 only provides evidence that smaller companies have generally outperformed larger companies across industries. The size premium study presented earlier in this chapter provides more reliable statistics as they relate to the size premium. In addition, measures of industry risk for use in the buildup model are presented in Table 3-5.

Table 7-14
Size Effect within Industries
Summary Statistics and Excess Returns

(Through Year-end 2007)

SIC Code	Description	Years	Large Company Group: Geometric Mean	Large Company Group: Arithmetic Mean	Large Company Group: Standard Deviation
10	Metal Mining	82	8.57%	12.18%	29.09%
13	Oil and Gas Extraction	45	11.90%	14.78%	25.84%
15	Building Construction-General Contractors & Op Builders	36	9.26%	16.60%	40.95%
16	Hvy Construction Other than Bldg. Construction-Contractors	37	9.17%	13.15%	32.18%
20	Food and Kindred Spirits	82	11.05%	12.65%	18.77%
22	Textile Mill Products	82	6.74%	11.50%	32.34%
23	Apparel & other Finished Products Made from Fabrics & Similar	48	7.54%	12.10%	32.52%
24	Lumber and Wood Products, Except Furniture	45	8.72%	11.34%	25.24%
25	Furniture and Fixtures	38	10.26%	12.49%	21.76%
26	Paper & Allied Products	77	11.53%	14.41%	28.75%
27	Printing, Publishing and Allied Products	47	9.62%	11.70%	20.98%
28	Chemicals and Allied Products	82	11.75%	13.83%	22.17%
29	Petroleum Refining & Related Industries	82	11.80%	13.88%	21.21%
30	Rubber & Miscellaneous Plastics Products	61	11.06%	13.69%	24.93%
31	Leather & Leather Products	45	11.86%	16.29%	33.11%
32	Stone, Clay, Glass & Concrete Products	78	9.08%	12.77%	31.09%
33	Primary Metal Industries	82	8.83%	12.79%	30.46%
34	Fabricated Metal Products, Except Machinery & Trans. Equip.	82	9.86%	12.34%	22.87%
35	Industrial & Commercial Machinery & Computer Equipment	82	10.85%	14.20%	27.38%
36	Electrical Equipment & Components, Except Computer	82	9.86%	13.49%	28.19%
37	Transportation Equipment	82	11.13%	15.28%	31.66%
38	Measuring, Analyzing & Controlling Instruments	71	12.12%	14.16%	21.64%
39	Miscellaneous Manufacturing Industries	48	8.15%	11.94%	28.35%
40	Railroad Transportation	82	9.76%	12.71%	24.55%
42	Motor Freight Transportation & Warehousing	44	9.20%	12.53%	27.81%
45	Transport by Air	62	6.76%	11.11%	32.15%
48	Communications	45	9.48%	11.76%	21.82%
49	Electric, Gas & Sanitary Services	82	9.03%	11.10%	21.25%
50	Wholesale Trade-Durable Goods	62	10.07%	12.35%	22.88%
51	Wholesale Trade-Nondurable Goods	40	9.80%	12.60%	24.31%
53	General Merchandise Stores	82	9.66%	12.81%	26.32%
54	Food Stores	51	11.12%	13.54%	22.99%
56	Apparel & Accessory Stores	61	13.56%	17.59%	31.88%
57	Home Furniture, Furnishings, and Equipment Stores	35	11.95%	22.64%	58.73%
58	Eating and Drinking Places	39	10.99%	15.29%	32.29%
59	Miscellaneous Retail	45	12.53%	16.65%	28.36%
60	Depository Institutions	39	10.89%	13.04%	21.41%
61	Nondepository Credit Institutions	58	11.94%	14.84%	26.63%
62	Security and Commod. Brokers, Dealers, Exchanges	35	17.50%	23.99%	42.13%
63	Insurance Carriers	39	10.70%	12.48%	19.78%
65	Real Estate	45	7.07%	11.46%	30.33%
67	Holding & Other Investment Offices	78	10.00%	13.11%	24.98%
70	Hotels, Rooming Houses, Camps, & Other Lodging	38	10.95%	16.53%	34.89%
72	Personal Services	38	8.26%	12.73%	30.17%
73	Business Services	45	10.31%	14.91%	31.82%
78	Motion Pictures	57	11.65%	16.18%	32.97%
79	Amusement and Recreation Services	35	12.72%	16.29%	26.95%
80	Health Services	36	12.73%	18.18%	34.89%

Table 7-14 (continued)
Size Effect within Industries
Summary Statistics and Excess Returns

(Through Year-end 2007)

		Small Company Group			
SIC Code	Description	Geometric Mean	Arithmetic Mean	Standard Deviation	Excess Return
10	Metal Mining	8.74%	16.57%	45.51%	4.38%
13	Oil and Gas Extraction	12.37%	20.28%	45.67%	5.50%
15	Building Construction-General Contractors & Op. Builders	3.58%	13.35%	44.06%	-3.25%
16	Hvy. Construction Other than Bldg. Construction-Contractors	18.60%	23.37%	36.44%	10.22%
20	Food and Kindred Spirits	12.57%	16.09%	29.80%	3.44%
22	Textile Mill Products	9.25%	14.76%	34.44%	3.26%
23	Apparel & other Finished Products Made from Fabrics & Similar	5.69%	11.38%	37.52%	-0.72%
24	Lumber and Wood Products, Except Furniture	10.80%	20.58%	52.46%	9.24%
25	Furniture and Fixtures	7.83%	11.94%	29.50%	-0.55%
26	Paper & Allied Products	15.10%	20.45%	41.47%	6.04%
27	Printing, Publishing and Allied Products	14.94%	17.85%	25.20%	6.15%
28	Chemicals and Allied Products	12.85%	18.29%	39.37%	4.45%
29	Petroleum Refining & Related Industries	13.53%	17.93%	31.63%	4.05%
30	Rubber & Miscellaneous Plastics Products	12.28%	16.74%	32.90%	3.06%
31	Leather & Leather Products	10.50%	15.46%	34.02%	-0.83%
32	Stone, Clay, Glass & Concrete Products	10.01%	14.75%	32.84%	1.98%
33	Primary Metal Industries	13.63%	19.32%	38.17%	6.52%
34	Fabricated Metal Products, Except Machinery & Trans. Equip.	11.88%	17.40%	35.99%	5.06%
35	Industrial & Commercial Machinery & Computer Equipment	12.20%	17.47%	35.22%	3.26%
36	Electrical Equipment & Components, Except Computer	11.83%	19.64%	45.39%	6.15%
37	Transportation Equipment	12.04%	18.20%	37.94%	2.92%
38	Measuring, Analyzing & Controlling Instruments	12.90%	17.73%	34.61%	3.57%
39	Miscellaneous Manufacturing Industries	7.59%	11.92%	31.37%	-0.02%
40	Railroad Transportation	8.80%	15.02%	35.94%	2.31%
42	Motor Freight Transportation & Warehousing	6.48%	12.32%	38.44%	-0.21%
45	Transport by Air	8.67%	16.87%	47.63%	5.76%
48	Communications	17.00%	24.85%	45.23%	13.10%
49	Electric, Gas & Sanitary Services	10.56%	14.11%	29.34%	3.02%
50	Wholesale Trade-Durable Goods	10.97%	16.01%	35.70%	3.66%
51	Wholesale Trade-Nondurable Goods	8.34%	11.86%	28.05%	-0.74%
53	General Merchandise Stores	8.92%	16.26%	42.81%	3.45%
54	Food Stores	10.42%	14.11%	28.99%	0.59%
56	Apparel & Accessory Stores	11.13%	17.31%	38.88%	-0.27%
57	Home Furniture, Furnishings, and Equipment Stores	14.63%	24.80%	50.41%	2.16%
58	Eating and Drinking Places	1.72%	7.50%	36.30%	-7.79%
59	Miscellaneous Retail	11.69%	16.97%	35.97%	1.32%
60	Depository Institutions	14.21%	16.90%	25.13%	3.86%
61	Nondepository Credit Institutions	12.74%	16.67%	29.94%	1.83%
62	Security and Commod Brokers, Dealers, Exchanges	14.85%	21.70%	41.62%	-2.29%
63	Insurance Carriers	12.77%	15.56%	23.78%	3.08%
65	Real Estate	6.42%	11.22%	34.37%	-0.24%
67	Holding & Other Investment Offices	11.07%	15.24%	30.91%	2.13%
70	Hotels, Rooming Houses, Camps, & Other Lodging	6.16%	12.03%	36.49%	-4.50%
72	Personal Services	17.90%	22.10%	31.96%	9.36%
73	Business Services	13.84%	23.17%	58.64%	8.26%
78	Motion Pictures	5.38%	13.10%	45.16%	-3.08%
79	Amusement and Recreation Services	10.03%	13.85%	31.27%	-2.44%
80	Health Services	14.76%	20.93%	39.89%	2.75%

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NEW REGULATORY FINANCE

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2006
PUBLIC UTILITIES REPORTS, INC.
Vienna, Virginia

EXAMPLE 4-1 *(cont.)*

(now Mergent) Public Utility Manual. To compute the annual stock return, the annual dividend yields reported on Moody's electric utility index are converted to annual dividends by multiplying the yield by the stock price for that year. The dividends are then added to the stock price appreciation for the year and the total is divided by the stock price. The bond price information is obtained by calculating the present value of a long-term Treasury bond due in 20 years with a $4.00 coupon and a yield to maturity equal to that particular year's U.S. Treasury bond yield. See example calculations below:

$$\text{2005 Stock Return} = \frac{\text{(2005 Stock Price} - \text{2004 Stock Price} + \text{2005 Dividend)}}{\text{2004 Stock Price}}$$

$$\text{2005 Bond Return} = \frac{\text{(2005 Bond Price} - \text{2004 Bond Price} + \text{2005 Interest)}}{\text{2004 Bond Price}}$$

Where Interest = $4.00

The average risk premium over the period is 5.6% above long-term Treasury bonds. If the current long-term Treasury bond is 4.5%, the implied cost of equity for the average risk electric utility is therefore 5.0% + 5.6% = 10.6%. The same analysis can be replicated using the yield on A-rated utility bonds instead of the yield on long-term Treasury bonds.

4.4 Expected Risk Premium

Another approach to estimating the risk premium is to examine the returns *expected* from investments in common equities and bonds. The risk premium is simply the difference between the expected returns on stocks and bonds. This approach is prospective in nature in contrast to the realized risk premium approach described in the previous section, which is retrospective in nature. The methodology can be expressed as follows:

$$K_e = K_d + \text{expected risk premium}$$

where: K_e = cost of common equity
K_d = cost of debt

For example, if the current cost of debt is 5% and the expected risk premium between stocks and bonds is 7%, then the cost of common equity equals 12%:

$$K_e = K_d + \text{expected risk premium}$$
$$= 5\% + 7\% = 12\%$$

To estimate the expected risk premium, the expected rate of return on equity for a broad sample of companies is computed with the DCF model for each of several time periods (months, or quarters, or years) and the yields on debt for the corresponding period are subtracted from these estimates.

Implementing the Expected Risk Premium Method

To implement the method, three issues must be resolved: 1) a representative selection of equity securities must be defined, 2) a method of computing returns selected, and 3) the risk premium adjusted for comparable risk. Each of those issues is discussed in turn.

Choice of Equity Securities. In order that the estimated risk premium be as stable as possible and be uncontaminated by the vagaries of a particular group of securities, the benchmark group of equity securities should be broadly representative and well diversified. There are several stock market indices on which comprehensive and easily accessible data are available: Value Line's Composite Market Index, Standard & Poor's 500 Index, and the Dow Jones Industrials Average are suitable proxies for the equity market portfolio. There are also several utility industry indices on which comprehensive and easily accessible data are available. Both Moody's and Standard & Poor's publish composite utility industry indices for the electric, natural gas distribution, natural gas transmission, and telecommunications industries.

Method of Computing Returns. In the case of bonds, the yield to maturity serves as a proxy for expected return, and is a suitable measure of the return expected by bondholders who anticipate holding the bond until maturity.[8] Yield to maturity data on government securities and utility bonds are widely available from published sources, including on-line Web sites, Bloomberg and bondsonline.com for example.

In the case of common stock, prospective returns derived from application of the DCF model to a stock market index or utility stock index can provide a reasonably precise estimate of expected return.

Risk Adjustments. The risk premium estimate derived from a composite market index must be adjusted for any risk differences between the equity market index employed in deriving the risk premium and a specified utility common stock. Several methods can be used to effect the proper risk adjustment.

[8] The yield to maturity of a bond is the return promised to the bondholder so long as the issuer meets all interest and principal obligations and the investor reinvests coupon income at a rate equal to the yield to maturity. See Homer and Leibowitz (1972) for a full discussion of bond return computations and of the pitfalls of yield to maturity as a valid return measure.

First, the beta risk measure for the subject utility or the beta of a group of equivalent risk companies can serve as an adjustment device. The market risk premium, RP_M, is multiplied by the beta of the utility, β_i, to find the utility's own risk premium, RP_i:

$$RP_i = \beta_i RP_M$$

and the beta-adjusted risk premium is added to the bond yield to arrive at the utility's own cost of equity capital. For example, if the risk premium on the average stock is 7% over the Treasury long-term bond yield, based on a broad-based index such as the S&P 500 or Value Line's Composite Market Index, and if the subject utility has a beta of 0.80, the adjusted risk premium is 7% × 0.80 = 5.6%. This method is essentially the Capital Asset Pricing Model approach discussed in Chapter 5.

A second risk adjustment approach is to scale the risk premium up or down based on a comparison of the utility's risk relative to that of the overall market. Any of the objective quantitative measures of risk described in Chapter 3 are adequate for this purpose. For example, the ratio of the utility's standard deviation of returns to the average standard deviation of the individual component stocks of the index can be computed and serve as a basis for relative risk adjustment. Alternately, in the case of non-publicly traded utility stocks, the utility's average deviation around trend of earnings per share or of book return on equity relative to that of the market index could serve as the basis for the risk adjustment. The scaling can also be performed judgmentally on the basis of qualitative risk measures, such as relative bond ratings, Standard & Poor's stock ratings, and Value Line's safety ratings.

Utility Industry Risk Premiums

Another way of tailoring the risk premium approach to a specific group of companies, such as regulated utilities, is to estimate a specialized risk premium for securities in a given industry, and then to base the risk premium for a specific company on the industry-wide risk premium. Both VanderWeide (2005) and McShane (2005) provide excellent examples of this approach. In Example 4-2 drawn from McShane (2005), a forward-looking risk premium is derived by using the DCF model to estimate expected utility returns over time.[9] The expected return on equity is estimated as the dividend yield on the stock plus the expected growth in dividends over the long term. Each "point in time" DCF estimate of equity return is then matched with a corresponding "point in time" bond yield. The difference between the two is an indicator of the required utility equity risk premium at that point in time. Example 4-2 illustrates the approach.

[9] The DCF model is discussed in detail in Chapters 8 and 9.

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Chapter 6
Alternative Asset Pricing Models

6.1 Empirical Validity of the CAPM

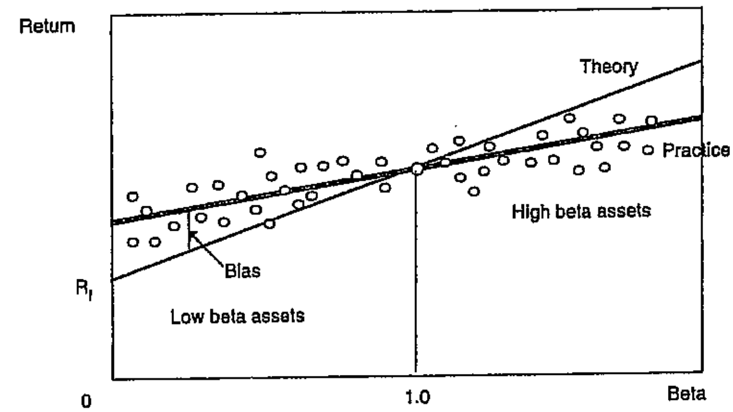
The last chapter showed that the practical difficulties of implementing the CAPM approach are surmountable. Conceptual and empirical problems remain, however.

At the conceptual level, the CAPM has been submitted to criticisms by academicians and practitioners. Contrary to the core assumption of the CAPM, investors may choose not to diversify, and bear company-specific risk if abnormal returns are expected. A substantial percentage of individual investors are indeed inadequately diversified. Short selling is somewhat restricted, in violation of CAPM assumptions. Factors other than market risk (beta) may also influence investor behavior, such as taxation, firm size, and restrictions on borrowing.

At the empirical level, there have been countless 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 predicted by the CAPM. With few exceptions, the empirical studies agree that the implied intercept term exceeds the risk-free rate and the slope term is less than predicted by the CAPM. That is, low-beta securities earn returns somewhat higher than the CAPM would predict, and high-beta securities earn less than predicted. This is shown pictorially in Figure 6-1. 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. Brealey, Myers, and Allen (2006), among many others,[1] provide recent empirical evidence very similar to the relationship depicted in Figure 6-1. This is one of the most

[1] For a summary of the empirical evidence on the CAPM, see Jensen (1972) and Ross (1978). The major empirical tests of the CAPM were published by Friend and Blume (1975), Black, Jensen, and Scholes (1972), Miller and Scholes (1972), Blume and Friend (1973), Blume and Husic (1973), Fama and Macbeth (1972), Basu (1977), Reinganum (1981B), Litzenberger and Ramaswamy (1979), Banz (1981), Gibbons (1982), Stambaugh (1982), Shanken (1985), Black (1993), and Brealey, Myers, and Allen (2006). Evidence in the Canadian context is available in Morin (1980, 1981).

FIGURE 6-1
PREDICTED VS. OBSERVED CAPM RETURN ESTIMATES



well-known results in finance. This result is particularly pertinent for public utilities whose betas are typically less than 1.00. Based on the evidence, as shown in Figure 6-1, a CAPM-based estimate of the cost of capital underestimates the return required from such securities.

The empirical evidence also demonstrates that the SML is highly unstable over short periods and differs significantly from the long-run relationship. This evidence underscores the potential for error in cost of capital estimates that apply the CAPM using historical data over short time periods. The evidence[2] also shows that the addition of specific company risk, as measured by standard deviation, adds explanatory power to the risk-return relationship.

In short, the currently available empirical evidence indicates that the simple version of the CAPM does not provide a perfectly accurate description of the process determining security returns. Explanations for this shortcoming include some or all of the following:

1. The CAPM excludes other important variables that are important in determining security returns, such as size, skewness, and taxes.
2. The market index used in the tests excludes important classes of securities, such as bonds, mortgages, and business investments. There is a further argument that the CAPM can never be really tested and that such a test is infeasible. This is because the market index proxy used

[2] See Friend, Westerfield, and Granito (1978) and Morin (1980).

in empirical tests of the CAPM is inadequate; since a true comprehensive market index is unavailable, such tests will be biased in the direction shown by the actual empirical results.[3] Moreover, the CAPM is a forward-looking expectational model and in order to test the model it is necessary to predict investor expectations correctly. Any empirical test of the CAPM is thus a test of the joint hypothesis of the model's validity and of the function used to generate expected returns from historical returns.

3. Constraints on investor borrowing exist contrary to the assumption of the CAPM.
4. Investors may value the hedging value of assets in protecting them against shifts in later investment opportunities. See Merton (1973) and Morin (1981).

Revised CAPM models have been proposed relaxing the above constraints, each model varying in complexity, each model attempting to inject more realism into the assumptions. Ross (1978), Tallman (1989), and more recently Guo (2004) present excellent surveys of the various asset pricing theories and related empirical evidence. These enhanced CAPMs produce broadly similar expressions for the relationship between risk and return and engender an SML that is flatter than the CAPM prediction, in line with the empirical evidence. Section 6.2 focuses on the more tractable extensions of the CAPM that possess some applicability to public utility regulation. Section 6.3 discusses the Empirical CAPM. Section 6.4 describes the Arbitrage Pricing Model, a viable alternative to the CAPM. Section 6.5 discusses the Fama-French Three-Factor Model of asset pricing. The Market-Derived Pricing Model is described in Section 6.6.

6.2 CAPM Extensions

Several attempts to enrich the CAPM's conceptual validity and to ameliorate its applicability have been advanced. One popular explanation of the CAPM's inability to explain security returns satisfactorily is that beta is insufficient and other systematic risk factors affect security returns. The implication is that the effects of these other independent variables should be quantified and used in estimating the cost of equity capital. The impact of the supplementary variables[4] can be expressed as an additive element to the standard CAPM equation as follows:

---

[3] See Roll (1977).

[4] The Arbitrage Pricing Model and the Fama-French three-factor asset pricing model, discussed in a later section, include factors other than the market that explain observed security returns.

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 (2006) 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 6-2. A practical alternative is to employ the Empirical CAPM, to which we now turn.

6.3 Empirical CAPM

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 ECAPM makes use of these empirical findings. The ECAPM estimates the cost of capital with the equation:

$$K = R_F + \acute{\alpha} + \beta \times (MRP - \acute{\alpha}) \qquad (6\text{-}5)$$

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 $\acute{\alpha}$, which must be estimated econometrically from market data. Table 6-2 summarizes[10] the empirical evidence on the magnitude of alpha.[11]

[10] 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 6-5 is estimated from market data. The utility's beta value is substituted into the equation to produce the cost of equity figure. Their own results demonstrate how the standard CAPM underestimates the cost of equity capital of public utilities because of utilities' high dividend yield and return skewness.

[11] Adapted from Vilbert (2004).

TABLE 6-2
EMPIRICAL EVIDENCE ON THE ALPHA FACTOR

Author	Range of alpha
Fischer (1993)	−3.6% to 3.6%
Fischer, 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)	1.63% to 5.04%
Pettengill, Sundaram and Mathur (1995)	4.6%
Morin (1989)	2.0%

For an alpha in the range of 1%–2% and for reasonable values of the market risk premium and the risk-free rate, Equation 6-5 reduces to the following more pragmatic form:

$$K = R_F + 0.25\,(R_M - R_F) + 0.75\,\beta(R_M - R_F) \qquad (6\text{-}6)$$

Over reasonable values of the risk-free rate and the market risk premium, Equation 6-6 produces results that are indistinguishable from the ECAPM of Equation 6-5.[12]

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

[12] 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:

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

Given that the risk-free rate over the estimation period was approximately 6% and that the market risk premium 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:

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

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

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

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. Moreover, the lowering of the tax burden on capital gains and dividend income enacted in 2002 may have decreased the required return for taxable investors, steepening the slope of the ECAPM risk-return trade-off and bring it closer to the CAPM predicted returns.[13]

To illustrate the application of the ECAPM, assume a risk-free rate of 5%, a market risk premium of 7%, and a beta of 0.80. The Empirical CAPM equation (6-6) above yields a cost of equity estimate of 11.0% as follows:

$$K = 5\% + 0.25\,(12\% - 5\%) + 0.75 \times 0.80\,(12\% - 5\%)$$
$$= 5.0\% + 1.8\% + 4.2\%$$
$$= 11.0\%$$

As an alternative to specifying alpha, see Example 6-1.

Some have argued that the use of the ECAPM is inconsistent with the use of adjusted betas, such as those supplied by Value Line and Bloomberg. This is because the reason for using the ECAPM is to allow for the tendency of betas to regress toward the mean value of 1.00 over time, and, since Value Line betas are already adjusted for such trend, an ECAPM analysis results in double-counting. This argument is erroneous. Fundamentally, the ECAPM is not an adjustment, increase or decrease, in beta. This is obvious from the fact that the expected return on high beta securities is actually lower than that produced by the CAPM estimate. The ECAPM is a formal recognition that the observed risk-return tradeoff is flatter than predicted by the CAPM based on myriad empirical evidence. The ECAPM and the use of adjusted betas comprised two separate features of asset pricing. Even if a company's beta is estimated accurately, the CAPM still understates the return for low-beta stocks. Even if the ECAPM is used, the return for low-beta securities is understated if the betas are understated. Referring back to Figure 6-1, the ECAPM is a return (vertical axis) adjustment and not a beta (horizontal axis) adjustment. Both adjustments are necessary. Moreover, recall from Chapter 3 that the use of adjusted betas compensates for interest rate sensitivity of utility stocks not captured by unadjusted betas.

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[13] The lowering of the tax burden on capital gains and dividend income has no impact as far as non-taxable institutional investors (pension funds, 401K, and mutual funds) are concerned, and such investors engage in very large amounts of trading on security markets. It is quite plausible that taxable retail investors are relatively inactive traders and that large non-taxable investors have a substantial influence on capital markets.

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Portfolio Beta Coefficients

A portfolio consisting of low-beta securities will itself have a low beta, since the beta of any set of securities is a weighted average of the individual securities' betas:

$$b_p = \sum_{i=1}^{n} w_i b_i. \qquad (6\text{-}5)$$

Here b_p is the beta of the portfolio, which reflects how volatile the portfolio is in relation to the market index; w_i is the fraction of the portfolio invested in the *i*th stock; and b_i is the beta coefficient of the *i*th stock.

If an investor holds a $100,000 portfolio consisting of $10,000 invested in each of 10 stocks, and if each stock has a beta of 0.8, then the portfolio will have $b_p = 0.8$. Thus, the portfolio is less risky than the market, and it should experience relatively narrow price swings and have small rate of return fluctuations.

Now suppose one of the existing stocks is sold and replaced by a stock with $b_i = 2.0$. This action will increase the riskiness of the portfolio from $b_{p1} = 0.8$ to $b_{p2} = 0.92$:

$$b_{p2} = \sum_{i=1}^{n} w_i b_i = 0.9(0.8) + 0.1(2.0) = 0.92.$$

Had a stock with $b_i = 0.2$ been added, the portfolio beta would have declined from 0.8 to 0.74. Adding this stock would, therefore, reduce the riskiness of the portfolio.

The Relationship between Risk and Rates of Return

In the preceding section, we saw that under the CAPM framework, beta is the appropriate measure of a stock's relevant risk. Now we must specify the relationship between risk and return—if beta rises by some specific amount, by how much must the stock's expected return increase to compensate for the increase in risk? To begin, let us define the following terms:

$\hat{k}_i$ = expected rate of return on the *i*th stock.

k_i = required rate of return on the *i*th stock. If $\hat{k}_i$ is less than k_i, then you would not purchase this stock, or you would sell it if you owned it.

R_F = riskless rate of return, generally measured by the rate of return on U.S. Treasury securities.

b_i = beta coefficient of the *i*th stock.

k_M = required rate of return on an average ($b = 1.0$) stock. k_M is also the required rate of return on a portfolio consisting of all stocks, or the market portfolio.

$RP_M = (k_M - R_F)$ = market risk premium. It is the additional return over the riskless rate required to compensate investors for assuming an "average" amount of risk.

$RP_i = b_i(k_M - R_F)$ = risk premium on the ith stock. The stock's risk premium is less than, equal to, or greater than the premium on an average stock, depending on whether its beta is less than, equal to, or greater than 1.0. If $b_i = 1.0$, then $RP_i = RP_M$.

The market risk premium, RP_M, depends on the degree of aversion that investors, in the aggregate, have to risk.[11] Let us assume that at the current time Treasury bonds yield $R_F = 8\%$, and an average share of stock has a required return of $k_M = 12\%$. Therefore, the market risk premium is 4 percent:

$$RP_M = k_M - R_F = 12\% - 8\% = 4\%.$$

It follows that, if one stock were twice as risky as some other, its risk premium would be twice as high, and, conversely, if its risk were only half as high, its risk premium would be half as high. Further, we can measure a stock's relative riskiness by its beta coefficient. Therefore, if we know the market risk premium, RP_M, and the stock's beta coefficient, b_i, we can find its risk premium as the product $b_i(RP_M)$. For example, if $b_i = 0.5$ and $RP_M = 4\%$, then RP_i is 2 percent:

$$\text{Risk premium for Stock i} = RP_i = b_i(RP_M) = 0.5(4\%) = 2.0\%. \quad (6\text{-}6)$$

To summarize, given estimates of R_F, k_M, and b_i, we can find the required rate of return on Stock i:

$$\begin{aligned} k_i &= R_F + b_i(k_M - R_F) = R_F + b_i(RP_M) \\ &= 8\% + 0.5(12\% - 8\%) = 8\% + 0.5(4\%) = 10\%. \end{aligned} \quad (6\text{-}7)$$

If some other stock, j, were more risky than Stock i and had $b_j = 2.0$, then its required rate of return would be 16 percent:

$$k_j = 8\% + 2.0(4\%) = 16\%.$$

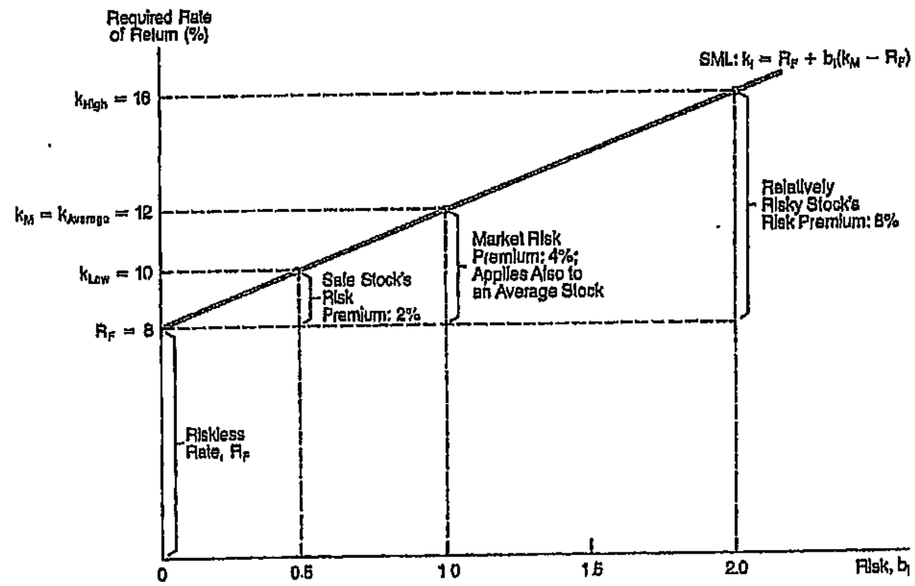
An average stock, with $b = 1.0$, would have a required return of 12 percent, the same as the market return:

$$k_{Average} = 8\% + 1.0(4\%) = 12\% = k_M.$$

Equation 6-7 is often expressed as a graph called the *Security Market Line (SML)*; Figure 6-9 shows the SML when $R_F = 8\%$ and $k_M = 12\%$. Note the following points:

[11]This concept is discussed in some detail in Appendix 6B. It should be noted that the risk premium of an average stock, $k_M - R_F$, cannot be measured with great precision because it is impossible to obtain precise values for k_M. However, empirical studies suggest that, where long-term U.S. Treasury bonds are used to measure R_F and where k_M is the expected return on the S&P 400 Industrial Stocks, the market risk premium varies somewhat from year to year, and it has generally ranged from 3 to 6 percent during the last 20 years.

Figure 6-9
The Security Market Line (SML)



1. Required rates of return are shown on the vertical axis, while risk as measured by beta is shown on the horizontal axis.

2. Riskless securities have $b_i = 0$; therefore, R_F appears as the vertical axis intercept.

3. The slope of the SML reflects the degree of risk aversion in the economy—the greater the average investor's aversion to risk, then (1) the steeper is the slope of the line, (2) the greater is the risk premium for any risky asset, and (3) the higher is the required rate of return on risky assets.[12] These points are discussed further in a later section.

[12]Students sometimes confuse beta with the slope of the SML. This is a mistake. As we saw earlier in connection with Figure 6-8, and as is developed further in Appendix 6A, beta does represent the slope of a line, but *not* the Security Market Line. This confusion arises partly because the SML equation is generally written, in this book and throughout the finance literature, as $k_i = R_F + b_i(k_M - R_F)$, and in this form b_i looks like the slope coefficient and $(k_M - R_F)$ the variable. It would perhaps be less confusing if the second term were written $(k_M - R_F)b_i$, but this is not generally done.

4. The values we worked out for stocks with $b_i = 0.5$, $b_i = 1.0$, and $b_i = 2.0$ agree with the values shown on the graph for k_{Low}, $k_{Average}$, and k_{High}.

The Security Market Line, and a company's position on the line, change over time as interest rates, investors' risk aversion, and individual companies' betas change. Such changes are discussed in the following sections.

The Impact of Inflation

As we saw in Chapter 3, interest amounts to "rent" on borrowed money, or the "price" of money. Thus, R_F is the price of money to a riskless borrower. The existing market risk-free rate is called the *nominal rate*, and it consists of two elements: (1) a *real*, or *inflation-free, rate of return*, k^*, and (2) an *inflation premium*, IP, equal to the anticipated rate of inflation. Thus, $R_F = k^* + IP$. The real rate on risk-free government securities has, historically, ranged from 2 to 4 percent, with a mean of about 3 percent. Thus, if no inflation were expected, risk-free government securities would tend to yield about 3 percent. However, as the expected rate of inflation increases, a premium must be added to the real rate of return to compensate investors for the loss of purchasing

Figure 6-10
Shift in the SML Caused by an Increase in Inflation