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On the differences in measuring SMB and HML in the UK — Do they matter?

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ABSTRACT

The Fama–French (FF) three factor model expands the capital asset pricing model (CAPM) to include two additional factors to the market factor — SMB, employed to capture a firm size effect in returns and HML employed to capture book-to-market effects in returns. In the UK, different researchers use different ways of calculating SMB and HML in the context of empirical applications of the three factor model, or extensions of it, perhaps because they believe the differences in the construction of the SMB and HML factors to be relatively unimportant from an empirical standpoint. We investigate whether indeed factor construction methods are unimportant. Our conclusion is that they do matter.

1. Introduction

The Fama–French (FF) three factor model (Fama & French, 1993, 1996) expands the capital asset pricing model (CAPM) to include two additional factors to the market factor. One — SMB — is employed to capture a firm size effect in returns. The other — HML — is employed to capture book-to-market effects in returns. In the USA, the estimation of the latter two factors has become increasingly standardised - versions are available from French's website.[2] In the UK, however, the situation is different and different (sets of) researchers use different ways of calculating SMB and HML in the context of applications of the three factor model, or extensions of it, perhaps because they believe the differences in the construction of the SMB and HML factors to be relatively unimportant from an empirical standpoint.

The plethora of methods used in estimating SMB and HML in the UK raises questions. Do the various ways of constructing SMB and HML produce similar factors in terms of their sample means? Further, given that these factors are meant to capture risk effects attributable to differences in firm characteristics, are the sample means of the various SMB and HML factors

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significantly different from zero? Then, we can ask whether the various SMBs and HMLs are correlated with each other (do they contain similar information)? Finally, as a case study of the impact of the different methods of estimating SMB and HML, we can ask whether it matters if the various SMB and HML factors have different characteristics if various FF three factor models based upon these factors are similar to each other with respect to the pricing of specific sets of test portfolios?[3]

There is a contribution in pursuing our line of enquiry because, although FF three factor-based models employing SMB and HML have been used in empirical research on UK data, relatively little formal testing of the performance of any of these models, or the factors employed, has taken place (see the next section for exceptions). Given the prominence of three factor models in empirical work, understanding the performance of these models in UK, and, in particular, whether performance is affected by the different methods of estimating SMB and HML, seems an important area of study. Further, some empirical researchers expand the FF three factor model to include other factors (for example, a momentum factor, to produce a UK version of the Carhart (1997) model, as studied in the UK by Gregory, Tharyan, and Christidis (2013)). Within such expanded models, an understanding of the properties of the various methods of estimating SMB and HML is still important. Overall, in the absence of an enhanced understanding of the performance of the various models, and the characteristics of their components, it is difficult to evaluate the validity of previous research findings dependent upon the use of specific versions of SMB and HML.

Given the objectives and questions outlined above, we perform a number of tests related to the different construction methods for SMB and HML. First, we ask whether the means of the monthly time series of the various SMB and HML factors significantly differ from zero. Second, we examine the correlations between the various SMBs and HMLs to assess the degree of similarity between them. Third, we specifically focus on asset pricing tests of the various three factor model applications we identify. We use time series regressions to ask whether the different three factor models price two sets of test portfolios, one set of sixteen portfolios constructed on the basis of size and book-to-market rankings, and the other a set of twenty industry portfolios, in a similar fashion.

Our data suggests that size appears to be associated with UK returns, although the association is concentrated in the bottom 30% of firms. For larger firms, there appears to be no obvious association. There does appear to be a reasonably clear association between UK returns and the book-to-market ratio. Despite these apparent associations, however, assessing the means of the various SMB and HML factors *via t*-tests suggests that they are not always significantly different from zero. For SMB, five out of nine estimates indicate significant small firm size *premia*. For HML, four out of nine estimates provide significant value *premia*. For correlations between different methods of constructing SMB and HML, we conclude that, although there is overlap in the information contained in the various factors, there is also a substantial degree of dissimilarity.

Our results from the asset pricing tests strongly reject the null hypothesis that *any* of the three factor models adequately price the test assets created by rankings of firms by size and the book-to-market ratio. Further, no specific pattern emerges as to which particular size/book-to-market portfolios are mispriced. When industry portfolios are used as the test assets, however, we cannot reject the null hypothesis that the pricing errors are jointly zero for four of the three factor models.

Overall, we conclude that different ways of estimating the SMB and HML factors can result in quite different characteristics for the factor time series means. Further, the correlations between the various SMB and HML factors suggest a degree of dissimilarity between them. If previous researchers believed that methods of operationalising the SMB and HML constructs were not important in empirical settings, our asset pricing results suggest otherwise. Within the context of FF three factor-based asset pricing tests, some models acceptably price industry portfolios, but some do not. Further, in pricing size/book-to-market portfolios, none of the models performs acceptably and, further, no particular pattern can be discerned as to which size/book-to-market portfolios are consistently priced by all models.

The paper proceeds as follows. Section 2 provides a review and discussion of prior literature. Section 3 describes the methodology for performing asset pricing tests. Section 4 describes the data, sample and the factor characteristics, with particular emphasis on the estimation of SMB and HML using the methods described in the nine papers studied and the construction of the two sets of test portfolios. Section 5 reports the empirical results. The final section summarises the results and offers conclusions.

2. Prior literature

There is limited evidence of how particular versions of SMB and HML perform on UK data, usually in the context of a FF three factor-based model. There are exceptions, however. For example, Miles and Timmermann (1996) compare the CAPM, a two factor model consisting of just SMB and HML as factors, and a three factor model on UK data. Using sixteen portfolios sorted on both size and the book-to-market ratio, their results, taken at face value, suggest that the two factor model is superior in explaining the sixteen time series of portfolio returns relative to the other pricing models. Fletcher (2001) evaluates a number of asset pricing models on UK data, including a three factor model. He warns against the indiscriminate use of any of the factor models he investigates. Hussain, Toms, and Diacon (2002) investigate the properties of a three factor model based upon Fama and French (1993) and conclude that it performs better than the CAPM in pricing various sets of portfolios formed by ranking firms according to a number of different criteria, although mispricing appears to occur for various portfolios when a three factor model is used.

[3] Also, we focus on the FF three factor model because that is the context in which the use of SMB and HML arose.