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Book-to-Market Equity, Distress Risk, and Stock Returns

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ABSTRACT

This paper examines the relationship between book-to-market equity, distress risk, and stock returns. Among firms with the highest distress risk as proxied by Ohlson's (1980) O-score, the difference in returns between high and low book-to-market securities is more than twice as large as that in other firms. This large return differential cannot be explained by the three-factor model or by differences in economic fundamentals. Consistent with mispricing arguments, firms with high distress risk exhibit the largest return reversals around earnings announcements, and the book-to-market effect is largest in small firms with low analyst coverage.

ONE PROMINENT EXPLANATION OF THE book-to-market equity premium in returns is that high book-to-market equity firms are assigned a higher risk premium because of the greater risk of distress.[1] Consistent with this view, Fama and French (1995) and Chen and Zhang (1998) show that firms with high book-to-market equity (BE/ME) have persistently low earnings, higher financial leverage, more earnings uncertainty, and are more likely to cut dividends compared to their low BE/ME counterparts. In contrast, Dichev (1998) uses measures of bankruptcy risk proposed by Ohlson (1980) and Altman (1968) to identify firms with a high likelihood of financial distress and finds that these firms tend to have low average stock returns. Dichev's results appear to be inconsistent with the view that firms with high BE/ME earn high returns as a premium for distress risk.[2]

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[1] While Fama and French (1992) and others document the importance of the book-to-market premium in U.S. returns, it has also been shown by Chan, Hamao, and Lakonishok (1991), Capaul, Rowley, and Sharpe (1993), Hawawini and Keim (1997), Fama and French (1998), and Griffin (2002), among others, to exist in many foreign markets as well.

[2] Using a different measure of distress risk, Shumway (1996) finds some evidence that firms with high distress risk do earn higher returns.

Using Ohlson's measure of the likelihood of bankruptcy (O-score) as a proxy for distress risk, we show that the group of firms with the highest risk of distress includes many firms with high BE/ME ratios and low past stock returns, but actually includes more firms with low BE/ME ratios and high past stock returns.[3] Among firms in the high O-score quintile, those with high BE/ME ratios exhibit characteristics traditionally associated with distress risk, such as weak earnings, high leverage, and low sales growth. The subsequent returns of these firms, however, are only slightly higher than returns of other high BE/ME firms, and intercepts from the Fama and French (1993) model are not significantly different from zero. Thus, for these firms, O-score does not seem to contain information about distress risk beyond that contained in their high BE/ME ratios.

In contrast to these findings, the characteristics of high O-score firms with low BE/ME ratios do not appear to be consistent with high levels of distress risk. Although these firms have weak current earnings, they have higher capital and R&D expenditures than any other group of firms and have relatively high sales growth. Interestingly, these firms earn subsequent returns that are significantly lower than those of other low BE/ME firms. In fact, the average returns for this group of firms are roughly similar to the risk-free rate. Our results show that the low average returns of firms with high distress risk documented by Dichev (1998) are driven by the poor stock price performance of these low BE/ME firms.

One possible explanation for the low returns earned by high O-score firms with low BE/ME ratios is that they are less risky than other firms. However, this does not appear to be the case. The low BE/ME firms in the highest O-score quintile exhibit factor loadings in the three-factor model of Fama and French (1993) that are higher in absolute magnitude than those of other low BE/ME firms.[4] Additionally, the model leaves average annual pricing errors of negative 9.6 percent for these firms. We also do not find evidence that the low BE/ME ratios of these firms are reflected in their profitability. In contrast to results in Fama and French (1995), low BE/ME firms in the high O-score quintile exhibit earnings persistently below those of other firms. These firms are also the most likely to be delisted from CRSP for performance reasons.

[3] Dichev (1998) finds that O-score predicts CRSP delistings better than Altman's (1968) *Z*-score. Because of this, we focus primarily on O-score, but show that our results are also similar when we identify firms with high distress risk using *Z*-score. Using an overall measure of economic strength like O-score should have substantial benefits for segmenting firms compared to using any single measure of economic stability. For example, high leverage may be a sign of relative distress for many firms, but not for an efficiently run firm in a growing industry. A similar argument is made by Cleary (1999) in his analysis of the relationship between investment and financial status of firms.

[4] This finding is similar to that in Daniel and Titman (1997), who also find that differences in factor loadings are not related to differences in average returns, after controlling for differences in book-to-market ratios. Ferson and Harvey (1999) find that even conditional versions of these factor loadings cannot fully explain the cross section of stock returns.

An alternative explanation for the return patterns we document is that low book-to-market stocks are overpriced and high book-to-market stocks are underpriced (e.g., Lakonishok, Shleifer, and Vishny (1994)). We argue that any mispricing is likely to be most pronounced in firms with a high degree of information asymmetry and where rational arbitrage is less likely to be effective. Consistent with this idea, firms in the highest O-score quintile tend to be small firms with low analyst coverage. They also have weak current fundamentals, which may make them more difficult to value. Following Chopra, Lakonishok, and Ritter (1992), La Porta (1996), and La Porta et al. (1997), we examine returns around subsequent earnings announcements. Consistent with the mispricing argument, we find that the difference in abnormal earnings announcement returns between high and low BE/ME stocks is largest for firms in the highest O-score quintile. We also sort firms based on size and analyst coverage and find that both variables play an important role in explaining the book-to-market effect. Small firms with low analyst coverage exhibit a return difference between high and low BE/ME firms of 16.49 percent per year, as compared to negative 2.64 percent per year for large firms with high analyst coverage. Moreover, similar to our findings using O-score, low BE/ME firms with low analyst coverage earn abnormally low returns.

Lakonishok et al. (1994) suggest that mispricing arises from investors extrapolating past operating performance too far into the future. In contrast, we find the strongest evidence of mispricing in firms with weak current operating performance. High O-score firms with low BE/ME tend to look like other low BE/ME firms in that they are concentrated in industries with high sales growth and relatively high R&D and capital spending, yet these firms have little or no current earnings. In spite of this, however, investors award these firms with higher valuation ratios (relative to both book equity and sales) than other low BE/ME firms. Overall, the evidence suggests that investors may underestimate the importance of current fundamentals and overestimate the payoffs from future growth opportunities for low BE/ME firms in the high O-score group.

The remainder of the paper is organized as follows. Section I describes the sample and provides summary statistics for portfolios formed according to O-score, BE/ME, and market capitalization. Section II documents return patterns for these portfolios. Section III examines whether the return patterns can be explained by differences in risk and Section IV examines whether they are consistent with mispricing. Section V discusses and evaluates possible interpretations of our findings. A brief conclusion follows in Section VI.

I. Data and Summary Statistics

The sample is constructed in a manner similar to Fama and French (1992). Nonfinancial NYSE, Nasdaq, and AMEX stocks with monthly returns from CRSP and with nonnegative book values of equity available from COMPUSTAT are examined from July 1965 to June 1996. Stocks are ranked each June

according to their previous December book-to-market equity ratio and June market capitalization. Ohlson's (1980) measure of the probability of financial distress (O-score) is also calculated using accounting values from the previous December for the June rankings.[5]

To separately examine the relationship between BE/ME and O-score, portfolios are formed from three independent rankings on BE/ME, five rankings on O-score, and two rankings on market capitalization (size). The three rankings on BE/ME use 30th and 70th percentile breakpoints. For brevity, we mainly report size-adjusted data, which are formed from a simple average of the means or medians of the small and large firm groups. More detailed controls for size are also performed and discussed throughout the paper. We calculate annual value-weighted buy-and-hold returns and adjust for delisting bias using the method suggested by Shumway (1997).

Table I presents summary statistics of the characteristics of the stocks in each group. Within the first four quintiles of O-score, low BE/ME firms exhibit similar probabilities of bankruptcy to those of high BE/ME firms. Within the highest quintile of O-score, however, low BE/ME firms have the highest probability of bankruptcy at 19.4 percent, while high BE/ME firms have lower probabilities of bankruptcy at 8.7 percent. Within the high BE/ME group, the median book-to-market ratio increases monotonically from 1.424 to 1.651 as firms move from low to high O-score. In contrast, within the low BE/ME group, firms with high O-score exhibit the lowest median book-to-market ratio at 0.267. Finally, the table also shows that there are actually more firms in the high O-score group with low BE/ME ratios than firms with high BE/ME ratios. Dichev (1998) also finds that O-score has a relatively low correlation with the BE/ME ratio.[6]

Given the high probabilities of financial distress, the low BE/ME ratios of firms in the high O-score group are puzzling. One possibility is that the low BE/ME ratios of these firms are driven by low book values rather than high

[5] The variable O-score is defined as:

$$\begin{aligned} \textit{O-score} = {} & -1.32 - 0.407 \log(\textit{total assets}) \\ & + 6.03\left(\frac{\textit{total liabil.}}{\textit{total assets}}\right) - 1.43\left(\frac{\textit{working capital}}{\textit{total assets}}\right) + 0.076\left(\frac{\textit{current liabil.}}{\textit{current assets}}\right) \\ & -1.72 \text{ (1 if total liabilities} > \text{total assets, 0 if otherwise)} \\ & -2.37\left(\frac{\textit{net income}}{\textit{total assets}}\right) - 1.83\left(\frac{\textit{funds from operations}}{\textit{total liabil.}}\right) \\ & + 0.285 \text{ (1 if a net loss for the last two years, 0 otherwise)} \\ & -0.521\left(\frac{\textit{net income}_t - \textit{net income}_{t-1}}{|\textit{net income}_t| + |\textit{net income}_{t-1}|}\right). \end{aligned}$$

[6] Over the entire sample, the Spearman rank correlation between O-score and BE/ME is 0.052. Dichev also finds a small positive correlation between O-score and BE/ME. Dichev's sample includes firms with negative BE/ME and covers only the 1981 to 1995 period.

Table I

Summary Statistics of Firm Characteristics for Portfolios Sorted on BE/ME and the Probability of Financial Distress

NYSE, Nasdaq, and AMEX firms from July 1965 to June 1996 are ranked independently every June based on their values of the probability of financial distress (O-score) calculated using Ohlson's (1980) model, book-to-market equity (BE/ME), and two groups of market capitalization (in millions of dollars). We report size-adjusted medians from a simple average of the large and small time series. Prior 12-month stock returns are the percentage of equal-weighted buy-and-hold returns from June to May in the year prior to ranking. The 36-month prior stock returns are the equal-weighted buy-and-hold stock return from June three years prior to ranking until through May in the year of ranking. Growth in retained earnings is the percentage change in retained earnings on the balance sheet over the year prior to ranking. Leverage is the ratio of total book assets less book equity to market equity. Return on assets is the ratio of income before extraordinary items to total book assets.

	Book-to-Market Equity								
O-score	L	M	H	L	M	H	L	M	H
	O-score Probability			BE/ME			Number of Firms per Year		
L	0.001	0.001	0.001	0.341	0.790	1.424	105	108	43
2	0.003	0.003	0.003	0.374	0.824	1.517	67	119	71
3	0.009	0.008	0.009	0.377	0.835	1.555	54	110	93
4	0.024	0.023	0.023	0.355	0.817	1.627	58	98	100
H	0.194	0.103	0.087	0.267	0.792	1.651	104	76	76
	Prior 12-month Returns (Percent)			Prior 36-month Returns (Percent)			Growth in Retained Earnings		
L	24.7	13.1	8.9	121.0	48.9	22.5	0.291	0.151	0.088
2	30.6	16.7	11.3	132.2	57.8	24.1	0.279	0.148	0.078
3	32.4	17.5	9.7	140.0	58.9	20.7	0.271	0.146	0.072
4	32.1	18.6	8.8	132.1	55.6	12.4	0.223	0.121	0.031
H	36.1	12.1	0.8	107.7	29.3	−12.1	−0.110	−0.160	−0.245
	Market Capitalization			Market Leverage			Return on Assets		
L	202	138	103	0.097	0.247	0.457	0.130	0.093	0.061
2	195	155	142	0.230	0.507	0.923	0.096	0.070	0.043
3	126	103	99	0.332	0.771	1.440	0.073	0.055	0.033
4	90	76	58	0.480	1.171	2.177	0.051	0.038	0.018
H	51	48	51	0.596	1.722	3.431	−0.078	−0.027	−0.038

market values. Specifically, because negative shocks to earnings directly affect the book value of equity, it may be the case that high O-score firms have low BE/ME not because investors are awarding them high market values, but rather because they have low book values. To examine this issue, Table I also reports equally weighted buy-and-hold stock returns of the portfolios over the one and three years prior to portfolio formation. Among all low BE/ME stocks, high O-score firms have the largest 12-month prior returns, and three-year prior returns that are similar to those of other low BE/ME

stocks. Moreover, both the 12-month and the three-year prior returns are considerably higher than those for stocks with high BE/ME. Finally, within the high O-score quintile, retained earnings growth in the year prior to ranking is larger (less negative) for low BE/ME firms than for high BE/ME firms. Taken together, these findings indicate that negative shocks to book equity cannot completely explain the low BE/ME ratios of these firms.

To further examine whether O-score and BE/ME are both related to characteristics that are typically thought to be related to distress risk, the table also reports summary statistics of firm size, market leverage, and profitability (return on assets) for the firms in each portfolio. Firm size, measured by the market capitalization of equity, tends to be inversely related to both BE/ME and O-score. Market leverage, measured as the ratio of the book value of liabilities to the market value of equity, is positively related to both O-score and BE/ME. Low BE/ME firms in the high O-score group have lower leverage than the high BE/ME firms in this group, but higher leverage than other low BE/ME firms. The return on assets, measured as the ratio of income before extraordinary items to total book assets is generally inversely related to the firm's book-to-market ratio and decreases as a firm's distress risk increases. Moreover, the return on assets is negative across all of the BE/ME groups in the high O-score quintile.[7]

In summary, our sorts reveal that both O-score and BE/ME are negatively related to firm size and return on assets, and positively related to leverage, which is consistent with the view that both O-score and BE/ME are related to differences in relative distress risk. However, low BE/ME firms in the high O-score quintile have high past stock returns, which is inconsistent with traditional notions of distress risk. These results suggest that O-score contains different information than the BE/ME ratio and that both variables are potentially related to differences in relative distress risk across firms. If the BE/ME ratio and O-score both capture unique information related to a priced distress risk factor, then we expect that both O-score and BE/ME will be positively related to average returns.

II. O-score, Book-to-Market Equity, and Returns

To investigate whether differences in distress risk captured by BE/ME and O-score are reflected in stock returns, Table II displays the annual buy-and-hold returns for each O-score and book-to-market portfolio. We report results separately for the small and large market capitalization groups, as well as size-adjusted returns. We assess statistical significance using *p*-values calculated from the time series of monthly returns. The book-to-market effect in returns increases substantially across O-score quintiles. The average annual size-adjusted percentage return differential between the portfolio of high and low BE/ME securities is 3.87, 3.25, 5.49, 10.62, and 14.44 within

[7] The fact that O-score is strongly related to earnings and leverage is not too surprising given that O-score is partially constructed using accounting ratios related to these variables.

O-score quintiles one through five, respectively. Similar patterns hold for both the small and large firm portfolios separately. For small (large) firms,

per year for low O-score firms and 13.56 (15.33) for high O-score firms. In both size groups, the return differentials in the low O-score quintile are not significantly different from zero, while those in the high O-score group are highly significant.[8]

The most striking result in the table is the extremely low returns on low BE/ME firms in the high O-score group. The size-adjusted average return on this group of firms is 6.36 percent, which is approximately twice as small as the average return on any of the other portfolios. In fact, this return is

quintiles across different economic regimes. We find that high BE/ME stocks in the highest (lowest) quintile of O-score outperform low BE/ME stocks in 62.4 (55.6) percent of the months in the sample. The size-adjusted percentage return differentials for portfolios of high minus low BE/ME stocks in the high O-score portfolio is 22.99, 10.47, 24.47, and 4.05 when moving from periods of low to high market movements. In each case, these return differentials are larger than those for firms in the low O-score quintile. Similar patterns are obtained when the data is divided into periods of negative and positive GNP changes. The evidence indicates that within the high O-score quintile, low BE/ME firms consistently earn lower returns than high BE/ME firms across different economic regimes.

Finally, we assess whether the results are affected by the stock exchange of listing (NYSE/AMEX and Nasdaq), time periods (formation years from 1965 to 1979 and 1980 to 1995

Table III

Three-Factor Regressions for Portfolios Sorted on BE/ME and the Probability of Financial Distress

NYSE, Nasdaq, and AMEX firms from July 1965 to June 1996 are ranked independently every June based on their values of the probability of financial distress (O-score) calculated using Ohlson's (1980) model, book-to-market equity (BE/ME), and two groups of size. Groupings use breakpoints calculated from all securities. Fama/French three-factor time-series regressions are then estimated over the entire period for each portfolio as follows:

$$r_t = \alpha + mMTB_t + sSMB_t + hHML_t + \epsilon_t.$$

MTB is the excess return on the value-weighted market portfolio, *SMB* is the factor mimicking portfolio for the returns on small minus big stocks, and *HML* is the factor mimicking portfolio for the returns on high minus low BE/ME. The coefficients from these regressions and their corresponding *t*-statistics are reported below.

	Small Firms						Large Firms					
	LBM	M	HBM	LBM	M	HBM	LBM	M	HBM	LBM	M	HBM
	α			$t(\alpha)$			α			$t(\alpha)$		
LO	0.05	0.15	0.23	0.25	1.25	1.77	0.10	0.05	−0.04	1.27	0.54	−0.26
2	−0.13	0.25	0.24	−0.62	2.21	2.17	0.15	−0.05	−0.04	1.65	−0.64	−0.33
3	−0.27	0.03	0.11	−1.00	0.31	1.06	−0.03	−0.08	−0.13	−0.24	−0.88	−1.32
4	−0.49	−0.29	0.09	−2.98	−2.35	0.83	−0.39	−0.05	0.20	−2.64	−0.49	1.24
HO	−0.73	−0.18	0.11	−3.73	−1.13	0.64	−0.87	−0.32	−0.40	−4.42	−1.47	−1.25
	m			$t(m)$			m			$t(m)$		
LO	0.92	0.84	0.77	17.51	28.71	24.16	0.92	0.97	0.98	46.82	39.89	24.99
2	1.09	0.97	0.88	21.82	33.78	32.27	1.08	1.07	1.05	47.61	52.43	38.57
3	1.00	0.95	0.96	14.83	34.61	36.48	1.07	1.06	1.06	39.09	48.95	42.15
4	1.13	1.02	0.97	27.90	33.47	35.37	1.19	1.17	1.25	32.45	43.27	31.27
HO	1.05	1.00	1.00	21.57	24.73	24.12	1.26	1.11	1.31	25.88	20.91	16.32
	s			$t(s)$			s			$t(s)$		
LO	1.12	1.11	0.99	14.96	26.49	21.96	−0.10	−0.13	0.08	−3.56	−3.89	1.46
2	1.34	1.08	1.09	18.90	26.76	28.01	0.02	0.09	0.24	0.65	3.14	6.08
3	1.78	1.23	1.16	18.32	31.55	31.24	0.33	0.35	0.45	8.48	11.52	12.45
4	1.42	1.40	1.27	24.61	32.43	32.73	0.60	0.47	0.69	11.54	12.19	12.23
HO	1.61	1.57	1.50	23.40	27.38	25.37	0.76	1.01	1.28	11.02	13.36	11.24
	h			$t(h)$			h			$t(h)$		
LO	−0.29	0.20	0.51	−3.36	4.17	9.85	−0.42	0.17	0.63	−13.02	4.39	9.91
2	−0.11	0.25	0.50	−1.30	5.44	11.20	−0.35	0.22	0.67	−9.49	6.63	15.07
3	−0.08	0.23	0.56	−0.77	5.20	13.12	−0.43	0.23	0.65	−9.69	6.54	15.77
4	−0.01	0.37	0.63	−0.10	7.38	14.00	−0.37	0.11	0.68	−6.22	2.46	10.44
HO	0.09	0.33	0.68	1.14	5.03	10.11	−0.44	0.22	0.72	−5.59	2.53	5.50
				Adj. R^2						Adj. R^2		
LO				0.71	0.86	0.80				0.90	0.83	0.66
2				0.78	0.88	0.88				0.90	0.90	0.83
3				0.71	0.90	0.90				0.88	0.90	0.87
4				0.86	0.90	0.90				0.85	0.89	0.80
HO				0.81	0.84	0.83				0.79	0.71	0.60

indistinguishable from zero. For the low BE/ME portfolios, pricing errors become more negative as one moves across O-score quintiles, and the pricing errors are statistically significant for the two highest O-score groups. The portfolio of small (large) firms in the highest O-score quintile with low BE/ME has a negative abnormal return of −0.73 (−0.87) percent per month, which is both economically and statistically significant with a *t*-statistic of −3.73 (−4.42).

It is important to note that these results are not simply a reaffirmation of the negative regression intercept documented in Fama and French (1993) for the portfolio of stocks with low BE/ME in the smallest NYSE size quintile. First, the magnitude of the intercept is over twice as large as any pricing error in Fama and French (1993). Second, the rejection is not limited to the smallest firms. We reestimate the three-factor regressions above for portfolios based on NYSE size quintiles (results not reported in a table). In the first size quintile, the regression intercept for the low BE/ME high O-score portfolio is −0.78 (*t*-statistic of −4.51). In the second and third size quintiles, the intercepts are −0.81 percent (*t*-statistic of −3.40) and −0.83 percent (*t*-statistic of −2.77), respectively.[10] To the extent that the three-factor model captures differences in risk across firms, the patterns in the factor loadings and the large pricing errors from the three-factor model do not support the view that the low returns to high O-score low BE/ME firms can be explained by these firms being less risky than other low BE/ME firms.

B. O-score, BE/ME, Earnings, and Performance-Related Delistings

Fama and French (1995) demonstrate that the behavior of earnings is consistent with book-to-market equity being associated with differences in relative distress risk in that low BE/ME firms have persistently higher earnings than high BE/

In untabulated results, we also examine the percentage of firms in each size-adjusted portfolio with performance-related delistings from CRSP over the postranking year. CRSP performance-related delistings include failure to meet minimum exchange requirements, pay fees, file reports, and filing for bankruptcy (delisting codes 500 and 520 to 584). Shumway (1997) finds that these delistings are, on average, associated with a negative 30 percent return. Examining the high O-score quintile, we observe that 6.58 percent of low BE/ME firms are delisted as compared to 5.28 percent of high BE/ME

Table IV

Three-Day Cumulative Abncrmal Returns around Earnings Announcements for Portfclios Sorted on BE/ME and Financial Distress

Three-day cumulative annualized abncrmal returns around earnings announcements fr NYSE, Nasdaq, and AMEX firms from July 1971 to June 1996 are displayed fr portf f on June rankings of size, book-to-market equity (BE/ME), and Ohlson's (1980) [illegible] groups are calculated within dist
BE/ME portf and short i40 n -45
BE/ME groups are calculated from a high distress minus low distres

	Book-to-Market Equity				
	O-score	L	M	H	Ret
					Equal-Weighted Returns
				L	−1
				2	−0
				3	−0
				4	−1
				H	−1
				Ret(H − L)	0
				(*p*-value)	(0

B. Mispricing, Firm Size, and Analyst Coverage

A possible reason that high O-score firms may be more subject to mispricing is that these firms are more difficult fr investors to value because they are associated with larger inf asymmetries. The fact that high O-score firms have weak current profitability and tend to be small firms is generally consistent with this view. To further examine whether high O-score firms are associated with a higher degree of inf asymmetry, w40 e -353 compute TJT* the -48

Institutional-Brokers-Estimates-System (IBES), and a measure of residual analyst coverage.

In untabulated results, we find that firms with high O-score are less likely to be followed by analysts and have lower residual analyst coverage. Within quintiles of O-score, firms with high BE/ME are more likely to be followed by analysts than low BE/ME firms are. For example, in the low BE/ME group, 60 percent of low O-score firms are covered by analysts compared to only 35 percent of the firms with high O-score. In the high BE/ME group of firms, the corresponding numbers are 65 and 52 percent, respectively. To control for the relationship between analyst coverage and firm size, we also measure residual analyst coverage, defined as the difference between the analyst coverage for a firm and the average analyst coverage for firms in the same NYSE size quintile. Using this measure, we also find that firms in the highest O-score quintile have the lowest residual analyst coverage, and low BE/ME firms in this group have residual analyst coverage that is lower than that in any other group.[13]

To test whether the potential for mispricing is related to the degree of information asymmetry, Table V presents value-weighted returns on portfolios formed on the prior year values of residual analyst coverage, firm size, and book-to-market equity within size quintiles based on NYSE breakpoints. The table also reports the mean number of analysts for each portfolio. Consistent with mispricing, both size and analyst coverage play an important role in explaining the book-to-market equity return premium. Within each size quintile, the difference in returns between high and low book-to-market stocks is larger for firms with low analyst coverage than for high analyst coverage stocks. The small firm portfolio with low analyst coverage displays a return difference between high and low BE/ME of 16.49 percent per year (p-value = 0.000), while the large, high analyst coverage portfolio displays a return difference between high and low BE/ME of -2.64 percent per year (p-value = 0.591).[14] Moreover, low BE/ME firms with low analyst coverage earn low average returns.

These findings provide some support for the conjecture that firms with large information asymmetries are more prone to mispricing. In addition, these findings are related to our results using O-score, given that firms with high O-score tend to be smaller firms with low analyst coverage. Nevertheless, analyst coverage does not completely subsume the predictive power of O-score. In untabulated results, we separately examine both O-score and analyst coverage and find that they both have incremental power in explain-

[13] Our tests in this section use only ranking years from 1976 onward because IBES data is only available beginning in 1976. We also obtain similar patterns after controlling for size using a regression approach similar to the procedure of Hong, Lim, and Stein (2000), who find that residual analyst coverage is related to momentum.

[14] The three-factor model also leaves large pricing errors for low BE/ME firms with low analyst coverage.

Table V

Average Annual Buy-and-Hold Returns for Portfolios Sorted on Book-to-Market Equity, Residual Analyst Coverage, and Size

NYSE, Nasdaq, and AMEX firms from July 1981 to June 1996 are ranked independently every June based on their values of size (five groups) calculated with NYSE breakpoints, book-to-market equity (three groups), and residual analysts coverage (three groups). Residual analyst coverage (Res. An.) is measured by subtracting the average analyst coverage within a NYSE size quintile from the number of analysts covering a firm. Low (high) coverage denotes firms with the lowest (highest) values of residual analyst coverage. Annual value-weighted portfolio returns are displayed for each portfolio along with returns on a portfolio of high minus low BE/ME firms within each size and residual analysts coverage group.

Res. An.	BE/ME	Small	2	3	4	Large
		Value-Weighted Returns				
L	L	3.20	6.21	11.08	9.81	13.56
L	M	14.74	15.09	17.69	14.07	15.58
L	H	19.69	18.76	18.82	15.04	19.53
L	Ret(H − L)	16.49	12.55	7.74	5.23	5.97
	(*p*-value)	(0.000)	(0.001)	(0.024)	(0.165)	(0.076)
M	L	1.31	6.99	11.76	18.16	18.24
M	M	14.39	15.19	19.07	16.08	17.55
M	H	17.30	22.28	16.18	21.09	16.73
M	Ret(H − L)	15.99	15.29	4.42	2.93	−1.51
	(*p*-value)	(0.000)	(0.002)	(0.141)	(0.235)	(0.702)
H	L	9.24	13.35	14.02	14.03	17.13
H	M	17.95	16.66	18.68	16.50	15.11
H	H	18.10	15.92	18.99	17.56	14.49
H	Ret(H − L)	8.86	2.57	4.97	3.53	−2.64
	(*p*-value)	(0.000)	(0.310)	(0.098)	(0.416)	(0.591)
		Mean Analyst Coverage				
L		0.00	0.71	2.23	4.74	8.59
M		0.39	3.19	6.59	11.81	19.82
H		2.83	7.93	13.17	19.45	29.74

ing the book-to-market premium in stock returns. While our focus here is on O-score, the large book-to-market premium in returns for firms with low analyst coverage warrants future research.

V. Discussion and Interpretation

One version of the mispricing hypothesis argues that investors extrapolate past performance too far into the future. For example, Lakonishok et al. (1994) show that past growth in sales, earnings, and cash flow add to the predictive ability of the book-to-market ratio. In contrast, we find the strongest evidence of overpricing in low BE/ME firms with high distress risk,

which have weak current earnings. In this section, we attempt to better understand the reasons that investors award these firms with high market values relative to their book values of equity. One possibility is that investors may overreact to information about the future growth potential of these firms.

To investigate this possibility, Panel A of Table VI reports size-adjusted medians of sales growth, the ratio of sales-to-book assets, the market-to-sales ratio, the ratio of capital expenditures to book assets, and the ratio of R&D expenditures to book assets for each portfolio. The low BE/ME firms in the high O-score quintile exhibit sales growth that is significantly higher than that of high BE/ME firms, but below that of other low BE/ME firms. The table also shows that low BE/ME firms in the high O-score quintile have the lowest ratios of sales to book assets, indicating that the current level of sales is low relative to the level of assets. Nevertheless, the market-to-sales ratios indicate that investors award these firms with high multiples for these low sales levels, suggesting that investors are anticipating improvements in sales growth and profitability in the future.

In line with this view, the table shows that high O-score firms with low BE/ME have the highest capital expenditures as a fraction of book assets and that R&D expenditures as a fraction of book assets are also relatively high for this group of firms. These findings indicate that, in spite of their poor current earnings, these firms continue to invest heavily in future growth opportunities. Panel B of Table VI reports the industry characteristics of these firms based on the 48 industries defined in Fama and French (1997). The table shows that firms with low BE/ME in the highest quintile of O-score are concentrated in industries with high levels of R&D, capital spending, and sales growth.

One interpretation of our findings is that low BE/ME firms in the high O-score group, like other low BE/ME firms, are in growth-oriented industries, but are lagging other firms in their industry in terms of sales and current earnings. Investors award these firms with similarly high multiples (relative to both book equity and sales), despite their poor current fundamentals, possibly perceiving that they will catch up to other firms in the industry. Subsequently, however, investors appear to be systematically disappointed and earn low returns when performance does not improve. Rather than extrapolating current performance too far into the future, our evidence suggests that investors may underestimate the importance of information about current fundamentals and overestimate the payoffs from future growth opportunities.

VI. Conclusion

We use a direct proxy of the likelihood of financial distress proposed by Ohlson (1980), which we denote by O-score, to examine the relationships between book-to-market equity, distress risk, and stock returns. Among firms with the highest risk of distress (the highest O-score quintile), the difference

by the three-factor model or by other variables often linked with distress risk, such as leverage and profitability. In general, the finding that standard distress risk explanations for the BE/ME effect break down for firms where one might expect the linkage to be strongest provides evidence against a risk-based explanation of the book-to-market premium.

An alternative explanation for the return patterns we document is that firms with high distress risk have characteristics that make them more likely to be mispriced by investors. Consistent with mispricing arguments, firms with high distress risk exhibit the largest return reversals around earnings announcements, and the book-to-market return premium is largest in small firms with low analyst coverage. Although we cannot completely rule out data mining as a potential explanation, the robustness of our results across the many tests and the links to alternative proxies for the degree of mispricing should, to a large extent, alleviate these concerns.

REFERENCES

Altman, Edward I., 1968, Financial ratios, discriminant analysis, and the prediction of corporate bankruptcy, *Journal of Finance* 23, 589–609.

Asness, Clifford, 1997, The interaction of value and momentum strategies, *Financial Analysts Journal*, March–April, 29–36.

Capaul, Carlo, Ira Rowley, and William F. Sharpe, 1993, International value and growth stock returns, *Financial Analysts Journal*, January–February, 27–36.

Chan, Louis K.C., Yasushi Hamao, and Josef Lakonishok, 1991, Fundamentals and stock returns in Japan, *Journal of Finance* 46, 1739–1764.

Chen, Nai-Fu, and Feng Zhang, 1998, Risk and return of value stocks, *Journal of Business* 71, 501–535.

Chopra, Navin, Josef Lakonishok, and Jay R. Ritter, 1992, Measuring abnormal performance: Do stocks overreact? *Journal of Financial Economics* 31, 235–268.

Cleary, Sean, 1999, The relationship between firm investment and financial status, *Journal of Finance* 54, 673–692.

Daniel, Kent, and Sheridan Titman, 1997, Evidence on the characteristics of cross-sectional variation in stock returns, *Journal of Finance* 52, 1–33.

Dichev, Ilia D., 1998, Is the risk of bankruptcy a systematic risk? *Journal of Finance* 53, 1131–1147.

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427–465.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 1995, Size and book-to-market factors in earnings and returns, *Journal of Finance* 50, 131–155.

Fama, Eugene F., and Kenneth R. French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Fama, Eugene F, and Kenneth R. French, 1998, Value versus growth: The international evidence, *Journal of Finance* 53, 1975–1999.

Ferson, Wayne E., and Campbell R. Harvey, 1999, Conditioning variables and the cross-section of stock returns, *Journal of Finance* 54, 1325–1360.

Griffin, John M., 2002, Are the Fama and French factors global or country-specific? *The Review of Financial Studies* 15, 783–803.

Hawawini, Gabriel, and Donald B. Keim, 1997, The cross section of common stock returns: A review of the evidence and some new findings, Working paper, University of Pennsylvania.

Hong, Harrison, Terrence Lim, and Jeremy C. Stein, 2000, Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies, *Journal of Finance* 55, 265–295.

Kothari, S.P., Jay Shanken, and Richard G. Sloan, 1995, Another look at the cross-section of expected stock returns, *Journal of Finance* 50, 185–224.

Lakonishok, Joseph, Andrei Shleifer, and Robert Vishny, 1994, Contrarian investment, extrapolation, and risk, *Journal of Finance* 49, 1541–1578.

La Porta, Rafael, 1996, Expectations and the cross-section of stock returns, *Journal of Finance* 51, 1715–1742.

La Porta, Rafael, Joseph Lakonishok, Andrei Shleifer, and Robert Vishny, 1997, Good news for value stocks: Further evidence on market efficiency, *Journal of Finance* 52, 859–874.

Ohlson, James A., 1980, Financial ratios and the probabilistic prediction of bankruptcy, *Journal of Accounting Research* 18, 109–131.

Ritter, Jay R., 1991, The long-run performance of initial public offerings, *Journal of Finance* 46, 3–27.

Shumway, Tyler, 1996, Size, overreaction, and book-to-market effect as default premia, Working paper, University of Michigan.

Shumway, Tyler, 1997, The delisting bias in CRSP data, *Journal of Finance* 52, 327–340.