Oxera

Agenda

Advancing economics in business

Fama–French: a challenge to the CAPM?

The CAPM has become the 'industry standard' for regulatory decisions on the cost of capital for utilities. Should regulators go beyond a single standard and opt for a multi-faceted approach, with several models in competition? This article looks at an alternative asset pricing technique, the Fama–French model, and its implications for regulatory decisions

The capital asset pricing model (CAPM) dominates cost of capital decisions in price controls. Several UK regulators have stated their commitment to the CAPM as the main tool to estimate the cost of equity, while other asset pricing models generally play only a marginal role.

Is the CAPM enough? Or should it be complemented by other techniques? This article addresses this question by comparing the CAPM with an alternative approach, the 1993 Fama–French model.[1]

Cracks in the CAPM

The estimation of the cost of capital in regulatory decision-making is becoming increasingly complex. Decisions are based on a broad range of evidence, and the estimation of the CAPM has risen to a high level of sophistication, with several ways to calculate the risk-free rate, beta and the equity risk premium. At the same time, a significant degree of judgement influences final decisions, with regulators taking account of factors such as market sentiment, investment requirements, and consistency over time, as well as detailed market data.

Problems with the CAPM

- ***Predictive power*—academic research has identified persistent deviations from the predictions of the CAPM about asset price behaviour. A number of 'anomalies' have emerged that cannot be explained within the CAPM framework—in particular, the impact of firm-specific characteristics (size, leverage, book-to-market ratio) and of past returns (short-term momentum effects and success of contrarian strategies over the longer term) on future returns.**
- ***Robustness of results*—the results of the CAPM are sensitive to changes in specific data characteristics. In particular, the estimation of the beta parameter may change significantly according to the time horizon, data frequency and benchmark used.**

In UK regulatory decisions, the use of the CAPM has rarely been questioned. However, since the 1960s, a growing body of empirical evidence in the academic literature has challenged the CAPM's predictive ability. In addition, a number of alternative models have been developed, which have introduced new risk factors to improve precision.

In 2003, the UK economic regulators and the Office of Fair Trading (OFT) commissioned a study on the cost of capital (the Smithers & Co study).[2] Among the goals of the study was the re-examination of the CAPM in comparison with other asset pricing models. The authors of the study concluded that:

> In our view, there is at present no one clear successor to the CAPM for practical cost of capital estimation. We do however feel that alternative models provide helpful insights into the points of vulnerability of the CAPM, and may also provide information on the robustness of the CAPM beta.

Several regulators have tended to focus on the 'lack of clear successors' as support for the CAPM,[3] with less attention being given to the 'helpful insights' provided by alternative models. Regulators sometimes use alternative techniques (eg, the dividend growth model) to 'check' the results of the CAPM and to identify a range for the cost of equity. However, the weight placed on these models in the final decision is limited, with the CAPM remaining the main point of reference. As a result, the gap between academic research and regulatory practice in cost of capital decisions appears to be widening.

An alternative approach

The 2003 Smithers & Co study indicated multi-factor models—and in particular, the Fama–French model—as the main alternative to the CAPM.[4] Like the CAPM, the

Table 1 Comparison of CAPM and Fama–French approaches

	CAPM	Fama–French
Assumptions on market behaviour	Efficient: return–rewards risk	Efficient: return–rewards risk
Risk factors	Market returns	Market returns Size Book-to-market ratio
Analytical approach	Portfolio theory	Empirical regularities

Fama–French approach is based around the idea that returns represent a reward for bearing risk and markets are efficient (see Table 1).[5] The main difference is in the definition of the risk factors that influence stock returns. According to the CAPM, stock returns can be explained in terms of sensitivity to one factor only, the overall market returns. However, according to the Fama–French model, there are other relevant risk factors; two financial variables, market capitalisation (size) and book-to-market ratio, are proxies for such risks. The approaches also differ in another respect: while the CAPM is based on portfolio theory, the Fama–French factors are identified on the basis of empirical regularities, rather than from theoretical premises.

What is the meaning of the additional factors—size and book-to-market? Fama and French interpreted the factors as proxies for underlying default risk: small firms are more exposed to long recessions than large firms (small firms have smaller pockets), and high book-to-market ratios can be interpreted as a symptom of financial distress (the low market value is the result of a series of negative news events). Rational investors require a premium to hold these stocks.[6]

However, an alternative explanation may be related to the CAPM beta. Campbell and Vuolteenaho (2004)[7] show how the beta coefficient can be decomposed into two components—discount rate shocks and cash-flow risks—and argue that, although the two sectors sum to give the CAPM beta, investors are more averse to cash-flow risk. They also show that (in their US sample) 'value stocks' have a greater exposure to cash-flow stocks. Consequently, at least one of the additional Fama–French factors might be rationalised on this basis.

Discussion of the Fama–French model in regulatory decisions has been rare. A recent exception was the liquid petroleum gas (LPG) inquiry, in which the Competition Commission used a Fama–French model to check the CAPM results.[8] The Commission used the model to assess whether a small-company premium should be included in the cost of equity for one firm (Calor), and concluded that the size factor was not statistically significant and that such a premium would not be warranted. In addition, the Commission's 2003 inquiry into wholesale mobile voice call termination provides an interesting debate on the use of the Fama–French approach.[9] In its submission, T-Mobile advocated the use of the Fama–French model, arguing that the CAPM 'does not provide an adequate description of risk premia', and that the Fama–French model 'provides a much better empirical description'.[10] Using this methodology, T-Mobile's submission presented a cost of capital in the range of 24–29%. This figure represented a substantial increase to both Oftel's range and the submissions of the other mobile network operators (all in the 13–18% range).[11] The Competition Commission criticised T-Mobile's position on three grounds: regulatory practice, empirical evidence for the UK, and theoretical problems with the Fama–French model (see box below). In its own cost of capital calculation, the Competition Commission relied solely on the CAPM.[12]

Potential problems in adopting Fama–French

- ***Theoretical problems*—the Fama–French model lacks a clear theoretical foundation that is comparable with that of the CAPM. The approach has been accused of 'data mining'—ie, providing an empirical patch that fits the particular set of data used. However, as noted, some supportive theories are being explored in the academic literature.**
- ***Robustness*—estimates based on Fama–French appear to present similar problems to those of the CAPM in terms of sensitivity to changes in the time horizon.**
- ***Empirical evidence for the UK*—in the mobile calls inquiry, the Competition Commission referred to two academic studies that tested the validity of the Fama–French approach and the CAPM for UK data, noting that both studies favoured the CAPM over Fama–French.[1] Other studies on UK data do provide empirical support for the Fama–French factors. For example, Dimson, Nagel and Quigley (2003) find a strong book-to-market premium in the UK for the period 1955–2001.[2]**

Notes: [1] Clare, A.D., Preistley, R. and Thomas, S.H. (1998), 'Reports of Beta's Death are Premature: Evidence from the UK', *Journal of Banking and Finance*, **22**, 1207–29; and Gregory, A., Harris, R.D.F. and Michou, M. (2003), 'Contrarian Investment and Macroeconomic Risk', *Journal of Business Finance & Accounting*, Jan/March, 213–55.
[2] Dimson, E., Nagel, S. and Quigley, G. (2003), 'Capturing the Value Premium in the United Kingdom', *Financial Analyst Journal*, November/December, 35.

Impact on the cost of equity for utilities

T-Mobile's estimates of the cost of capital using the Fama–French model were higher than similar estimates made with the CAPM. Is this result limited to mobile operators? Academic research suggests that the Fama–French estimates of the cost of equity for utilities could be significantly higher than those derived using the CAPM. In a study of stock returns in different sectors between 1963 and 1994, Fama and French obtained a cost of equity for US utilities of 5.4% using their own model, compared with 3.4% using the CAPM.[13] Evidence for the UK suggests that the Fama–French model may lead to estimates that are, on average, more than 100 basis points over the CAPM result.[14]

Using the Fama–French factors in the TM Risk/Style Database of the University of Exeter, Oxera compared the two approaches for a sample of 15 UK companies in regulated sectors, in 1995–2000 and 2000–05 (from July to June) (see Figure 1). The analysis indicates that the Fama–French cost of equity may be higher than the CAPM for the transport sector but lower for the telecoms sector. However, the results for the water and energy sectors change substantially according to the period under consideration. Across all sectors, the average cost of equity is slightly higher using the Fama–French estimates than when using the CAPM.

The empirical evidence appears to be at odds with the Fama–French interpretation of the size and book-to-market factors as proxies for default risk during bad times. Utility stocks have often been regarded as a 'safe haven' in periods of market turbulence (they did relatively well when the stock market was falling in the early 2000s). If utilities are less exposed to default risk in bad times, the Fama–French approach should yield a lower cost of equity than the CAPM. However, the evidence suggests that the Fama–French estimates may be somewhat higher overall than those of the CAPM.

An alternative interpretation for the Fama–French factors is that investors systematically produce irrational forecasts of stock returns. Investors extrapolate past earnings growth and thus over-value good companies that have outperformed in the past, and that have for this same reason low book-to-market ratios.[15] La Porta (1996) showed that analysts' earning forecasts fit this pattern.[16]

An interpretation of the Fama–French model based on irrational investor behaviour would give rise to new problems for regulators. In particular, should regulators allow a return to compensate for irrational behaviour?

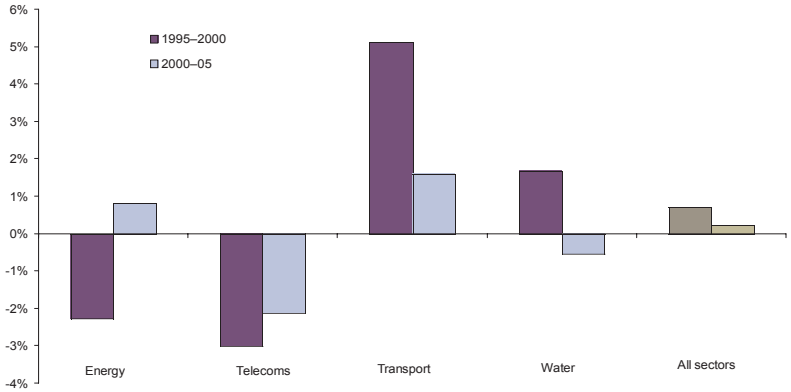
Towards a multi-faceted approach?

The CAPM has become the 'industry standard' for regulatory decisions on the cost of capital. Should regulators abandon this standard and opt for a multi-faceted approach, with several models in competition? The problem is the trade-off between predictability and innovation.

Abandoning a well-understood standard runs the risk of opening a Pandora's box of new issues. The result may be a lack of policy transparency and confusion among market participants. However, the more regulators depend on the CAPM, the wider the gap between regulatory practice and state-of-the-art financial economics.

By focusing on an increasingly outdated model, regulators appear to have chosen predictability. However, in the long term, the risk is that the transition to a different model will generate greater disruption. A gradual transition, which brings new techniques to complement the CAPM, may prove more sustainable over the long term.

Figure 1 Difference between Fama–French and CAPM cost of equity (percentage points)



Sources: TM Risk/Style Database, and Oxera calculations.

[1] Fama, E.F. and French, K.R. (1993), 'Common Risk Factors in the Returns on Stocks and Bonds', *Journal of Financial Economics*, **33**, 3–56.
[2] Wright, S., Mason, R. and Miles, D. (2003), 'A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK', Smithers & Co.
[3] See, for example, Ofcom (2005), 'Ofcom's Approach to Risk in the Assessment of the Cost of Capital', p. 20, para 3.22.
[4] Wright, Mason and Miles (2003), op. cit., p. 6.
[5] Fama and French (1993), op. cit.
[6] Cochrane, J.H. (2001), *Asset Pricing*, Princeton University Press, 399–401.
[7] Campbell, J.Y. and Vuolteenaho, T. (2004), 'Bad Beta, Good Beta', *The American Economic Review*, **94**:5, December, 1249–75.
[8] Competition Commission (2005), 'Market Investigation into Supply of Bulk Liquefied Petroleum Gas for Domestic Use: Provisional Findings Report', August, Appendix K, p. 18.
[9] Competition Commission (2003), 'Vodafone, O2, Orange and T-Mobile: Reports on References under Section 13 of the Telecommunications Act 1984 on the Charges Made by Vodafone, O2, Orange and T-Mobile for Terminating Calls from Fixed and Mobile Networks'.
[10] Schaefer, S., Giles, T. and Butterworth, D. (2003), 'Cost of Capital for T-Mobile (UK)', submission to Oftel, p. 8.
[11] Competition Commission (2003), op. cit., p. 198.
[12] Competition Commission (2003), op. cit., pp. 199–200.
[13] Fama, E. and French, K. (1997), 'Industry Cost of Equity', *Journal of Financial Economics*, **43**, 153–93.
[14] Franks, J. (2005), 'Cost of Capital: Some Current Issues', presentation at the Beesley Lectures on Regulation, November, p. 21.
[15] Lakonishok, J., Shleifer A. and Vishny R. (1994), 'Contrarian Investment, Extrapolation, and Risk', *Journal of Finance*, **49**, 1541–78.
[16] La Porta, R. (1996), 'Expectations and the Cross-section of Returns', *Journal of Finance*, **51**, 1715–42.