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On the Cross-section of Expected Stock Returns: Fama-French Ten Years Later

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Abstract

We examine the explanatory power of size and book-to-market (BM) in the cross-section of stock returns over various sample periods, especially for the period after the papers that highlight the size and BM effects are published. The empirical results indicate that overall the predictive ability of size and BM diminishes for the periods 1982-2001 and 1990-2001, respectively. Further investigation, however, reveals that size effect remains significant in January, and BM remains significant in non-January months even after the 1980s.

Key words: Fama and French, Size, Book to Market, Cross-sectional Stock Returns, Least Trimmed Squares
JEL classification: G0, G1, G2

1. INTRODUCTION

Rationality-based asset-pricing models assert that the cross-section of expected stock returns can be explained by betas or factor loadings on a set of common factors. Early evidence in the 1970s largely supports the Sharpe-Lintner-Black capital asset-pricing model (CAPM) and the efficient market hypothesis (EMH) (Fama, 1991). The seminal work of Fama and French (1992), however, identified market value (size) and the ratio of book to market equity (BM) as the two major determinants of the cross-sectional expected returns, and sentenced the "death" of beta. The publication of this work initiates the war on the life and death of beta, as well as the competition between the rational school and the behavioral school (Fama and French (1998) and Davis, Fama and French (2000)).[1]

Cross-sectional regularities such as size and BM have been perceived as asset-pricing anomalies that are inconsistent with the mainstream theories. Anomalies may stem from (1) chance results or data mining, (2) market frictions (transaction cost), (3) outliers or extreme observations, (4) incorrect model specification, (5) improper measures of risks, or (6) market inefficiency (see Knez and Ready (1997), Fama and French (1998), Hawainini and Keim (2000), and Schwert (2002)). Fama and French (1993) view size and BM as variables capturing certain distressed factors that are not included in the CAPM, and propose a three-factor model *a la* Merton's intertemporal asset-pricing model or Ross's arbitrage pricing theory (APT).[2] In contrast, based on extensive psychological findings on the non-rational aspects of human beings, behavioral finance theories view these anomalies as a result of investors' irrationality.

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[1] For example, based on the keywords "cross-section(al)" and "stock returns," search of article titles on Econlit database alone (up to the year of 2003) yields a result of 33 papers in finance journals, of which 17 papers are published in renowned journals like Journal of Finance, Journal of Financial Economics, Review of Financial Studies, and Journal of Financial Quantitative Analysis.

[2] Yet Cochrane (2001) suggests that such distressed factor is firm specific and is not "pervasive." Thus, the three-factor model does not really conform to the spirit of the APT.

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Hawanini and Keim (2000) provide a nice survey on the cross-section of stock returns, and claim that many anomalies appear to be only significant during the month of January. Hence, they cast doubt on the risk-based explanation because it appears to be implausible that the markets are systematically riskier only in January.

Notably, Schwert (2002) points out that anomalies such as size effect, the value effect, the weekend effect and the dividend yield effect seem to have weakened or simply disappeared after the papers that highlighted them were published. Based on time-series regression, Schwert (2002) examines the significance of the Jensen's alphas for the size and value portfolios constructed by the Dimensional Fund Advisors (DFA) over various sample periods. His results indicate that the estimate of abnormal return for the small company portfolio is 0.0020 (with a t-statistic of 0.67) for the sample period (1982-2002) after Banz's (1981) paper is published. Also, the estimate of abnormal returns is –0.0022 (with a t-statistic of –0.59) for the value portfolio for the period (1994-2002) after Fama and French's (1992) paper is published. Since both estimates are insignificantly different from zero, Schwert (2002) asserts that practitioners that began investment vehicles that implemented the strategies implied by some of these academic papers cause the anomalies to disappear. Thus, Schwert suggests that research findings cause the market to become more efficient.

If Schwert (2002) is correct, will size and BM still be able to account for the cross-section of stock returns? Indeed, if the documented anomalies were of any economic significance, one would expect that the anomalies will disappear as time goes by when the market participants perceive the profitable opportunities embedded in the anomalies or when a more appropriate pricing model is developed or proposed. If the anomalies are the results of chance or of being "overlooked," then their significance will diminish out of samples.

Thus, it is of interest to reexamine the role of size and BM in explaining the cross-section of stock returns for samples beyond the papers that highlight them. Insignificance of size and BM for out of samples would be supportive of Schwert's assertion that markets are becoming more efficient. If size and BM retain their explanatory power, Fama and French's (1992, 1993) risk-based argument would be more evident because it is unreasonable for a behavior-induced anomaly to persist for a long time, especially long after they were explicitly made known to the public.

In this paper, we focus on the explanatory power of size and BM in explaining the cross-section of stock returns. More specifically, following Fama and French's (1992) methodology, we examine the "out-of-sample" predictive power of size and BM. The rest of the paper proceeds as follows. The next section briefly describes the data and the methodology. Section 3 presents the empirical results, while the last section concludes the paper.

2. DATA AND METHODOLOGY

We use the same data selection procedure as in Fama and French (1992), except that our data period is extended to more recent years, which is from July of 1963 through December of 2001. The data include all nonfinancial firms in the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Nasdaq in the Center for Research in Security Prices (CRSP) files. Accounting information is obtained from the COMPUSTAT database. Stocks are assigned the post-ranking β, obtained by the same procedure as in Fama and French, of the size-β portfolio to which they belong at the end of June of year t. Book-to-market is the natural logarithm of the ratio of the book value to market value at year t - 1. Size is the natural logarithm of market value as of June 30 at year t. These regressors are matched with the firm's returns from July through June of year t.

Fama and MacBeth (1973) suggested a procedure for calculating the factor premia and their test statistics. A cross-sectional regression is performed each month, and the resulting time-series of monthly coefficients are averaged. The significances of these average coefficients are based on the time-series standard deviations of the monthly coefficients.

3. EMPIRICAL RESULTS

The empirical results are summarized in Tables 1 and 2. Table 1 presents the results over the full sample from July 1963 through December 2001 and over various subsamples of different time cut-offs. As in Fama and French (1992), Panel A of Table 1 indicates that over the full sample period, there is a significant negative relationship between size and stock returns, and a significant positive relationship between BM and stock returns. Again, the relationship between beta and stock returns is still flat.

The second and third rows of Panel A are results for subperiods using 1981- the publication year of Banz's size paper - as the cut-off point. Interestingly, the results reveal that the coefficient of size diminishes for the "out-of-sample" period 1982-2001. The last two rows are results for subperiods using 1990 as the cut-off point, which is roughly the end of Fama and French's (1992) sample period. The results indicate that BM has a significant positive coefficient of 0.28 for the period 1963-1989, but the coefficient is significant for the post-sample 1990-2001 (t-statistic = 1.13). Thus, the empirical results support Schwert's (2002) assertion that the explanatory power of these two characteristics disappears after the papers highlighting them are published.

Table 1. Average Coefficients of Fama-MacBeth Regressions: No Trimming

	β	**ln(ME)**	**ln(BE/ME)**
Panel A: All Months			
1963/07 – 2001/12	0.03 (0.14)	-0.13 (-2.97)	0.24 (3.92)
1963/07 – 1981/12	0.26 (0.78)	-0.17 (-2.61)	0.24 (2.71)
1982/01 – 2001/12	-0.17 (-0.47)	-0.11 (-1.64)	0.24 (2.82)
1963/07 – 1989/12	-0.11 (-0.42)	-0.13 (-2.54)	0.28 (4.28)
1990/01 – 2001/12	0.36 (0.66)	-0.15 (-1.59)	0.15 (1.13)
Panel B: January			
1963/07 – 2001/12	3.97 (3.02)	-1.61 (-8.28)	0.01 (0.04)
1963/07 – 1981/12	2.92 (1.69)	-1.75 (-6.97)	1.06 (3.26)
1982/01 – 2001/12	4.91 (2.50)	-1.48 (-5.02)	-0.93 (-2.10)
1963/07 – 1989/12	2.89 (2.27)	-1.43 (-6.88)	0.62 (2.16)
1990/01 – 2001/12	6.30 (2.03)	-1.99 (-4.85)	-1.30 (-1.92)
Panel C: Non-January			
1963/07 – 2001/12	-0.32 (-1.35)	0.00 (-0.07)	0.26 (4.31)
1963/07 – 1981/12	0.02 (0.07)	-0.03 (-0.49)	0.17 (1.85)
1982/01 – 2001/12	-0.63 (-1.87)	0.02 (0.34)	0.35 (4.27)
1963/07 – 1989/12	-0.38 (-1.47)	-0.01 (-0.26)	0.25 (3.76)
1990/01 – 2001/12	-0.18 (-0.37)	0.02 (0.20)	0.28 (2.22)

Panel B of Table 1 presents the results on the months of January. An interesting, yet unexpected result is that beta significantly accounts the cross-sectional variation in stock returns in January. The coefficients of beta are significantly positive for the full sample period and various sub-periods, except for the early years (1963-1981). The coefficients of size are significantly negative for every scenario, suggesting the existence of a significant January-size effect. The last two rows of Panel B indicate that the BM premium is significantly positive in January before 1990, but becomes significantly negative after 1990. Turning to Panel C of Table 1, it can be seen that for non-January months, size is never significant, but BM is always significantly positive, even for the last subsample (1990-2001).

Our empirical results suggest that while size and BM effect appear to fail to survive for "out-of-samples," the two effects actually survive *all* the time. Our results actually identify size as a January effect, and BM as a non-January effect. There exists puzzling seasonality in both effects, and research findings have not yet caused the markets to become efficient.

Table 2. Average Coefficients of Fama-MacBeth Regressions: 5% Trimming

	β	ln(ME)	ln(BE/ME)
Panel A: All Months			
1963/07 – 2001/12	-0.40 (-1.73)	0.22 (5.79)	0.39 (7.05)
1963/07 – 1981/12	-0.16 (-0.49)	0.10 (1.91)	0.27 (3.18)
1982/01 – 2001/12	-0.62 (-1.89)	0.33 (6.28)	0.50 (7.08)
1963/07 – 1989/12	-0.49 (-1.89)	0.16 (3.56)	0.35 (5.45)
1990/01 – 2001/12	-0.20 (-0.42)	0.36 (4.94)	0.48 (4.49)
Panel B: January			
1963/07 – 2001/12	3.28 (3.03)	-0.87 (-5.38)	0.57 (2.19)
1963/07 – 1981/12	2.52 (1.58)	-1.22 (-5.62)	1.38 (4.25)
1982/01 – 2001/12	3.95 (2.66)	-0.55 (-2.53)	-0.16 (-0.51)
1963/07 – 1989/12	2.51 (2.11)	-0.87 (-4.46)	1.00 (3.66)
1990/01 – 2001/12	4.93 (2.18)	-0.86 (-2.88)	-0.36 (-0.75)
Panel C: Non-January			
1963/07 – 2001/12	-0.73 (-3.24)	0.32 (9.03)	0.38 (6.72)
1963/07 – 1981/12	-0.39 (-1.24)	0.22 (4.56)	0.18 (2.05)
1982/01 – 2001/12	-1.03 (-3.26)	0.41 (8.13)	0.56 (8.00)
1963/07 – 1989/12	-0.75 (-2.96)	0.25 (6.14)	0.29 (4.52)
1990/01 – 2001/12	-0.66 (-1.47)	0.47 (6.99)	0.56 (5.24)

As a robustness check, we employ the least trimmed squares method, suggested by Knez and Ready (1997), to examine how the results are affected by extreme observations. Panel A of Table 2 indicates that the coefficients of size become significantly positive for all samples after the five-percent extreme observations are trimmed from the regressions. Panels B and C of Tables 2 reveal that the coefficients of size remain significantly negative in January and significantly positive in non-January months. Therefore, the results confirm Knez and Ready's (1997) findings that there is overall a *positive* relationship between size and stock returns. The negative relationship is entirely driven by the overwhelming negative relationship in January.

Regarding the BM effect, the results in Table 2 show that the coefficients of BM are mostly positive. The only exception is that after the 1980s, its coefficient becomes negative, but insignificant, in the months of January (see Panel B of Table 2). Overall, our empirical results suggest that size effect survives, but only in January, and that the BM effect also survives, but mainly in non-January months.

4. CONCLUSION

We reexamine the role of size and BM in the cross-section of expected stock returns. We find that size effect becomes insignificant during the post-1981 period, and BM effect becomes insignificant during the post-

1990 period. The results appear to echo Schwert's (2002) assertion that research findings make the markets more efficient. Further robustness check on various subperiods reveals that size effect still survives in January months, and BM effect survives in non-January months. Thus, research findings seem to have not yet caused the markets to become efficient, and the puzzling seasonality in both effects remains an important issue that merits further investigation.

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This paper studies the cross-sectional properties of return forecasts derived from Fama-MacBeth regressions. These forecasts mimic how an investor could, in real time, combine many firm characteristics to obtain a composite estimate of a stockâ€™s expected return. Empirically, the forecasts vary substantially across stocks and have strong predictive power for actual returns. For example, using ten-year rolling estimates of Fama-MacBeth slopes and a cross-sectional model with 15 firm characteristics (all based on low-frequency data), the expected-return estimates have a cross-sectional standard d Fama and French (1992a) use the cross-section regressions of Fama and MacBeth (1973): the cross-section of stock returns is regressed on variables hypothesized to explain average returns. It would be difficult to add bonds to the cross-section regressions since explanatory variables like size and book-to-market equity have no obvious meaning for government and corporate bonds. This paper uses the time-series regression approach of Black, Jensen, and Scholes (1972). Monthly returns on stocks and bonds are regressed on the returns to a market portfolio of stocks and mimicking portfolios for size In their critique of Fama-French, Kothari, Shanken & Sloan took aim at the time period chosen is biased by 6-9% for the time period chosen: Journal of Finance, March 1995 "Another look at the cross-section of expected stock returns" S.P. Kothari; Jay Shanken; Richard G. Sloan. Dongcheal Kim's article argues that the Fama & French model had errors in estimates of beta which would wipe out the apparent gains of small cap and value stocks: Journal of Finance, December, 1995 "The errors in the variables problem in the cross-section of expected stock returns" Dongch