



## Research and Development Activity and Expected Returns in the United Kingdom

A. AL-HORANI<sup>1</sup>, P. F. POPE<sup>2</sup> and A. W. STARK<sup>3</sup>

<sup>1</sup>*Amman University*; <sup>2</sup>*Lancaster University Management School*; <sup>3</sup>*Manchester Business School*

**Abstract.** Fama and French (1992) show that size and book-to-price dominate CAPM beta and other variables such as the price-earnings ratio and dividend yield in explaining the cross-section of US stock returns. Comparable evidence for the UK points to a book-to-price effect, but not a size effect (Chan and Chui, 1996; Strong and Xu, 1997). In this paper, our first contribution is to show that a measure of research and development (RD) helps explain cross-sectional variation in UK stock returns. Our cross-sectional results on the association between stock returns and RD are consistent with recent US evidence reported by Lev and Sougiannis (1996, 1999) and Chan, Lakonishok and Sougiannis (2001). Fama and French (1993, 1995, 1996) also show that a three-factor model captures a high proportion of the time series variation in portfolio returns, again for the US. Our second contribution is to show, for the UK, that a modification to the three-factor model to take account of RD activity can significantly enhance the explanatory power of the three-factor model. We show that, as a practical matter, estimated risk premia based on the modified three-factor model can differ considerably from risk premia estimated using the CAPM or the three-factor model. In particular, risk premia for industries in which few firms undertake RD activities tend to be over-estimated.

### 1. Introduction

In this paper we build on recent US-based evidence suggesting that the relation between stock returns and the book-to-market ratio (BM) is associated with off-balance sheet research and development (RD) capital (Lev and Sougiannis, 1996, 1999; Chan, Lakonishok and Sougiannis, 2001). Consistent with prior research, our first contribution is to show that RD activity is informative in explaining the unconditional and conditional cross-section of returns for a large sample of UK stocks over a ten-year period. Indeed, RD dominates BM as an explanatory factor for returns. The cross-sectional analysis also shows that both BM and firm size, defined as the market value of equity (ME), are associated with RD activity.

Fama and French (1993, 1996) show that risk factors constructed on the basis of BM and ME are incrementally important beyond a market factor in explaining the time series of US portfolio returns. The cross-sectional association between RD

---

The financial support of the Economic and Social Research Council (award reference R000237663) is gratefully acknowledged. Helpful comments have been received from the anonymous reviewer and seminar participants at Queen's University of Belfast, University of Exeter and the 2000 Real Options Conference, Cambridge University.