Financial Distress, Market Anomalies and Single and Multifactor Asset Pricing Models: New Evidence

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ABSTRACT

Data snooping and the nature of the distress premium are unresolved issues for the Fama and French three-factor model. These are addressed using UK data to create and test the model on portfolios based on market anomalies. We explore the apparent distress premium identified in prior research with particular reference to negative book equity-to-market equity (BE/ME) stocks. Although neglected in the prior research, we argue that these stocks offer new insights into the nature of the distress premium. We conclude that the distress premium is real and the three-factor model is an improvement on CAPM for all portfolios tested including the negative (BE/ME) portfolio. Unlike other distressed portfolios there is no compensation with high abnormal returns for this portfolio.

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The Fama and French three-factor model (1993, 1996) has had a very significant impact on financial research. However, because apparent regularities emerged from models based on empirical observation rather than reference to theory there have been accusations of data snooping (Black (1993), MacKinlay (1995)). These accusations have been difficult to rebut, partly because the original tests used comprehensive samples of US data over a long time period (1963-1992). Recently there have been attempts to replicate the results using longer run historical data (Davis, Fama and French, 2000) and in other country specific studies, for example Japan (Daniel, Titman and Wei, 2001), together with partial replication across a larger number of countries (Fama and French, 1998). Although these tests have tended to confirm the original results, the intervening effects of institutional variation and non-comparable time periods inevitably limit the value of historical and international comparatives. In particular, these problems are compounded where there is a relatively thin or under-developed, or only recently developed set of stock market institutions. Such limitations are less apparent for the UK economy and empirical tests of the Fama and French model using a similar long run time period are more likely than alternative data samples to fairly confirm or reject the validity of the model.

Within the context of the unresolved empirical issues, much recent controversy has concentrated on the nature of the value premium, or the book equity to market equity (BE/ME) anomaly (Daniel and Titman, 1997, Davis, Fama and

French, 2000). In addition to the argument that this is a fortuitous result unlikely to be observed out of sample, the value premium has been attributed to financial distress and growth potential. Accordingly, in any study seeking to extend the original empirical tests of the Fama and French model, it is appropriate to also consider the nature of the value premium. In this paper we examine the proposition that it is linked to financial distress by examining the BE/ME variable in more detail, in a manner not hitherto considered in the prior research. In particular we consider the special circumstance of negative BE/ME firms. These firms should be differentiated from high BE/ME firms. Because market value is always positive, high BE/ME firms may be distressed, whereas negative book-to-market value implies that a firm must be financially distressed, since liabilities are greater than assets. These firms are in a category of financial distress that is different to other weak or value stocks whose characteristic is merely low price. For example firms with negative net assets are likely to face legal and regulatory restrictions on financial and trading policy. They are also likely to engage in highly context specific actions, such as asset sales and changes in top management. Meanwhile low share price in relation to book value may be symptomatic of financial distress, but may also reflect systematic factors such as industry norms and vulnerability to cyclical downturns and may be not itself sufficient to threaten the firm with administration.

The contrast between negative and high BE/ME firms also points to a weakness in the way prior research has been conducted. If the BE/ME ratio is treated as a continuous variable in portfolio construction, negative BE/ME stocks are put in the lowest decile because of their negative sign as opposed to going in the highest decile where relatively distressed stocks tend to be (Fama and French, 1995). For this reason negative book to market firms were excluded in the original Fama and French

(1996) tests. Nonetheless, because the BE/ME factor loads highly for relatively distressed stocks and may therefore proxy for relative distress, a good test of this hypothesis is to examine whether it also holds for negative BE/ME stocks.

Specification of an accurate asset pricing model has great significance for financial research. Fama and French's (1992) conclusion that size and book-to-market equity are the most significant factors in explaining stock returns for the US had implications for the established capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965). Their results implied that the CAPM was mis-specified and more emphasis should be placed on size and book-to-market equity in any new model. Fama and French (1993) point out that although size and book-to-market equity seem like ad hoc variables for explaining average stock returns, there is reason to suspect that they proxy for common risk factors in returns. Fama and French (1992) find that for the US, size and book-to-market equity are related to economic fundamentals. Not surprisingly, firms that have high BE/ME (a low stock price relative to book value) tend to have low earnings on assets. Conversely, low BE/ME (a high stock price relative to book value) is associated with persistently high earnings. Size is also related to profitability. Controlling for book-to-market equity, small firms tend to have lower earnings on assets than big firms.

The size effect in earnings, however, is likely to be country and time period specific. In the US until 1981, small firms were only slightly less profitable compared to big firms. The 1980-1982 recession turned into a prolonged earnings depression for small firms and they did not participate in the economic boom of the mid and late 1980s. Fama and French (1993) argue because small firms can suffer a long earnings depression that bypasses big firms, size is associated with a common risk factor that might explain the negative relation between size and average return. Similarly, the relation between book-to-market equity and earnings suggests that relative profitability is the source of a common risk factor in returns that might explain the positive relation between BE/ME and average return. Strong and Xu (1997) suggest that similar relationships exist in the UK between size, book-to-market and average returns as in the US, although research in the UK is relatively limited.

Tests in Fama and French (1996) confirmed patterns in average stock returns not explained by the capital asset pricing model (CAPM) and therefore typically referrred to as anomalies. These are size, book-to-market equity (BE/ME), earnings/price (E/P), cash flow/price (C/P), and past sales growth, (Banz 1981, Basu 1977, 1983, Rosenberg, Reid, and Lanstein 1985, Lakonishok, Schleifer and Vishny 1994). The three-factor model in the US absorbs these anomalies. As suggested earlier, these results have been attributed to data snooping and that they only apply to the sample used to identify them. Although the Fama and French (1992) study has been replicated with similar results in Japan (Chan, Hamao and Lakonishok, 1991) and the UK (Strong and Xu, 1997) the situation is more complex regarding time series tests of the three-factor model (Fama and French, 1993, 1996). Davis et al (2000) considered longer time periods, but the databases often did not account for all listed stocks and because some of the data had to be collected manually, some sectors were left out. Daniel and Titman (2001) consider Japan, but in this case the three-factor portfolios have not been constructed as in Fama and French (1993, 1996) and only the size and book-to-market anomalies are considered. Fama and French (1998) analyze thirteen countries on international evidence of the book-to-market premium. The study concludes that a two-factor model is an improvement to the one factor CAPM model but size has been neglected in this study as the focus was only on a limited sample of large stocks in each country.

In view of these omissions in the prior literature, this study offers the closest like for like comparison with Fama and French (1996) using comprehensive, long run evidence using a previously untested returns dataset, thereby enabling us to answer the data snooping question. Also the research provides greater empirical scope than all prior UK studies. The population of securities is examined over a long period and potential data problems are overcome by creating a comparable database to the Chicago Research on Security Prices (CRSP).

The remainder of this paper is structured as follows: Section I describes the models tested, the data collection process in UK conditions and some overall features of stock returns in the period 1976-1998. Section II discusses tests on 25 size and book-to-market intersection portfolios for the CAPM and three-factor model and compares the two. Section III describes tests on portfolios formed on book-to-market, earnings/price, cash flow/price and sales growth for the CAPM and the three-factor model and compares the two. Section IV looks at tests on negative BE/ME firms. Section V draws conclusions.

I. Model and Data Description

A. Models

The three-factor model relates the expected return on a portfolio in excess of the risk free rate $[E(R_i) - R_f]$ to three factors: (i) the excess return on a broad market portfolio $(R_M - R_f)$; (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big); and (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (HML, high minus low). For a specific firm or portfolio i, the expected excess return is,

$$E(R_i) - R_f \;=\; b_i\,[E(R_M) - R_f] \;+ s_i\,E(SMB) \;+ h_i\,E(HML) \qquad (1)$$

Where $(R_M) - R_f$, E(SMB), and E(HML) are expected premiums, and the factor sensitivities or loadings, b_i, s_i, and h_i, are the slopes in the OLS time-series regression and ε_i is distributed $N(0,\sigma^2)$,

$$R_i - R_f \;=\; \alpha_i + b_i\,(R_M - R_f) \;+ s_i SMB \;+ h_i HML \;+ \varepsilon_i \qquad (2)$$

The single factor model or CAPM relates the expected return on a portfolio in excess of the risk free rate $[E(R_i) - R_f]$ to the excess return on a broad market portfolio $(R_M - R_f)$. For a specific firm or portfolio i, the expected excess return is,

$$E(R_i) - R_f \;=\; b_i\,[E(R_M) - R_f] \qquad (3)$$

where $(R_M) - R_f$, is the expected premium, and the factor sensitivity or loading, b_i is the slope in the OLS time-series regression and ε_i is distributed $N(0,\sigma^2)$,

$$R_i - R_f \;=\; \alpha_i + b_i\,(R_M - R_f) \;+ \varepsilon_i \qquad (4)$$

B. Data

An important problem in replicating US studies internationally is that stock price data are not maintained in comparable fashion to the (CRSP) database. In past UK single factor (CAPM) studies the Financial Times All Share Index has been used to calculate market return and stock prices at the end of each month have been used to calculate stock returns (Levis 1985 and Davies et al. 1999). Unlike the CRSP this method does not include returns due to dividends. In order to incorporate dividends into the analysis, the DATASTREAM return index is used. To construct the three independent variables, in June of each year t from 1974 to 1998, all London Stock Exchange (LSE) stocks on DATASTREAM are ranked on size (price times issued shares). The median LSE size is then used to split LSE stocks into two groups, small and big (S and B). LSE stocks are also split into three book-to-market equity groups based on the breakpoints for the bottom 30% (low), middle 40% (medium), and top 30% (high) of the ranked values of BE/ME for LSE stocks. Book Equity is defined as net tangible assets which is equity capital and reserves minus total intangibles. BE/ME, is then book value for the end of the calendar year t-1,[1] divided by market equity at the end of December of t-1. Negative BE/ME firms are not used when calculating the breakpoints for BE/ME or when forming the size-BE/ME portfolios.

The decision to sort firms into three groups on BE/ME and only two on ME is consistent with Fama and French (1993) and follows from UK evidence that book-to-market equity has a stronger role in explaining average stock returns than size (Strong and Xu, 1997). The splits are consistent with Fama and French (1993) except that their tests span the three US exchanges (NYSE, AMEX and NASDAQ). The median of the NYSE is used to split the stocks into groups for SMB and HML causing a disproportionate number to be in the small groups for the US. In the UK however, there is only one exchange, the LSE, therefore the median of the LSE is used which places an equal number of small stocks and big stocks in each group. As Fama and French (1993) suggest no reason to argue that the tests should be sensitive to the choice of split, we have not considered alternatives, and similarly assumed that the tests are not sensitive to these choices.

Six portfolios (S/L, S/M, S/H, B/L, B/M, B/H) are constructed from the intersections of the two ME and three BE/ME groups. For example, the S/L portfolio contains the stocks in the small-ME group that are also in the low BE/ME group, and the B/H portfolio contains the big-ME stocks that also have high BE/MEs. Monthly value-weighted returns on the six portfolios are calculated from July of year t to June of t+1, and the portfolios are reformed in June of t+1.

In order to be included in the tests, a firm must have DATASTREAM stock prices for December of year t-1 and June of year t and DATASTREAM book value for year t-1. To avoid survival bias inherent in the way COMPUSTAT adds firms to its tapes as discussed by Banz and Breen (1986), Fama and French (1993) do not include firms until they have appeared on COMPUSTAT for two years. This is because COMPUSTAT claim they rarely include more than two years of historical data when they add firms. To be consistent with Fama and French (1993) this study does not include firms until they have appeared on DATASTREAM for two years.

The SMB portfolio is the difference, each month, between the simple average of the returns on the three small stock portfolios (S/L, S/M, and S/H) and the simple average of the returns on the three big stock portfolios (B/L, B/M, and B/H). Thus, SMB is the difference between returns on small stock and big stock portfolios with about the same weighted average book-to-market equity. This influence should be largely free of the influence of BE/ME, focusing instead on the different return behaviors of small and big stocks.

The HML portfolio is defined in a similar manner. HML is the difference each month, between the simple average of the returns on the two high-BE/ME portfolios

(S/H and B/H) and the average of the returns on the two low-BE/ME portfolios (S/L and B/L). The two components of HML are returns on high-BE/ME and low-BE/ME portfolios with about the same weighted average size. Thus the difference between the two returns should be largely free of the size factor in returns, focusing instead on the different return behaviors of high and low BE/ME firms. The evidence of the success of this procedure is that the correlation from 2/75 to 6/99 monthly mimicking returns for the size and book-to-market factors is just under 0.08. For the US Fama and French (1993) find a negative correlation of –0.08 over 1963-1991.

According to Fama and French (1993) true mimicking portfolios for the common risk factors in returns minimize the variance of firm-specific factors. Using value-weighted components is in the spirit of minimizing variance, since return variances are negatively related to size. Hence the six size-BE/ME portfolios in SMB and HML are value-weighted. Also using value-weighted components results in mimicking portfolios that capture the different return behaviors of small and big stocks, or high and low BE/ME stocks, in a way that corresponds to realistic investment opportunities.

The proxy for the market factor in stock returns is the excess market return, R_M-R_f. R_M is the return on the value-weighted portfolio of the stocks in the six size-BE/ME portfolios plus the negative-BE stocks excluded from the portfolios. R_f is the one-month T-bill rate taken at the beginning of the month. This market factor is also used as the independent variable in the single factor (CAPM) model.

Lakonishok Schleifer and Vishny (1994) and Haugen (1995) conclude that the HML premium is almost always positive and so is close to an arbitrage opportunity. Table I shows the annual R_M - R_f , SMB, and HML returns for 1976 to 1998 for the UK. According to Fama and French (1996) if the premium for relative distress is close to an arbitrage opportunity, the standard deviation of HML should be small. In fact, HML's standard deviation of 13.68 percent per year, is similar to the standard deviations of R_M - R_f and SMB, 12.90 percent and 17.65 percent per year, respectively. The average values of the three annual premiums are also similar: 6.68 percent for HML, 8.35 percent for R_M - R_f and 1.79 percent for SMB. The yearly returns confirm that a high book-to-market strategy is not a sure thing. HML is negative for seven out of the twenty-three years we study, R_M - R_f is also negative six times and SMB is negative eleven times. In short, the relative-distress premium is positive, but not an arbitrage opportunity and therefore a potentially important factor in the pricing of UK stocks.

Insert Table I here.

II. Tests on the 25 Size-BE/ME intersection Portfolios

Table II shows the average excess returns on 25 size-BE/ME portfolios of equally weighted LSE stocks. The table shows that small stocks tend to have higher returns than big stocks and high-book-to-market stocks have higher returns than low-BE/ME stocks. Table II also reports estimates of the CAPM (4) and three-factor time-series regression (2). If the CAPM (3) or the three-factor model (1) describes expected returns, the regression intercepts should be close to 0.0. The estimated intercepts for the CAPM and the three-factor model suggest that the models generally leave negative unexplained returns for portfolios in the largest size and lowest BE/ME quintiles, and a large positive unexplained return for the portfolio in the smallest size and highest BE/ME quintiles.

The average of the 25 regression R^2 for the CAPM and three-factor model are 0.59 and 0.83, so the intercepts are distinguishable from zero. The three-factor model appears to capture more variation in the average returns on the portfolios than the CAPM, this is also suggested by the smaller average absolute intercept which is 0.22 percent for the three factor model and 0.35 percent for CAPM. It should be noted that in the time-series regression (2), variation through time in the expected premiums $E(R_M) - R_f$, E(SMB), and E(HML) in (1) is embedded in the explanatory returns, $R_M - R_f$, SMB, and HML. Thus the regression intercepts are net of (they are conditional on) variation in the expected premiums. Results below also show that forming portfolios periodically on size, BE/ME, E/P, C/P, and sales growth results in loadings on the three factors that are roughly constant.

The UK results are similar to those reported by Fama and French (1996) for the US. In both cases it is possible that the CAPM holds but is spuriously rejected, for three possible reasons. First because there is survivor bias in the returns used to test the model (Kothari, Shanken, and Sloan (1995)), second because CAPM anomalies are the result of data snooping (Black 1993, MacKinlay, 1995), or third because the tests use poor proxies for the market portfolio. The data snooping issue has now been successfully addressed using a different database and a different market and finding similar results. The survivor bias issue has been addressed by using data going back five years in sim Lakonishok Schleifer and Vishny (1994). Considering the poor proxies for market argument, Fama and French (1996) say the irony argument is that if CAPM is true but the market portfolio is unobservable, multi-factor models like the three-factor model may provide better estimates of CAPM expected returns. On the basis of our analysis, we would agree with this view.

Insert Table II here.

III. Tests on the BE/ME, E/P, C/P, and Sales growth Portfolios.

Table III summarizes the excess returns on sets of deciles formed for the UK on BE/ME, E/P, C/P, and five year sales rank in a similar manner to Fama and French (1996). The portfolios are formed each year using DATASTREAM accounting data for the fiscal year ending in the current calendar year (see note before table III below). Returns are then calculated beginning in July of the following year. To be included in the tests for a given year, a stock must have data on all the above variables. This means that firms must have DATASTREAM data on sales for six years before they are included in the return tests. Fama and French (1996) and Lakonishok, Schleifer and Vishny (1994) claim that this method reduces biases that might arise because of the inclusion of historical data when the database adds firms (Banz and Breen, 1986, Kothari, Shanken and Sloan, 1995). Although this research relies on a different database, it is nonetheless reasonable to take this precaution.

The LSE stocks sorted in table IV produce strong positive correlations between average return and BE/ME, E/P and C/P. Past sales growth is also negatively related to future return. These results are broadly consistent with Fama and French

(1996) in that the three-factor model appears to be a better model than CAPM. For portfolios formed on BE/ME, E/P and C/P, the average R^2 for regressions using the CAPM model are 0.74, 0.75, and 0.75 for BE/ME, E/P and C/P, for the three-factor model these increase to 0.89, 0.88, and 0.89. The average absolute intercept using the CAPM model are 0.3, 0.22, and 0.31 for BE/ME, E/P and C/P, for the three-factor model these decrease to 0.21, 0.08, and 0.22, implying that the three-factor model explains the returns better than CAPM for these portfolios.

To explain the superior performance of the three-factor model for portfolios formed with BE/ME, E/P, and C/P as grouping variables one must consider all the regression slopes. On average excluding the lowest C/P and E/P portfolios, the trend is for higher BE/ME, E/P and C/P portfolios to produce larger slopes on SMB and especially HML. Loading patterns on the BE/ME, E/P, and C/P deciles on HML, and the high average value of HML (0.48 percent per month) demonstrate how the three-factor regressions transform strong positive relationships between average return and these ratios into intercepts closer to zero compared to CAPM (Table IV).

Among the different portfolio sorts in Table IV, the three-factor model has the most difficulty with returns on the sales-rank portfolios. According to US studies by Lakonishok, Schleifer and Vishny (1994) high sales rank firms (strong past performers) have low future returns and low sales rank firms (weak past performers) have high future returns. Table III shows monthly excess returns and table IV shows the CAPM and the three-factor model for this grouping variable. The three-factor model appears to work better here largely because low sales-rank stocks behave like distressed stocks (they tend to have stronger loadings on HML relative to non-distressed stocks). The average of the 10 regression R^2 for the CAPM and three-factor model are 0.75 and 0.89, so the intercepts are distinguishable from zero. The average absolute intercept when using the three-factor model as opposed to CAPM decreases from 0.27 to 0.14. The evidence that the three-factor model describes the returns on the sales rank deciles better than CAPM is important since sales rank is the only portfolio formation variable that is not a transformed version of stock price.

Standard tests of the CAPM ask whether loadings on a market proxy can describe the average returns on other portfolios. Algebraically, these are just tests of whether the market proxy is in the set of mean-variance-efficient (MVE) portfolios that can be formed from the returns to be explained (Fama (1976), Roll (1977), Gibbons, Ross and Shanken (1989)). In a similar manner, Fama (1994) states that tests of a three-factor model ask whether loadings on three portfolios can describe the average returns on other portfolios. Such tests aim to find whether the explanatory portfolios span the three-factor MMV (multifactor-mean-variance) portfolios that can be formed from the returns to be explained. A purely algebraic interpretation of the results is that portfolios M, S, B, H, and L are in the sets of three-factor-MMV portfolios that can be formed from sorts on E/P. The explanatory portfolios cannot span the three-factor-MMV portfolios that can be constructed from sorts on size, BE/ME, C/P, and sales growth. The explanatory portfolios do a better job of spanning the three-factor-MMV portfolios that can be constructed from sorts on size, BE/ME, E/P, C/P, and sales growth than the market proxy alone.

Insert Table III & Table IV here.

IV. Tests on Negative BE/ME firms.

In the development of the three-factor model, when constructing the SMB and HML variables the negative BE/ME stocks were left out and there was little justification by Fama and French (1993) for doing this apart from the fact that there were only a small number prior to 1980. Dichev (1998) argues that firms with high bankruptcy risk and therefore high relative distress have a high book-to-market value but firms with the highest bankruptcy risk and therefore highest financial distress have a negative book-to-market value. The reasoning for this is that unlike market value, book value of the most distressed firms is completely wiped out by losses and is usually negative. If the loading on the HML variable proxies for relative distress then negative book-to-market portfolio should load high on HML.

The negative BE/ME stocks used in the tests are the same as used in constructing the R_M-R_f portfolio. The number of months used were 198 starting from January 1983 to June 1999. The high BE/ME stock portfolio from section III was also regressed again for the same time period so direct comparisons could be made. Comparative statistics for these portfolios are shown in Table V.

Insert Table V here.

According to Table V, the negative BE/ME portfolio has a mean monthly return in excess of the one month t-bill for this portfolio of 0.51 with standard deviation of 8.48 and t value of 0.84. The high BE/ME portfolio has a mean monthly return in excess of the one month t-bill for this portfolio of 1.23 with standard deviation of 4.27 and t value of 4.04. In contrast to the returns on the high BE/ME portfolio, the returns on the negative BE/ME portfolio are insignificant.

Insert Table VI here.

Table VI shows the results when the negative BE/ME portfolio is regressed against CAPM. This portfolio has an insignificant alpha value of –0.11 and a significant beta of 0.94. In contrast the high BE/ME portfolio has a significant alpha of 0.76 and a significant beta of 0.76. Using the three-factor model shown in Table VII for the negative BE/ME firms, an insignificant alpha value of –0.47 is recorded and a significant beta of 1.33. The co-efficient on SMB is significant with a value of 1.38, and the HML co-efficient is also significant with a value of 0.58. R^2 increases from 0.24 on the CAPM to 0.46 on the three-factor model. For high BE/ME firms, a significant alpha value of 0.52 is recorded and a significant beta of 0.93. The co-efficient on SMB is significant with a value of 0.79, and the HML co-efficient is also significant with a value of 0.39. R^2 increases from 0.54 on the CAPM to 0.85 on the three-factor model.

Insert Table VII here.

These results imply that both the CAPM and the three-factor model absorb the negative BE/ME portfolio, as alpha is insignificant in both cases. Secondly as the R^2 increases substantially from CAPM to the three-factor model this implies that the three-factor model is an improvement on CAPM for this portfolio. Thirdly the loading on HML for the negative BE/ME portfolio is higher than the loading for HML on the high BE/ME portfolio. This implies that the HML variable proxies for relative distress and that the more distressed a portfolio the higher the loading on the HML. As relative distress increases, the explanatory power of the systematic factors in all models falls, suggesting high levels of specific risk in distressed firms and hence a rational distress premium. Thus the negative BE/ME portfolio is associated with lower returns and negative and insignificant alphas compared to the high BE/ME portfolios. Although the three-factor model does not fully describe returns, a high premium for relative distress is present in the findings.

V. Conclusions.

Although an attempt has been made to keep this study as consistent to the US study by Fama and French (1996), there are inevitably slight differences. A different database, DATASTREAM has been used for this study, secondly the grouping variables are defined slightly differently to Fama and French (1996). In the US study NYSE median breakpoints were used this meant that there were a disproportionately larger number of small stocks in the small stock portfolio due to NASDAQ stocks. In the UK there is only one exchange and therefore the same number of stocks were assigned to both the small and big portfolios.

Despite these minor technical differences the results provide strong evidence in favor of the Fama and French (1993) three-factor model. The single factor model or CAPM does not capture as much of the cross-sectional variation in average stock returns. Our tests conclude that the distress premium for the UK is real, like Fama and French (1996). It is not however close to an arbitrage opportunity as reported by Haugen (1995) and Lakonishok, Schleifer and Vishny (1994). All market anomalies stated for the US using CAPM also hold for the UK. The three-factor model only captures the returns to portfolios formed on E/P. BE/ME, C/P, size and sales growth remain as market anomalies for the three-factor model in the UK. Nonetheless, the three-factor model performs better than CAPM on these portfolios. As in the, US stocks with high BE/ME high E/P, high C/P, or low sales growth tend to load positively on HML, this is because they are relatively distressed and have higher average returns. Conversely, low BE/ME, low E/P, low C/P, or high sales growth are typical of strong firms that have negative slopes on HML, these negative slopes imply lower expected returns using the three-factor model. The results invalidate the data snooping argument because although the market anomaly portfolios are not totally absorbed by the three-factor model, SMB and HML are significant and behave in a similar way as tested in the US. This implies that the distress premium is real and that it is not a case of data snooping.

Negative BE/ME firms are absorbed by the CAPM and the three-factor model and the three-factor model also explains returns better than the CAPM for this portfolio. The loading on HML is high implying that relative distress is captured for this portfolio by this model and the HML variable is doing its job. However, the risk in this portfolio is not compensated by systematically higher returns. This suggests a split between value stocks including potentially financially distressed firms (highest BE/ME) which is generously compensated in returns and the highest financially distressed firms (negative BE/ME) which are not as well compensated. Although high BE/ME stocks and negative BE/ME stocks are both potentially financially distressed groups of stocks, the non-monotonic relationship allows a distinction of severity to be made. The relatively poor performance of CAPM and the three-factor model on this portfolio suggests high levels of specific risk. This tends to confirm that negative BE/ME stocks are in greater financial distress and more likely to fail and therefore these stocks are not rewarded with systematically higher average returns. However, further research on non-UK or other out of sample data is required to confirm this proposition.

In summary, the results show that the Fama and French (1993) three-factor model provides a better explanation of returns than the single factor model or CAPM. There are size, book-to-market, earnings-to-price, cash-flow to price and sales growth anomalies for the UK when using the CAPM. The three-factor model created in a similar manner to Fama and French (1993) absorbs the earnings to price anomaly for the UK but all other anomalies hold. The three-factor model does appear to give a better explanation of average portfolio returns than CAPM and trends on the loadings of the SMB and HML variables appear similar to the US. Although the market anomalies are not fully absorbed it can be concluded from the UK data that the three-factor model is a significant improvement on CAPM and that this is not the result of mere data snooping.

Notes

[1] This may be delayed until the end of June of year t but is back-filled by DATASTREAM for research purposes, once it is reported, to the relevant month in the calendar year t-1 when the accounting year ends.

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Table I

R_M is the annual market return. R_f is the return obtained by rolling over 12 one-month bills during a year. SMB is the difference between the annual returns on the small-stock portfolio, S, and the big-stock portfolio, B. HML is the difference between the annual returns on the high-book-to-market portfolio, H, and the low book-to-market portfolio, L. t(Mean) is the mean of the annual returns (mean) divided by its standard error (std.dev)/$22^{1/2}$. Negative is the number of negative annual returns.

Date	R(M)-R(F)	SMB	HML	R(F)
1976	-6.38	3.00	9.31	10.93
1977	40.43	47.48	15.52	8.08
1978	3.72	25.42	5.01	8.09
1979	-0.81	0.78	4.57	12.79
1980	17.33	-21.81	-19.58	15.38
1981	-0.14	12.32	16.45	13.22
1982	15.14	-5.42	-10.97	12.24
1983	19.88	7.18	23.87	9.96
1984	16.51	-2.04	16.50	9.62
1985	7.63	8.26	18.56	11.95
1986	16.15	14.18	26.45	10.77
1987	-1.44	30.42	8.94	9.65
1988	0.85	1.23	15.35	9.67
1989	17.61	-29.24	-0.04	13.62
1990	-24.37	-13.43	-3.18	14.67
1991	7.66	-0.74	-10.17	11.58
1992	7.74	-20.88	3.38	9.45
1993	19.74	14.57	34.02	5.69
1994	-9.39	7.09	5.49	5.06
1995	14.85	-10.56	-1.93	6.38
1996	9.37	-4.62	9.58	5.90
1997	14.97	-11.03	5.44	6.48
1998	4.95	-11.07	-18.88	7.24
Mean	8.35	1.79	6.68	9.93
Stdev	12.90	17.65	13.68	2.98
t(Mean)	3.10	0.49	2.34	15.98
Negative	6	11	7	0

Table II

Summary Statistics and Three-Factor Regressions for Simple Monthly Percent Excess Returns on 25 Portfolios Formed on Size and BE/ME: 2/75-6/99, 293 Months

The 25 size-BE/ME portfolios are formed like the six size-BE/ME portfolios used to construct SMB and HML, except that quintile breakpoints for ME and BE/ME for LSE stocks are used to allocate LSE stocks to the portfolios and unlike the six size-BE/ME portfolios which are value-weighted, the 25 size-BE/ME portfolios are equally weighted. R_f is the one-month Treasury bill rate observed at the beginning of the month (from DATASTREAM).

The table shows the mean of each of the portfolios return minus the risk free rate and the t(mean), this is followed by the second part of the table which shows regressions of the 25 portfolios using a single factor model or CAPM, showing loadings, intercepts, t-values, and R-square. The third part of the table shows regressions of the 25 portfolios using the three-factor model with loadings, intercepts, t-values and R-square values. The final part of the table is a comparison between the two models to see which is superior.

	Book-to-Market Equity (BE/ME) Quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
	Summary Statistics									
	Means					t(Mean)				
Small	0.65	1.06	1.39	1.38	1.65	2.01	3.66	4.31	5.42	6.33
2	0.43	0.69	0.79	0.94	1.33	1.49	2.66	2.94	3.59	4.58
3	0.41	0.59	0.89	1.05	1.17	1.56	2.26	3.18	3.59	3.49
4	0.56	0.73	0.80	1.01	1.17	1.91	2.52	2.60	3.29	3.41
Big	0.58	0.78	0.89	1.00	1.28	1.93	2.42	2.70	2.91	3.65
	$R_i - R_f = a_i + b_i (R_M - R_f) + e_i$									
	a					t(a)				
Small	0.23	0.63	0.96	0.97	1.22	0.78	2.52	3.31	4.54	5.65
2	-0.14	0.20	0.24	0.42	0.74	-0.63	1.01	1.27	2.20	3.59
3	-0.18	0.02	0.28	0.40	0.48	-1.08	0.13	1.53	2.15	2.04
4	-0.16	0.01	0.04	0.24	0.38	-1.07	0.08	0.27	1.62	1.85
Big	-0.24	-0.10	-0.01	0.08	0.38	-2.69	-1.02	-0.13	0.65	2.45
	b					t(b)				
Small	0.50	0.50	0.52	0.48	0.51	8.76	10.16	9.11	11.39	12.16
2	0.68	0.58	0.65	0.63	0.71	16.10	15.22	17.40	16.87	17.76
3	0.70	0.68	0.72	0.77	0.82	21.64	20.14	20.06	20.89	17.88
4	0.86	0.85	0.90	0.91	0.94	29.02	30.07	29.19	31.13	23.29
Big	0.98	1.04	1.07	1.10	1.07	55.71	55.22	57.17	47.38	35.17
	R-square					Adj-R-square				
Small	0.21	0.26	0.22	0.31	0.34	0.21	0.26	0.22	0.31	0.33
2	0.47	0.44	0.51	0.49	0.52	0.47	0.44	0.51	0.49	0.52
3	0.62	0.58	0.58	0.60	0.52	0.62	0.58	0.58	0.60	0.52
4	0.74	0.76	0.75	0.77	0.65	0.74	0.76	0.74	0.77	0.65
Big	0.91	0.91	0.92	0.89	0.81	0.91	0.91	0.92	0.88	0.81

Table II Continued

	Book-to-Market Equity (BE/ME) Quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
	$R_i - R_f = a_i + b_i(R_M - R_f) + s_iSMB + h_iHML + e_i$									
			a					t(a)		
Small	-0.14	0.31	0.51	0.55	0.78	-0.58	1.76	2.31	3.96	5.96
2	-0.30	-0.08	-0.14	0.01	0.23	-1.84	-0.64	-1.51	0.14	2.59
3	-0.32	-0.26	-0.09	-0.04	-0.13	-2.87	-2.62	-0.88	-0.44	-1.09
4	-0.28	-0.22	-0.24	-0.06	-0.10	-2.37	-2.25	-2.31	-0.56	-0.62
Big	-0.21	-0.17	-0.19	-0.18	0.01	-2.50	-1.77	-2.13	-1.70	0.10
			b					t(b)		
Small	0.86	0.90	0.91	0.80	0.85	15.41	21.71	17.92	25.08	28.29
2	1.01	0.93	0.98	0.95	1.06	26.89	34.13	44.26	42.99	50.90
3	0.98	0.98	1.04	1.07	1.17	37.68	41.95	44.95	48.21	41.85
4	1.08	1.08	1.14	1.09	1.13	39.58	47.34	46.30	41.57	31.12
Big	1.07	1.09	1.11	1.14	1.06	56.03	49.31	54.60	47.25	35.19
			s					t(s)		
Small	1.04	1.12	1.15	0.95	1.00	12.05	17.58	14.64	19.32	21.45
2	0.92	0.98	0.97	0.95	1.03	15.83	23.28	28.39	27.94	32.08
3	0.78	0.86	0.91	0.90	1.06	19.35	23.81	25.71	26.32	24.65
4	0.62	0.65	0.69	0.53	0.63	14.68	18.55	18.28	13.27	11.16
Big	0.23	0.15	0.14	0.16	0.07	7.89	4.41	4.47	4.25	1.52
			h					t(h)		
Small	0.22	0.07	0.34	0.40	0.41	1.76	0.72	2.99	5.68	6.14
2	-0.17	0.04	0.29	0.35	0.53	-2.05	0.67	6.01	7.05	11.46
3	-0.13	0.14	0.29	0.47	0.74	-2.25	2.69	5.72	9.65	12.05
4	-0.10	0.14	0.24	0.37	0.70	-1.62	2.77	4.42	6.42	8.71
Big	-0.22	0.07	0.31	0.47	0.78	-5.09	1.46	6.85	8.92	11.68
			R-square					Adj-R-square		
Small	0.49	0.65	0.58	0.73	0.77	0.49	0.65	0.57	0.73	0.77
2	0.72	0.81	0.88	0.88	0.91	0.71	0.81	0.88	0.88	0.91
3	0.83	0.87	0.88	0.90	0.88	0.83	0.86	0.88	0.90	0.88
4	0.85	0.89	0.89	0.88	0.81	0.85	0.89	0.89	0.88	0.81
Big	0.93	0.92	0.94	0.92	0.87	0.93	0.92	0.94	0.92	0.87

Table III

Summary Statistics for Simple Monthly Percent Excess Returns on Equal Weight Deciles for BE/ME, E/P, C/P and Sales Growth: 2/75-6/99, 293 Months

At the end of June of each year t (1974-1998), the LSE stocks on DATASTREAM are allocated to ten portfolios, based on the decile breakpoints for BE/ME (book-to-market equity), E/P (earnings/price), C/P (cashflow/price), and past five-year sales rank (5-Yr SR). Equal-weight returns on the portfolios are calculated from July to the following June, resulting in a time series of 293 monthly returns from February 1975 to June 1999. (July 1974 to January 1975 returns are not used due to the fact that Treasury bill rates are not available for these dates). To be included in the tests for a given year, a stock must have data on all of the portfolio-formation variables of this table. Thus, the sample of firms is the same for all variables.

For portfolios formed in June of year t, the denominator of BE/ME is market equity (ME, stock price times shares outstanding) for the end of December of year t – 1. The denominator of E/P and C/P is the share price P taken for the end of December of year t – 1. Book equity BE is defined in the second part of section I. E or earnings per share is taken for the accounting year ending in calendar year t - 1 and is defined as earnings before exceptional items, but after interest, taxes, minorities and preference dividends divided by the average number of shares in issue, (calculated by DATASTREAM). C or cash earnings per share is also taken for the accounting year ending in calendar year t - 1 and is defined as earned for ordinary, plus depreciation, amortisation and non-cash movements divided by the average number of shares in issue, (calculated by DATASTREAM).

The five-year sales rank for June of year t, 5-Yr SR(t), is the weighted average of the annual sales growth ranks for the prior five years, that is,

$$\text{5-Yr SR}(t) = \sum_{j=1}^{5} (6 - j) \quad \text{x} \quad \text{Rank}\,(t - j)$$

The sales growth for year t – j is the percentage change in sales from t – j – 1 to t – j, ln[Sales(t-j)/Sales(t-j-1)]. Only firms with data for all five prior years are used to determine the annual sales growth ranks for years t – 5 to t – 1.

For each portfolio, the table shows the mean monthly return in excess of the one-month Treasury bill rate (Mean), the standard deviation of the monthly excess returns (Std. Dev.) and the ratio of the mean excess return to its standard error [t(mean) = Mean/Std. Dev./ $292^{1/2}$].

	Deciles									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
BE/ME	**Low**									**High**
Mean	0.61	0.68	0.60	0.79	0.85	0.83	1.02	1.17	1.34	1.52
Std. Dev.	5.31	4.75	4.74	4.68	4.86	5.01	5.33	4.86	4.85	5.01
t(Mean)	1.97	2.44	2.15	2.88	3.01	2.82	3.28	4.12	4.74	5.20
E/P	**Low**									**High**
Mean	0.80	0.75	0.89	0.76	0.84	0.95	0.95	1.09	1.18	1.21
Std. Dev.	4.47	4.89	4.75	4.67	4.81	5.02	5.11	5.07	5.24	5.30
t(Mean)	3.07	2.62	3.21	2.79	3.00	3.25	3.17	3.68	3.84	3.90
C/P	**Low**									**High**
Mean	0.40	0.57	0.71	0.72	0.87	0.98	1.03	1.12	1.39	1.64
Std. Dev.	4.71	4.67	4.76	4.81	4.73	5.03	5.14	4.95	5.22	5.25
t(Mean)	1.45	2.10	2.54	2.56	3.16	3.33	3.44	3.86	4.55	5.34
5-Yr SR	**High**									**Low**
Mean	0.64	0.80	0.84	0.88	0.95	0.97	1.00	1.17	0.98	1.17
Std. Dev.	5.63	5.16	5.06	4.98	4.94	4.75	4.71	4.55	4.56	4.71
t(Mean)	1.95	2.66	2.85	3.04	3.28	3.49	3.62	4.40	3.69	4.26

Table IV
Single and Three-Factor Time-Series Regressions for Monthly Excess Returns (in Percent) on Equal Weight Deciles for BE/ME, E/P, C/P and Sales Growth: 2/75-6/99, 293 Months

$$R_i - R_f = \alpha_i + b_i (R_M - R_f) + \varepsilon_i$$
$$R_i - R_f = \alpha_i + b_i (R_M - R_f) + s_i SMB + h_i HML + \varepsilon_i$$

The formation of the BE/ME, E/P, C/P, and five-year-sales-rank (5-Yr SR) deciles is described in Table II. The explanatory returns ($R_M - R_f$), SMB, and HML are described in the second part of section I.

	Deciles									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
BE/ME	**Low**									**High**
a	-0.18	-0.03	-0.11	0.10	0.14	0.10	0.26	0.49	0.68	0.88
b	0.94	0.84	0.83	0.82	0.85	0.86	0.90	0.81	0.79	0.77
t(a)	-1.28	-0.22	-0.82	0.76	1.01	0.67	1.59	3.13	4.14	4.65
t(b)	34.04	33.48	32.99	32.42	32.64	30.31	28.30	26.68	24.61	20.77
R-sq	0.80	0.79	0.79	0.78	0.79	0.76	0.73	0.71	0.68	0.60
Adj-R-sq	0.80	0.79	0.79	0.78	0.78	0.76	0.73	0.71	0.67	0.60
E/P	**Low**									**High**
a	0.17	0.01	0.18	0.07	0.13	0.22	0.21	0.37	0.45	0.52
b	0.74	0.87	0.85	0.83	0.85	0.86	0.88	0.86	0.86	0.82
t(a)	1.21	0.11	1.46	0.53	0.98	1.52	1.38	2.35	2.60	2.64
t(b)	26.41	35.18	35.00	34.20	33.53	30.12	30.24	28.03	25.30	21.35
R-sq	0.71	0.81	0.81	0.80	0.79	0.76	0.76	0.73	0.69	0.61
Adj-R-sq	0.70	0.81	0.81	0.80	0.79	0.76	0.76	0.73	0.69	0.61
C/P	**Low**									**High**
a	-0.25	-0.12	-0.01	0.00	0.19	0.24	0.29	0.42	0.64	0.93
b	0.77	0.82	0.85	0.85	0.82	0.88	0.89	0.82	0.88	0.84
t(a)	-1.55	-0.97	-0.07	0.03	1.36	1.70	1.93	2.66	3.98	5.08
t(b)	24.64	33.70	35.44	33.91	30.66	31.70	30.61	26.46	27.77	23.55
R-sq	0.68	0.80	0.81	0.80	0.76	0.78	0.76	0.71	0.73	0.66
Adj-R-sq	0.67	0.80	0.81	0.80	0.76	0.77	0.76	0.71	0.73	0.65
5-Yr SR	**High**									**Low**
a	-0.19	0.06	0.10	0.17	0.22	0.28	0.32	0.52	0.34	0.52
b	0.98	0.89	0.88	0.85	0.86	0.82	0.81	0.78	0.76	0.78
t(a)	-1.17	0.37	0.71	1.12	1.59	2.03	2.27	3.77	2.35	3.37
t(b)	31.76	29.74	31.82	29.44	31.95	31.09	29.67	29.03	27.10	25.84
R-sq	0.78	0.75	0.78	0.75	0.78	0.77	0.75	0.74	0.72	0.70
Adj-R-sq	0.78	0.75	0.78	0.75	0.78	0.77	0.75	0.74	0.72	0.70

Table IV Continued.

	Deciles									
	1	2	3	4	5	6	7	8	9	10
BE/ME	**Low**									**High**
a	-0.25	-0.15	-0.28	-0.11	-0.13	-0.21	-0.09	0.14	0.30	0.44
b	1.14	1.01	1.01	1.01	1.05	1.06	1.11	1.05	1.04	1.04
s	0.55	0.49	0.50	0.55	0.57	0.58	0.63	0.72	0.74	0.82
h	-0.15	-0.01	0.09	0.14	0.26	0.34	0.42	0.37	0.42	0.50
t(a)	-2.24	-1.46	-2.74	-1.14	-1.45	-2.03	-0.81	1.53	3.14	3.86
t(b)	43.22	42.42	42.96	46.86	50.51	44.83	42.00	51.15	46.89	39.51
t(s)	13.51	13.41	13.91	16.53	17.93	15.98	15.54	22.60	21.67	20.29
t(h)	-2.64	-0.28	1.73	2.85	5.64	6.53	7.11	8.07	8.56	8.62
R-sq	0.88	0.87	0.88	0.89	0.91	0.89	0.88	0.91	0.90	0.86
Adj-R-sq	0.88	0.87	0.88	0.89	0.91	0.89	0.88	0.91	0.90	0.86
E/P	**Low**									**High**
a	-0.03	-0.15	0.03	-0.13	-0.11	-0.03	-0.10	0.04	0.05	0.10
b	0.96	1.06	1.02	0.99	1.04	1.07	1.09	1.07	1.12	1.11
s	0.61	0.54	0.49	0.48	0.55	0.61	0.62	0.63	0.78	0.86
h	0.10	0.06	0.05	0.16	0.21	0.22	0.32	0.36	0.43	0.45
t(a)	-0.25	-1.63	0.32	-1.43	-1.25	-0.31	-1.00	0.37	0.53	0.78
t(b)	38.69	48.96	45.51	45.58	50.30	43.93	46.46	42.66	47.88	38.42
t(s)	15.90	16.12	14.24	14.44	17.42	16.17	17.13	16.36	21.72	19.26
t(h)	1.77	1.24	0.97	3.41	4.60	4.03	6.26	6.57	8.37	6.99
R-sq	0.85	0.90	0.89	0.89	0.91	0.88	0.90	0.88	0.90	0.85
Adj-R-sq	0.85	0.90	0.89	0.89	0.91	0.88	0.89	0.88	0.90	0.85
C/P	**Low**									**High**
a	-0.48	-0.29	-0.20	-0.16	-0.05	-0.02	-0.04	0.10	0.27	0.54
b	0.98	1.00	1.04	1.04	1.02	1.07	1.08	1.05	1.12	1.12
s	0.63	0.49	0.54	0.55	0.58	0.57	0.59	0.68	0.72	0.82
h	0.15	0.09	0.12	0.04	0.19	0.26	0.38	0.33	0.42	0.38
t(a)	-3.90	-2.99	-2.38	-1.67	-0.56	-0.21	-0.39	0.95	2.80	4.84
t(b)	34.70	44.26	52.48	47.56	46.00	45.08	46.02	43.10	49.84	42.99
t(s)	14.37	14.24	17.70	16.18	17.07	15.54	16.24	18.09	20.68	20.52
t(h)	2.42	1.84	2.79	0.89	3.98	4.87	7.36	6.05	8.44	6.55
R-sq	0.82	0.88	0.91	0.90	0.89	0.89	0.90	0.88	0.91	0.88
Adj-R-sq	0.82	0.88	0.91	0.90	0.89	0.89	0.89	0.88	0.91	0.88
5-Yr SR	**High**									**Low**
a	-0.40	-0.20	-0.14	-0.11	-0.03	0.01	0.04	0.23	0.05	0.22
b	1.20	1.12	1.08	1.06	1.07	1.02	1.00	0.96	0.98	1.03
s	0.63	0.69	0.57	0.62	0.61	0.57	0.56	0.56	0.63	0.72
h	0.11	0.18	0.20	0.26	0.20	0.26	0.29	0.32	0.28	0.24
t(a)	-3.29	-2.00	-1.35	-1.08	-0.33	0.08	0.39	2.44	0.51	2.36
t(b)	42.59	47.58	44.63	44.31	50.29	47.68	43.84	44.24	45.26	46.98
t(s)	14.52	18.83	15.41	16.74	18.62	17.41	16.03	16.57	19.00	21.41
t(h)	1.80	3.46	3.84	4.91	4.30	5.59	5.82	6.61	5.93	5.00
R-sq	0.88	0.90	0.89	0.88	0.91	0.90	0.88	0.89	0.89	0.89
Adj-R-sq	0.87	0.89	0.89	0.88	0.91	0.90	0.88	0.89	0.89	0.89

Table V
Summary Statistics for Simple Monthly Percent Excess Returns on Equal Weight Deciles for Negative BE/ME and high BE/ME: 1/83-6/99, 198 Months

The Negative BE/ME portfolio contains all negative stocks used in the R_M-R_F portfolio from 1982 to 1999. The high BE/ME portfolio contains all the BE/ME stocks from the BE/ME portfolio 10 from Table III. Equal-weight returns on the portfolios are calculated from July to the following June, resulting in a time series of 198 monthly returns from January 1983 to June 1999.

	Negative BE/ME	High BE/ME
Mean	0.51	1.23
Stdev	8.48	4.27
t(Mean)	0.84	4.04

Table VI
CAPM Time-Series Regressions for Monthly Excess Returns
(in Percent) on Equal Weight Deciles for Negative BE/ME and high BE/ME:
1/83-6/99, 198 Months

$$R_i - R_f = \alpha_i + b_i (R_M - R_f) + \varepsilon_i$$

The formation of the negative BE/ME portfolio is mentioned in Table V, The high BE/ME portfolio is decile 10 of the BE/ME portfolios in Table II. The explanatory returns ($R_M - R_f$), SMB, and HML are described in the second part of section I.

	Negative BE/ME	High BE/ME
a	-0.11	0.76
b	0.94	0.71
t(a)	-0.21	3.64
t(b)	7.87	15.21
R-Square	0.24	0.54
Adj-R-sq	0.24	0.54

Table VII
Three-Factor Time-Series Regressions for Monthly Excess Returns (in Percent) on Equal Weight Deciles for Negative BE/ME and high BE/ME: 1/83-6/99, 198 Months

$$R_i - R_f = \alpha_i + b_i (R_M - R_f) + s_i SMB + h_i HML + \varepsilon_i$$

The formation of the negative BE/ME portfolio is mentioned in Table V, The high BE/ME portfolio is decile 10 of the BE/ME portfolios in Table II. The explanatory returns ($R_M - R_f$), SMB, and HML are described in the second part of section I.

	Negative BE/ME	High BE/ME
a	-0.47	0.52
b	1.33	0.93
s	1.38	0.79
h	0.58	0.39
t(a)	-1.02	4.26
t(b)	11.66	30.86
t(s)	8.33	18.05
t(h)	2.47	6.28
R-Square	0.47	0.85
Adj-R-sq	0.46	0.85