Applying the Fama-French Model to Regulated Energy Utilities: Some Challenges and Issues

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I. Introduction

The primary purpose of this paper is to present some issues concerning the Fama-French Three-Factor Model (FFM) for estimating the cost of common equity for a regulated energy utility (1). This paper is organized into the following sections. First, a brief overview of state regulatory proceedings, second a brief explanation of the CAPM, third the FFM is presented. Fourth, some important issues concerning the application of the FFM for estimating the cost of common equity for a regulated energy utility are proposed. Fifth, empirical evidence from state regulatory proceedings are discussed, and lastly, the conclusions are presented.

II. Overview

State regulatory proceedings are held periodically in order to determine the rates that regulated utility companies charge their customers. When determining the rates that utility companies will charge, one of the issues to be considered is the return on equity (ROE) that the regulated utility investors require. This is also referred to as the cost of equity. There are several models that are widely used and accepted within state regulatory proceedings. The darling model of the state regulatory agencies is the Discounted Cash Flow Model (DCF). The DCF cost of equity estimates receive anywhere between 70 to 100 percent of the total weight when deciding on a final cost of equity for the regulated utility company (2). Generally, a risk premium model is used in conjunction with the DCF model as a check, to make sure that the DCF model is returning a reasonable estimate. The most common risk premium models in state regulatory proceedings are the basic Capital Asset Pricing Model and the Debt-Equity Risk Premium Model. Recently, the Fama French 3 Factor Model (FFM) has appeared in a few state regulatory proceedings.

III. Capital Asset Pricing Model

The basic Capital Asset Pricing Model (CAPM) was introduced in the 1960s. It is a popular textbook model that takes into account both the time value of money and an equity risk premium. It has a strong theoretical appeal because it considers both diversifiable and non-diversifiable risk.

The basic CAPM model is written in the following manner:

$$K = R_f + \beta_i \, MRP$$

Where R_f = risk-free rate
B_i = beta risk factor for company ‘i’
MRP = market risk premium

In academic literature the CAPM has been criticized, many people feel that it does not have a reasonable risk premium adjustment. This is especially true when applied to regulated utility

companies whose beta values are historically lower (generally between .6 and .7) than the market beta. Some feel that this does not accurately describe the total risk associated with regulated utility companies (3).

IV. Fama-French Three-Factor Model

The Fama-French Three-Factor Model reflects a recent development in the finance literature and is essentially an extended CAPM (4). The Fama-French research indicates that two factors, other than beta, are important in explaining and predicting security returns. These two factors include size (measured by market capitalization) and financial distress (measured by the book-to-market ratio).

The Fama-French formula for estimating the cost of capital incorporates two additional factors to the CAPM to reflect a portfolio's (or security's) sensitivity to these two additional risk factors. This model is written in the following manner:

$$K = R_f + \beta_i \, MRP + s_i \, SMB + hi \, HML$$

Where
- R_f = risk-free rate
- B_i = beta risk factor for company 'i'
- s_i = size coefficient for company 'i.' Small-minus-big (SMB) regression coefficient
- h_i = financial distress coefficient for company 'i.' High-minus-low (HML) regression coefficient
- MRP = market risk premium
- SMB = size factor risk. Expected return of a portfolio of small stocks minus the expected return on a portfolio of large stocks
- HML = distress factor risk, where distress is measured by book equity divided by market value of equity. Expected return of a portfolio of high book-to-market stocks minus the expected return on a portfolio of low book-to-market stocks

V. Some Issues With the FFM

The FFM appears to answer the problem of a reasonable risk adjustment by adding the two additional risk factors. However, there are criticisms that arise with the FFM itself.

Unlike the CAPM, which was developed from financial theory, the FFM was created using empirical data. Statistical analysis was used to determine which additional risk factors provided the most accurate risk premium adjustment. Some argue that there is nothing to

support the two additional factors used in the FFM as the most appropriate risk factors and contend that adding any additional factor to the regression increases the R squared value (5).

Also, compared to the CAPM model, the FFM is more complex because of the additional factors that must be used. These two additional risk factors historically have been volatile which creates another issue with determining consistent cost of equity estimates. For example, from 2003 to 2008, the SML factor ranged from -25.56 to 50.58 (6).

VI. Empirical Data California and Nevada

The first data obtained comes from the 2005 state regulatory proceeding for Southern California Edison (SCE). Paul Hunt, testifying before the California Public Utilities Commission (CPUC), used the FFM and calculated a cost of equity of 13.9 percent; using the CAPM, Hunt calculated a cost of equity of 12.21 percent. In this proceeding, the FFM returned a result 169 basis points above the CAPM (7).

In 2006 Ron Knecht from the Nevada Public Utilities Commission (NPUC) used the FFM for his cost of equity measurements and calculated a cost of 11.39 percent, Knecht's CAPM estimate was 11.38 percent. In this year, the FFM calculated a cost of equity 1 basis point above the CAPM estimate (8).

In 2007 Paul Hunt from the SCE used the FFM in a testimony before the CPUC and calculated a cost of equity for SCE of 15.04 percent. Hunt's CAPM estimate was 11.59 percent. In this proceeding, the FFM returned a result 345 basis points above the CAPM (9).

In 2007 Gary Hayes from San Diego Gas & Electric used the FFM model in his testimony before the CPUC. Hayes calculated a cost of equity of 13.89 percent using the FFM; using the CAPM Hayes calculated a cost of equity of 11.73 percent. In this proceeding, the FFM result was 216 basis points above the CAPM result (10).

In 2007 Ron Knecht used the FFM for his cost of equity measurements for the NPUC and calculated a cost of 10.65 percent, using the CAPM Knecht's cost of equity estimate was 9.62 percent. In this year, the FFM estimate was 103 basis points above the CAPM estimate (11).

In 2008 Ron Knecht used the FFM, again for the NPUC, and it returned a result of 5.87 percent. The CAPM returned a result of 6.99 percent. In this year, the FFM result was 112 basis points below the CAPM result (12).

The results are summarized in table 1.1.

VII. Conclusions

Considering that the FFM is a relatively new introduction into state regulatory proceedings, there is little data available regarding its use. As the FFM is used in upcoming regulatory state proceedings it would be valuable to examine the data and compare it to the data in this paper. Given the data that was obtained, there are some interesting findings. From 2005 to 2007, the FFM returned a cost of equity estimate that was consistently higher than the estimate from the CAPM. This is in line with intuition. It makes sense that adding additional risk premium adjustments to the CAPM should return a higher cost of equity estimate than the CAPM estimate. However, in 2008, when general economic conditions in the US market declined, the FFM returned a cost of equity estimate below the CAPM estimate. From the data collected for this paper, it appears that the FFM is more responsive to market conditions, and therefore more volatile.

Another interesting finding comes from the California state regulatory proceedings in 2005 for SCE and 2007 for both SCE and SDG&E. In each year the CPUC decided to give no weight to the FFM when determining the final cost of equity for each of the regulated utility companies. The CPUC explained in the 2007 state regulatory proceeding:

> "Irrespective of its use in other jurisdictions, Fama French results continue to appear unrealistically high in comparison to the results of SCE and SDG&E's other financial models… There is insufficient evidence to substantiate that the additional subjective risk factors, size and exposure, are relevant to companies in a regulated industry in a state in which over 50% of the energy utilities revenue requirements are protected by balancing account recovery. There is also insufficient evidence to validate that the Fama French results are reasonable compared to the CAPM, DCF and HRP model results… We conclude there is insufficient evidence to assess the applicability of the Fama French model to California regulated utilities and decline to incorporate the Fama French results into our ROE analyses." (13)

Though the FFM has been given some weight in the final decision in at least two states, Massachusetts and Nevada, as shown through the CPUC's decision, there is still concern regarding its use in some state regulatory proceedings. More data should be collected as it becomes available to determine whether or not it is a reasonable model for state regulatory proceedings.

I. Summary

A regulatory commission should carefully consider the results of various mathematical models, including some type of discounted cash flow model and some type of risk premium model, in

order to establish a zone of reasonableness for the cost of common equity for a regulated energy utility. Moreover, a regulatory commission should apply its sound judgment when considering the results from these models in order to formulate a ROE (allowed return on common equity). The FFM is more complex and appears to be more volatile than the CAPM. The jury is still out as to whether or not the FFM should be used as a viable risk premium model within a state regulatory setting. Therefore, this issue deserves further analysis.

Footnotes

(1) E.F. Fama and K.R. French, "The Cross-Section of Expected Stock Returns, Jornal of Finance, June 1992, pp. 427-465.

(2) Charles E. Peterson and J. Robert Malko, "Applying the CAPM: Issues and Activities in Utah," The National Regulatory Research Institute – Volume 3, December 2005, pp. 57-65.

(3) Stephane Cretien and Frank Coggins, "Cost of Equity for Energy Utilities: Beyond the CAPM," February 2008 Draft

(4) Roger A. Morin, New Regulatory Finance, "Public Utilities Reports, Inc.", Vienna, Virginia, 2006, pp 202-206.

(5) Richard A. Michelfelder, "Fama-French 3-Factor Model: Theoretical and Conceptual Underpinnings," presented at SURFA-41st Financial Forum, Washington DC, April 16-17, 2009.

(6) Richard A. Michelfelder, "Fama-French 3-Factor Model: Theoretical and Conceptual Underpinnings," presented at SURFA-41st Financial Forum, Washington DC, April 16-17, 2009.

(7) Paul Hunt, testimony on behalf of Southern California Edison before the California Public Utilities Commission, 2007.

(8) Ron Knecht, "Cost of Capital Determination in the Current Financial Turmoil and Recessions," presented at SURFA-41st Financial Forum, Washington DC, April 16-17, 2009.

(9) Paul Hunt, testimony on behalf of Southern California Edison before the California Public Utilities Commission, 2007.

(10) Gary H Hayes, testimony on behalf of San Diego Gas and Electric before the California Public Utilities Commission, 2007. <http://www.sdge.com/regulatory/documents/a-07-05-007/SDGE-2GHayesErrataTestimony.pdf>

(11) Ron Knecht, “Cost of Capital Determination in the Current Financial Turmoil and Recessions,” presented at SURFA-41st Financial Forum, Washington DC, April 16-17, 2009.

(12) Ron Knecht, “Cost of Capital Determination in the Current Financial Turmoil and Recessions,” presented at SURFA-41st Financial Forum, Washington DC, April 16-17, 2009.

(13) California Public Utilities Commission. 2007, Final Decision Regulatory Rate Case.

Table 1.1

Year	2005	2006	2007	2007	2007	2008
Company	SCE	NPUC	SCE	SDG&E	NPUC	NPUC
FFM	13.90%	11.39%	15.04%	13.89%	10.65%	5.87%
CAPM	12.21%	11.38%	11.59%	11.73%	9.62%	6.99%
Difference	**169 bps**	**1 bps**	**345 bps**	**216 bps**	**103 bps**	**-112 bps**