Explaining the Cross-section of Stock Returns in France: Characteristics or Risk Factors?

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ABSTRACT In this study, the three-factor model of Fama and French and the ‘characteristic model’ of Daniel and Titman are tested using the French Stock Market. Stocks are ranked by size and book to market ratio and then by ex-ante β, HML or SMB loadings. Based on average returns, results reject the factor model with ‘characteristic balanced’ portfolios. In contrast, in time-series regressions, results are consistent with the factor pricing model and inconsistent with the characteristic-based pricing model. Because the value premium is small, conclusions must be interpreted carefully. However, size and market premiums allow more powerful tests of the two models.

KEY WORDS: Asset pricing, anomalies, risk factors, Fama and French model

1. Introduction

The Capital Asset Pricing Model CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966; Black, 1972) is the first and the most widely used model of asset pricing because of its simplicity. It assumes that investors respect the Markowitz mean-variance criterion in choosing their portfolios. The beta revolution has had significant impact on the academic and non-academic financial community. Other factor pricing models attempted to explain the cross-section of average asset returns as the Inter-temporal Capital Asset Pricing Model (Merton, 1973), the Arbitrage Pricing Model (Ross, 1976) and the inter-temporal capital asset pricing model based on consumption (Rubinstein, 1976; Lucas, 1978; Breeden, 1979), among others.

The well-known prediction of the CAPM is that the expected excess return on an asset equals the β of the asset times the expected excess return on the market portfolio, where the β is the covariance of the asset’s return with the return on the market portfolio divided by the variance of the market return. However, Roll (1977) argued that the model is not testable because the tests involve a joint hypothesis on the model and on the choice of the market portfolio.

Moreover, many patterns emerge from empirical studies which are not explained by the CAPM; such as expected returns and earnings to price ratio have a positive relation (Basu, 1977); small capitalizations have higher expected returns than big ones (Banz, 1981); there is a positive relation between the level of debt and stock returns (Bhandari, 1988) or the book to market ratio can be
considered as an explanatory variable in stock returns (Chan et al., 1991 and Fama and French, 1992 on Japanese and American stock markets respectively).

Fama and French (1993) argue that stock returns can be explained by three factors: market, book to market ratio and size. Their model summarizes earlier results (Banz, 1981; Huberman and Kandel, 1987; Chan and Chen, 1991). However, it is much debated: to be a compensation for risk in a multi-factor version of Merton’s (1973) Inter-temporal Capital Asset Pricing Model (ICAPM) or Ross’s (1976) Arbitrage Pricing Theory (APT), factors must be related to state variables that justify a risk premium.

A competing hypothesis of the three-factor model of Fama and French is the model of the characteristics of the firm (Daniel and Titman, 1997). Indeed, Daniel and Titman give a different interpretation for the relation between book to market ratio and stock returns. They reject the assumption of ‘factor of risk’ in favour of the model of ‘the characteristics of the firm’: a low book to market ratio, which is one of the characteristics of large firms, causes a low stock return, which does not, necessarily, correspond to a risk. They show the superiority of their model in comparison to that of the three factors of Fama and French in the case of the New York Stock Exchange. However, Davis et al. (2000) show that this interpretation is specific to the period of study and confirm the results of the three-factor model. In the same way, Lewellen (1999) confirms the superiority of the model of Fama and French (1993) compared to the model of Daniel and Titman (1997).

The aim of this paper is to compare the three-factor Asset Pricing Model of Fama and French (1993) and the ‘Characteristic Model’ of Daniel and Titman (1997) in explaining stock returns in the case of France. We test the two models for a one quarter century period. Our study extends the asset pricing tests in two ways: (a) We expand the test of the three-factor model to the French market for a long period. So our results can be useful for an out-of-sample test of the three-factor model. The main conclusion is that the three-factor model explains the common variation and the cross-section of stock returns. (b) We compare the three-factor model and the characteristic model. This is the first empirical investigation using the French market. Our results, which are based on Daniel and Titman (1997) tests, fail to reject the Fama and French three-factor model.

In the next section, we discuss the theoretical framework of our study. The methodology used and database considered are discussed in the second part of the paper. In Sections 3 and 4, we summarize results and conclude.

2. Theoretical Framework the Three-Factor Model vs. the Characteristic Model

2.1 The Three Factor Model

According to Fama and French (1993), the size and the book to market ratio are considered as factors of risk that we must remunerate. The unconditional version of the model is expressed in the following equation:

$$E(R_i) - R_f = \beta_i (E(R_M) - R_f) + s_i E(SMB) + h_i E(HML) \tag{2.1}$$

with $E(R_i)$ the expected stock return; $R_f$ the risk free rate; $E(R_M)$ the expected return of market portfolio; $E(SMB)$ (Small Minus Big) is the difference between the equal-weight averages of the returns on the three small stock portfolios and the three big stock portfolios; $E(HML)$ (High book to market Minus Low book to market) is 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, sorted to be neutral with respect to size; and $\beta_i, s_i, h_i$: are factor loadings.
Indeed, on the basis of two criteria, size and book to market (BE/ME), Fama and French construct 25 portfolios, from a sample of the stocks of the NYSE, AMEX and NASD over 366 months (from June 1963 to December 1993). Monthly stock returns show a superiority of stocks of small capitalization and high book to market ratio, compared to the stocks of big capitalizations and low book to market ratio. This is why, the two authors propose the following regression:

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i SMB + h_i HML + \epsilon_i \quad (2.2)$$

Except the results on the extremes, the coefficient $\alpha_i$ is not significantly different from zero; which makes it possible to affirm that the three-factor model explains cross-section stock returns.

However, there are many explanations for size and book to market anomalies. Some authors consider that the premium of the financial distress is irrational (Lakonishok et al., 1994; MacKinlay, 1995). Three arguments justify it: it can express an over-reaction of the investors. The second argument is relative to the empirical observation of low stock return of firms with a distressed financial situation, but not necessarily during a period of low rate of growth of the Gross National Product or of low returns of all stocks. Lastly, diversified portfolios of stocks with both high and low ratio book to market, have the same variance of returns.

Other researchers have documented many arguments in favour of the traditional CAPM. Indeed, extrapolation of data can lead to false conclusions, so we need the out-of-sample tests (Data-snooping: Black, 1993b; Black, 1993a; Lo and MacKinlay, 1990). Fama and French (1996b) and Fama and French (1996a) reject this bias. Moreover, the relation between stock returns and the book to market ratio was confirmed by Davis (1994) on data over a long period, Chan et al. (1991) on Japanese data, and Barber and Lyon (1997) on data on financial institutions, among others.

Kothari et al. (1995) give the argument of survivor bias. However, it should be noticed that even if criticism of the survivor bias is true, it is not necessarily in favour of the CAPM (Kim, 1997; Barber and Lyon, 1997).

Finally, the model of asset pricing to be retained is that of the CAPM. Anomalies are a consequence of the unknown market portfolio (bad market proxies: Roll, 1977). This is why the ‘real’ $\beta$s are not observed. This problem is called errors-in-variables (Kim, 1997).

Nevertheless, there have been many attempts to give theoretical explanations for the three-factor model. Berk et al. (1999) give a micro-economic model of the firm which integrates options of growth investments. Simulations of the model give results consistent with the conclusions of the three-factor model. More recently, Ferguson and Shockley (2003) explain that the factor portfolios of Fama and French are correlated with a missing beta risk related to leverage. Empirical application of their model shows that relative leverage and relative distress are powerful in explaining cross-sectional returns.

### 2.2 The Characteristic Model

A competing model of the three factor model of Fama and French is the model of the characteristics of the firm (Daniel and Titman, 1997). Indeed, Daniel and Titman give a different interpretation for the relation between book to market ratio and stock returns. They reject the assumption of ‘factor of risk’ in favour of the model of ‘the characteristics of the firm’: a low book to market ratio, which is one of characteristics of large firms, causes low stock returns which does not, necessarily, correspond to risk.

To understand the difference between the three-factor model and the characteristic model, Daniel and Titman (1998) propose the following example:
We know that people with college degrees earn more. The question is why. One hypothesis (the characteristic model) might be that getting a degree enhances your earning power. An alternative hypothesis (the factor model) is that the degree doesn’t add anything; only IQ is valued. The reason that people with degrees earn more is that the degree proxies for their IQ.

To show the superiority of their model in comparison to that of the three-factor model of Fama and French, Daniel and Titman form two sorts of portfolios: (1) a factor balanced portfolio (FB), which consists in the purchase of stocks of high ratio $B/M$ and low sensitivity to factor $HML \beta_{hml}$ and the sale of stocks of low ratio $B/M$ and of the same sensitivity to factor $HML \beta_{hml}$; and (2) a characteristic balanced portfolio (CB) which has a high sensitivity to factor $HML$. It consists in the purchase and the sale of stocks of high ratio $B/M$ (the purchase and sale are made for the same amount).

The behaviour of these portfolios, with null investment, differs according to the model considered: the average returns of portfolio CB is null according to the characteristic model; while the factor model predicts that the average stock returns of portfolio FB is zero.

Daniel and Titman (1997) reject the factor model for US stocks. However, Davis et al. (2000) show that this interpretation is specific to the period of study and confirm the results of the three-factor model. In the same way, Lewellen (1999) confirms the superiority of the model of Fama and French (1993) compared to the model of Daniel and Titman (1997) in explaining time-varying expected returns on the US market. Daniel et al. (2001) replicate the Daniel and Titman tests on a Japanese sample and fail to reject the characteristic model. Because of these contradictory conclusions, we give in our study another out-of-sample test. We compare the Three-factor Asset Pricing Model of Fama and French (1993) and the Characteristic Model of Daniel and Titman (1997) in explaining stock returns in the case of France.

3. Size and Book to Market Sorted Portfolios

3.1 Database and Methodology

We study monthly returns on stock portfolios for France. Portfolios use all French stocks with the relevant Datastream data. Only the stocks with market and accounting data available are used. The total number of stocks is 636. We consider the period from July 1976 to June 2001 (300 months). As Fama and French (1993), we made two classifications: a book to market classification (three classes: High, Medium and Low) and a size classification (two classes: Big and Small).

Six portfolios (HS, HB, MS, MB, LS, and LB) are formed with the intersection of the two preceding classifications, made yearly and independently. The monthly returns of each portfolio correspond to the value-weight monthly returns of the stocks assigned to the portfolio.

Table 1 shows that portfolios in the smallest size quintile and the lowest book to market quintile and those in the biggest size quintile and the highest book to market quintile contain, on average, less stocks than other portfolios. Like Table 1 in Fama and French (1993), in the smallest (biggest) size quintile, the number of stocks increases (decreases) from lower to higher book to market portfolios. Two portfolios, $HML$ and $SMB$, are formed from the six portfolios presented above.

Table 1 shows average values of explanatory variables. These values give the average risk premiums for the common factors in returns. The average value of excess returns of the market portfolio is 1.134% per month with 3.157 $t$-statistic. Fama and French (1998) documented an average annual value for the market portfolio in the French case of about 11.26% (0.89% per month) and Heston et al. (1999) about 1.21% per month. The average $HML$ return is only 0.597% per month with a 1.758 standard error from zero. The size factor $SMB$ produces an average premium of 0.742% per month and $t$-statistic 2.771.
Table 1. Descriptive statistics for six stock portfolios formed from independent sorts on size and book to market: July 1976/June 2001 (300 months)

| Book to market equity quintile | L   | M   | H   |
|-------------------------------|-----|-----|-----|
| Annual average market value   |     |     |     |
| S                            | 104.99 | 93.65 | 77.49 |
| B                            | 1763.91 | 1396.05 | 1071.28 |
| Annual average book to market ratio |     |     |     |
| S                            | 0.100 | 0.596 | 1.476 |
| B                            | 0.142 | 0.574 | 1.343 |
| Annual average number of stocks |     |     |     |
| S                            | 22.2 | 41.0 | 40.0 |
| B                            | 39.6 | 41.7 | 22.0 |

Explanatory variables

| Correlations | Mktpond. | HML | SMB |
|--------------|----------|-----|-----|
| Mktpond.     | 1.00     |     |     |
| HML          | 0.079    | 1.00|     |
| SMB          | -0.121   | 0.164| 1.00|

Monthly excess returns (in per cent)

|           | Mktpond. | HML | SMB |
|-----------|----------|-----|-----|
| Mean      | 1.134    | 0.597| 0.742|
| Std. Dev. | 6.221    | 5.880| 4.637|
| t-statistic for means | 3.157 | 1.758 | 2.771 |

The sample is composed of 636 French stocks. The six size-book to market portfolios are formed from independent sorts on book to market and size as described in the text. The table gives some characteristics of these six portfolios. Average annual market value is in millions of euros. The table gives correlations, average monthly excess returns and standard deviation for the three explanatory variables, market, HML and SMB.

Unlike Fama and French (1993), Table 1 shows that the HML portfolio returns have a positive correlation with excess market and SMB portfolio returns. SMB and market portfolio have negative correlation. The main observation is that we have low correlation between the three explanatory variables.

4. Size, Book to Market and HML Factor Loadings Sorted Portfolios

4.1 Database and Methodology

Like Daniel and Titman, we use ex-ante observable information to estimate expected future HML factor loading of stocks. We regress each stock’s returns on the three-factor portfolios (Market, HML and SMB) for the period −42 to −7 relative to the portfolio formation date.

Both Daniel and Titman (1997) and Davis et al. (2000), use special factor portfolios to calculate the preformation factor loadings. They consider constant weights for June of year t to returns from date −42 to −7. In our study, we use the Fama and French factor portfolios with variable weights to estimate preformation factor loadings.
Based on independent size and book to market sorts, we place stocks into six groups. Each of the six groups is subdivided into two portfolios based on preformation HML slopes. We obtain 12 portfolios.

Table 2 summarizes the descriptive statistics for the 12 portfolios. The results reveal a positive relation between average monthly excess return and ex-ante factor loading rankings for medium book to market portfolios. However, this positive relationship is reversed for low book to market portfolios. In this book to market group, low factor loading portfolios have, on average, monthly excess returns higher than high factor loading ones. Finally, for the high book to market group, there is no regular pattern between average monthly excess return and ex-ante factor loading rankings.

The three-factor risk model predicts that the high factor loading portfolios have higher average returns than low factor loading portfolios. However, Daniel and Titman (1997) explain this positive relation between mean excess returns and factor loadings as follows: when we sort stocks according to HML factor loading, we may pick up variation in the book to market ratio. We examine

| B/M ratio | Size | HML factor loading class |
|-----------|------|-------------------------|
|           |      | Low | High |
| **Average number of stocks** | | | |
| L | S | 3.3 | 3.5 |
| L | B | 14.8 | 14.0 |
| M | S | 11.2 | 11.3 |
| M | B | 17.5 | 17.5 |
| H | S | 12.3 | 12.5 |
| H | B | 7.7 | 8.0 |
| **Average monthly excess returns (%)** | | | |
| L | S | 1.56 | 1.14 |
| L | B | 1.16 | 0.97 |
| M | S | 1.26 | 1.28 |
| M | B | 0.79 | 1.09 |
| H | S | 3.41 | 2.08 |
| H | B | 1.32 | 1.61 |
| **Standard deviation of monthly excess returns** | | | |
| L | S | 0.099 | 0.091 |
| L | B | 0.066 | 0.061 |
| M | S | 0.066 | 0.065 |
| M | B | 0.063 | 0.070 |
| H | S | 0.284 | 0.085 |
| H | B | 0.076 | 0.080 |

The sample is composed of 410 French stocks. Six size-book to market portfolios are formed. Each of these portfolios is then sorted into one of two sub-portfolios based on their HML loadings in the regression: 

\[ R_i - R_f = \alpha + \beta_{Mkt}(R_{Mkt} - R_f) + \beta_{SMB}R_{SMB} + \beta_{HML}R_{HML}. \]

We use ex-ante observable information to estimate expected future HML factor loading. We regress each stock’s returns on the three-factor portfolios for the period \(-42\) to \(-7\) relative to the portfolio formation date. This table presents the average number of stocks, the mean and standard deviation of the monthly excess returns of the 12 portfolios formed on the basis of size, book to market and the estimated HML factor loadings.
this possibility by calculating the average book to market ratios and the sizes of each of the 12 portfolios. At each yearly formation date, the average book to market ratios and sizes, presented in Table 3, are calculated relative to the median French market.

Like Daniel and Titman, we find some covariation between the average book to market ratio and the \( HML \) factor loading. Indeed, for each size and book to market group, the book to market ratio relative to the median is higher for high \( HML \) factor loadings in comparison with the portfolios with low \( HML \) factor loadings. Moreover, we have no regular pattern for mean size.

The results reported in Tables 2 and 3 indicate that for each size and book to market class, the portfolio with the highest average market value relative to the median has the highest average excess monthly returns.

Otherwise, there is no significant relation between factor loadings and returns. Daniel and Titman report that this pattern assumes that the pre-formation factor loadings are good predictors of post-formation loadings.

**Table 3. Average book to market and size of test portfolios**

| B/M ratio | Size | Factor loading portfolio | Low | High |
|-----------|------|--------------------------|-----|------|
|           |      |                          |     |      |
| Book to market relative to median | |                          |     |      |
| L         | S    | 0.340                    | 0.472 |
| L         | B    | 0.370                    | 0.410 |
| M         | S    | 1.067                    | 1.099 |
| M         | B    | 0.956                    | 1.028 |
| H         | S    | 2.447                    | 2.798 |
| H         | B    | 2.475                    | 2.676 |
| Market equity relative to median | |                          |     |      |
| L         | S    | 0.699                    | 0.651 |
| L         | B    | 29.946                   | 26.853 |
| M         | S    | 0.620                    | 0.654 |
| M         | B    | 17.078                   | 36.235 |
| H         | S    | 0.551                    | 0.548 |
| H         | B    | 9.434                    | 19.562 |

The sample is composed of 410 French stocks. Six size-book to market portfolios are formed. Each of these portfolios is then sorted into one of two sub-portfolios based on their \( HML \) loadings in the regression: \( R_i - R_f = \alpha_i + \beta_M(R_{Mkt} - R_f) + \beta_{SMB}R_{SMB} + \beta_{HML}R_{HML} \). We use ex-ante observable information to estimate expected future \( HML \) factor loading of stocks. We regress each stock’s returns on the three-factor portfolios for the period \(-42\) to \(-7\) relative to the portfolio formation date. At each yearly formation date, the average size and book to market for each portfolio is calculated using value weighting:

\[
\bar{SZ}_t = \frac{1}{\sum_i M_{E_{i,t}}} \sum_i M_{E_{i,t}^2}
\]

\[
\bar{BM}_t = \frac{1}{\sum_i M_{E_{i,t}}} \sum_i M_{E_{i,t}}BM_{i,t}.
\]

Then at each point, and are divided by the median market equity and median book to market of French market. The two time series are then averaged to get numbers that are presented in the table above.
In Table 4, we report the three-factor regressions applied to each of the 12 test portfolios. The market $\beta$s are all more than five standard errors from zero and adjusted $R^2$ ranges from 28.9% to 84.3%.

Moreover, $HML$ slopes are related to book to market ratio. Indeed, for each size-$HML$ loading group, $HML$ slopes increase from negative values for low book to market class to positive values for high book to market class. Similarly, $SMB$ slopes are related to size. In every book to market-$HML$ loading group, $SMB$ slopes decrease from small to big capitalizations.

Table 4 shows also that the post-formation $HML$ slopes reproduce the ordering of the pre-formation slopes only in three cases out of six. Indeed, for big capitalization portfolios ($LB$, $MB$ and $HB$), pre-formation slopes are informative about post-formation slopes: $HML$ coefficient ($h$) is higher for high factor loading portfolios than that for low factor loading portfolios.

### Table 4. Time-series regressions for portfolios formed from sorts on size, book to market and $HML$ slopes: July 1980 to June 2001 (252 months)

|    | $\alpha$ | $\beta$ | $s$ | $h$ | Adjusted $R^2$ | DW |
|----|----------|---------|-----|-----|----------------|----|
| LSl | 0.000    | 0.815   | 0.725 | 0.029 | 0.311 | 1.992 |
|    | (0.007)  | (9.251) | (3.281) | (0.146) |       |     |
| LSh | -0.000   | 0.803   | 0.432 | -0.134 | 0.289 | 2.003 |
|    | (-0.152) | (9.297) | (3.674) | (-1.152) |       |     |
| LBl | 0.000    | 1.017   | -0.001 | -0.108 | 0.843 | 1.938 |
|    | (0.485)  | (29.117) | (-0.016) | (-1.746) |       |     |
| LBh | 0.000    | 0.904   | -0.092 | -0.036 | 0.804 | 1.951 |
|    | (0.387)  | (25.878) | (-2.029) | (-1.028) |       |     |
| MSI | 0.000    | 0.769   | 0.379 | 0.094 | 0.531 | 1.747 |
|    | (0.109)  | (13.110) | (3.011) | (0.803) |       |     |
| MSh | 0.001    | 0.759   | 0.274 | 0.093 | 0.510 | 1.911 |
|    | (0.518)  | (11.865) | (1.960) | (0.716) |       |     |
| MBl | -0.003   | 0.944   | 0.081 | -0.048 | 0.781 | 2.176 |
|    | (-1.732) | (20.945) | (1.637) | (-1.113) |       |     |
| MBh | 0.000    | 1.006   | -0.099 | 0.029 | 0.758 | 2.123 |
|    | (0.184)  | (21.688) | (-1.845) | (0.686) |       |     |
| HSl | -0.021   | 1.497   | 3.004 | 2.799 | 0.778 | 1.952 |
|    | (-2.213) | (5.845) | (4.087) | (3.846) |       |     |
| HSh | 0.005    | 1.009   | 0.427 | 0.150 | 0.547 | 2.162 |
|    | (1.406)  | (9.369) | (1.783) | (0.659) |       |     |
| HBl | 0.002    | 0.985   | -0.085 | 0.207 | 0.644 | 1.967 |
|    | (0.698)  | (17.786) | (-0.866) | (2.382) |       |     |
| H Bh| 0.006    | 0.894   | -0.257 | 0.461 | 0.619 | 2.137 |
|    | (2.006)  | (13.971) | (-2.537) | (5.270) |       |     |

Portfolios are formed based on size (small S and big B), book to market (low L, medium M and high H) and pre-formation $HML$ factor loadings (low l and high h). This table presents each of the coefficients estimates and $t$-statistics from the following time series regression (using least squares and White heteroscedasticity consistent standard errors and covariance):

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i SMB + h_i HML + \epsilon_i.$$
Moreover, the factor model predicts that the regression intercepts should be zero. Ten intercepts have \( t \)-statistics with an absolute value less than 2. This evidence is in favour of the factor model.

Finally, the characteristic model predicts that the intercepts of the low factor loading portfolios should be positive and those of the high factor loading portfolios should be negative. Our results indicate that this is not always the case.

4.2 Empirical Results: the Characteristic-balanced Portfolios Regressions

Like Daniel and Titman (1997), our formal test of the factor model against the characteristic model is based on the intercepts in the time series regressions of the characteristic-balanced portfolio returns on the three-factor Fama and French portfolio returns.

We calculate the returns of ‘characteristic-balanced’ portfolios \((h - l)\). Our version of \((h - l)\) portfolios is the difference between the returns on high \(HML\) factor loading and low \(HML\) factor loading portfolios of each size-book to market group. We form six characteristic-balanced portfolios.

The three-factor risk model predicts that the intercepts of regressions of the returns of these characteristic-balanced portfolios on the Fama and French factor portfolios are indistinguishable from zero. In contrast, the hypothesis of the characteristic model says that the intercepts in the \((h - l)\) time series regressions should be negative.

In addition, the characteristic-based model predicts that the average return of characteristic-balanced portfolios should be indistinguishable from zero because these portfolios are long and short assets with equal characteristics. However, the factor model says that these returns should be positive. The characteristic-balanced portfolios have high loading on the \(HML\) factor. The descriptives statistics of the average returns of the characteristic balanced portfolios are reported in Table 5.

The mean returns of the six characteristic-balanced portfolios, reported in the first column of Table 5, reveal that three of the portfolios have positive mean returns. In addition, all of these means are indistinguishable from zero because they have \( t \)-statistics below two. In other words, this pattern does not reject the characteristic model.

|                  | Mean | Standard deviation | \( t \)-statistic | Probability |
|------------------|------|--------------------|-------------------|-------------|
| **LS\((h - l)\)** | −0.004 | 0.114               | −0.579            | 0.562       |
| **LB\((h - l)\)** | −0.001 | 0.040               | −0.741            | 0.459       |
| **MS\((h - l)\)** | 0.000  | 0.057               | 0.050             | 0.960       |
| **MB\((h - l)\)** | 0.002  | 0.048               | 0.964             | 0.335       |
| **HS\((h - l)\)** | −0.013 | 0.280               | −0.755            | 0.450       |
| **HB\((h - l)\)** | 0.002  | 0.070               | 0.668             | 0.504       |

Portfolios are formed based on size (small S and big B), book to market (low L, medium M and high H) and pre-formation \(HML\) factor loadings (low l and high h). Our version of \((h - l)\) portfolios is the difference between the returns on the high and the low portfolio of each size-book to market group. The average monthly excess returns and their \( t \)-statistic of the six portfolios are reported here.
Table 6. Time-series regression results for the characteristic-balanced portfolios: July 1980 to June 2001

| Portfolio | \( \alpha \) | \( \beta \) | \( s \) | \( h \) | Adjusted \( R^2 \) | DW |
|-----------|---------|---------|--------|--------|---------------|-----|
| LS\((h-l)\) | -0.000  | -0.012  | -0.293 | -0.163 | 0.013         | 2.162 |
|           | (-0.106)| (-0.112)| (-1.305)| (-0.714)|             |      |
| LB\((h-l)\) | -0.000  | -0.112  | -0.091 | 0.072  | 0.029         | 1.961 |
|           | (-0.054)| (-2.200)| (-1.501)| (1.310)|             |      |
| MS\((h-l)\) | 0.001   | -0.010  | -0.104 | -0.001 | -0.004        | 2.046 |
|           | (0.325) | (-0.152)| (-1.703)| (-0.026)|             |      |
| MB\((h-l)\) | 0.003   | 0.062   | -0.180 | 0.078  | 0.032         | 2.181 |
|           | (1.154) | (0.978) | (-2.769)| (1.548)|             |      |
| HS\((h-l)\) | 0.026   | -0.487  | -2.576 | -2.649 | 0.599         | 2.026 |
|           | (2.107) | (-1.386)| (-2.686)| (-2.802)|             |      |
| HB\((h-l)\) | 0.004   | -0.090  | -0.172 | 0.254  | 0.041         | 2.068 |
|           | (1.029) | (-1.008)| (-1.297)| (2.353)|             |      |

Portfolios are formed based on size, book to market and pre-formation HML factor loadings. Our version of \((h-l)\) portfolios is the difference between the returns on the high and the low portfolio of each size-book to market group. This table presents each of the coefficients estimates and \( t \)-statistics from the following time series regression (using least squares and White heteroscedasticity consistent standard errors and covariance):

\[
R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i SMB + h_i HML + \epsilon_i.
\]

In contrast, the results reported in Table 6 reveal that all the intercepts, but one, from the time-series regressions of the six characteristic-balanced portfolio returns on the three-factor returns have \( t \)-statistics below two. These results are consistent with the factor pricing model and inconsistent with the characteristic-based pricing model. However, because the value premium (see Table 1) is relatively small, we cannot produce a conclusive contest between the risk model and the characteristic model.

5. Size, Book to Market and SMB Factor Loadings Sorted Portfolios

We construct a set of portfolios in the manner described in the previous section. However, rather than using the pre-formation HML factor loading, we consider SMB factor loadings. We note that for the period considered (July 1980 to June 2001), the size premium (average monthly excess return of SMB) is about 0.88\% per month with a \( t \)-statistic of 2.974.

As shown with the HML slopes, we note that the pre-formation SMB slopes are good estimators of post-formation slopes in the case of big capitalizations. Then, both SMB and HML slopes are in relation to size and book to market classifications respectively. Our results are consistent with the Fama and French predictions (for more details see Lajili, 2003).

Monthly returns of ‘characteristic-balanced’ portfolios \((h-l)\) are calculated in the same manner as in the previous section. All means are not significantly different from zero. This result suggests that we cannot reject the hypothesis of Daniel and Titman.

Time-series regressions of monthly returns of the six characteristic-balanced portfolios on the three factors are presented in Table 7. Only intercepts of low book to market portfolios are negative. Moreover, all \( t \)-statistics of intercepts, but two, are below two. All these results are in favour of the three-factor model.
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Table 7. Time-series regression results for the characteristic-balanced portfolios: July 1980 to June 2001

|          | α   | β   | s     | h     | Adjusted $R^2$ | DW |
|----------|-----|-----|-------|-------|----------------|----|
| LS($h - l$) | -0.009 | 0.017 | -0.026 | 0.203 | -0.000        | 2.055 |
|          | (-1.426) | (0.166) | (-0.152) | (1.209) |               |     |
| LB($h - l$) | -0.005 | 0.085 | 0.397 | -0.333 | 0.230         | 2.210 |
|          | (-2.093) | (1.467) | (4.476) | (-4.698) |               |     |
| MS($h - l$) | 0.001 | 0.018 | -0.055 | -0.040 | -0.008        | 2.190 |
|          | (0.340) | (0.248) | (-0.784) | (-0.867) |               |     |
| MB($h - l$) | 0.001 | -0.153 | 0.153 | 0.022 | 0.062         | 1.912 |
|          | (0.422) | (-2.342) | (1.741) | (0.320) |               |     |
| HS($h - l$) | 0.022 | -0.371 | -1.916 | -2.201 | 0.584         | 1.909 |
|          | (2.234) | (-1.307) | (-2.532) | (-2.962) |               |     |
| HB($h - l$) | 0.000 | 0.142 | 0.520 | -0.376 | 0.151         | 2.319 |
|          | (0.177) | (1.285) | (3.544) | (-3.008) |               |     |

Portfolios are formed based on size, book to market and pre-formation SMB factor loadings. Our version of ($h - l$) portfolios is the difference between the returns on the high and the low portfolio of each size-book to market group. This table presents each of the coefficients estimates and $t$-statistics from the following time series regression (using least squares and White heteroscedasticity consistent standard errors and covariance):

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i SMB + h_i HML + \epsilon_i.$$

6. Size, Book to Market and β Factor Loadings Sorted Portfolios

The market premium is about 1.11% per month with a $t$-statistic of 2.937 for the period from July 1980 to June 2001. Again, the pre-formation slopes are informative about the post-formation slopes because the post-formation $\beta$ slopes do reproduce the ordering of the pre-formation ones (except in the case of big capitalizations with medium book to market ratio).

Moreover, in every size-$\beta$ group, slopes of HML portfolio ($h_i$) are higher for the high book to market group than for the low ratio group. The positive relation between book to market classification and $h_i$ coefficients is confirmed. However, only four coefficients are significant. In the same manner, we observe a negative relation between size classification and $s_i$ coefficients. In every book to market-$\beta$ group, small capitalizations have higher $s_i$ slopes than large ones.

Finally, ten intercepts are indistinguishable from zero and all $\beta$s are significant. The average adjusted $R^2$ is about 59.8%. The three factors, and especially the market and size portfolios, do a good job in explaining time-series variation of portfolio returns.

All means of monthly returns of ‘characteristic-balanced’ portfolios ($h - l$) are not significantly different from zero. They range from $-0.8\%$ to $1.4\%$ per month: the hypothesis of Daniel and Titman cannot be rejected.

Time series regressions of characteristic-balanced portfolios on the three factors of Fama and French are summarized in Table 8. All intercepts, but one, are indistinguishable from zero, which suggests that the three-factor model cannot be rejected.

7. Summary and Conclusions

This paper examines French stock returns for the period from July 1976 to June 2001. The value premium in average stock returns is only about $0.597\%$ per month ($t$-statistic = 1.758).
Table 8. Time-series regression results for the characteristic-balanced portfolios: July 1980 to June 2001

|          | α      | β      | s      | h      | Adjusted $R^2$ | DW   |
|----------|--------|--------|--------|--------|----------------|------|
| LS$(h-l)$ | −0.009 | 0.298  | 0.279  | 0.026  | 0.020          | 2.103|
|          | (−1.360) | (2.765) | (1.428) | (0.133) |                |      |
| LB$(h-l)$ | −0.002 | 0.079  | 0.019  | −0.095 | 0.016          | 2.082|
|          | (−0.716) | (1.151) | (0.317) | (−1.850) |                |      |
| MS$(h-l)$ | −0.004 | 0.098  | −0.043 | −0.055 | 0.003          | 2.044|
|          | (−1.141) | (1.465) | (−0.566) | (−0.836) |                |      |
| MB$(h-l)$ | 0.000  | −0.010 | 0.123  | −0.076 | 0.013          | 2.139|
|          | (0.140) | (−0.202) | (2.049) | (−1.829) |                |      |
| HS$(h-l)$ | −0.022 | 0.747  | 2.191  | 2.135  | 0.626          | 2.006|
|          | (−2.217) | (2.731) | (2.996) | (2.949) |                |      |
| HB$(h-l)$ | −0.006 | 0.098  | −0.408 | 0.112  | 0.060          | 2.287|
|          | (−1.468) | (0.746) | (−3.121) | (1.139) |                |      |

Portfolios are formed based on size, book to market and pre-formation β factor loadings. Our version of $(h-l)$ portfolios is the difference between the returns on the high and the low portfolio of each size-book to market group. This table presents each of the coefficients estimates and $t$-statistics from the following time series regression (using least squares and White heteroscedasticity consistent standard errors and covariance):

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i SMB + h_i HML + \epsilon_i.$$  

However, the size effect in average returns, measured by $SMB$ portfolio, as well as the market premium, are robust. They are respectively 0.742% and 1.134% per month with $t$-statistics of 2.771 and 3.157. Despite the small value premium, we carry out tests to compare the risk model of Fama and French (1993) and the characteristic-based model of Daniel and Titman (1997).

To test the two models, we use Daniel and Titman methodology to construct characteristic-balanced portfolios. The characteristic-based model predicts that these portfolios should have a return of zero on average. These portfolios are long and short assets with equal characteristics.

However, the factor model says that these returns should be positive because the characteristic-balanced portfolios have high loading on the $HML$ factor (or $SMB$ or $\beta$ loadings). Our results reject the factor model with characteristic balanced portfolios that load on the $HML$, $SMB$ and $\beta$ factors.

Moreover, the three-factor risk model predicts that the intercepts of time series regressions of the returns of these characteristic-balanced portfolios on the Fama and French factor portfolios are indistinguishable from zero. In contrast, the hypothesis of the characteristic model says that these intercepts should be negative. Our results reveal that except in few cases, all the intercepts have $t$-statistics below two. These results are consistent with the factor pricing model and inconsistent with the characteristic-based pricing model.

In conclusion, the methodology proposed by Daniel and Titman to distinguish factor model and characteristic model does not allow one to make clear conclusions about the French case. Despite its shortcomings, the three-factor model gives more conclusive results. These shortcomings are not those predicted by the characteristic model. In a pragmatic way, we can say that the three-factor model is a good tool to describe returns. It can be useful for many fields in finance such as portfolio analysis, performance evaluation or corporate finance. However, the debate regarding its theoretical legitimacy remains open.
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