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Is the Risk of Bankruptcy a Systematic Risk?

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ABSTRACT

Several studies suggest that a firm distress risk factor could be behind the size and the book-to-market effects. A natural proxy for firm distress is bankruptcy risk. If bankruptcy risk is systematic, one would expect a positive association between bankruptcy risk and subsequent realized returns. However, results demonstrate that bankruptcy risk is not rewarded by higher returns. Thus, a distress factor is unlikely to account for the size and book-to-market effects. Surprisingly, firms with high bankruptcy risk earn lower than average returns since 1980. A risk-based explanation cannot fully explain the anomalous evidence.

SEVERAL STUDIES SUGGEST that the effects of firm size and book-to-market, probably the two most powerful predictors of stock returns, could be related to some sort of a firm distress risk factor. For example, Chan and Chen (1991) find that "marginal" firms, or inefficient firms with high leverage and cash flow problems, seem to drive the small firm effect. Fama and French (1992) conjecture that the book-to-market effect might be due to the risk of distress. Chan, Chen, and Hsieh (1985) show that much of the size effect is explained by a default factor, computed as the difference between high-grade and low-grade bond returns. Fama and French (1993) and Chen, Roll, and Ross (1986) find that a similarly defined default factor is significant in explaining stock returns.

This study investigates the importance of the firm distress risk factor and its relation to size and book-to-market effects. Probability of bankruptcy is a natural proxy for firm distress, and there is a well-developed literature on bankruptcy prediction that provides powerful measures of ex ante bankruptcy risk (see Altman (1993) for a review). Evidence that bankruptcy risk is systematic would support a distress factor explanation for the size and the book-to-market effects.

Existing evidence on the relation of bankruptcy risk to systematic risk is mostly circumstantial and often contradictory. Lang and Stulz (1992) and Denis and Denis (1995) demonstrate that bankruptcy risk is related to aggregate factors, which implies that bankruptcy risk could be positively related

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to systematic risk. Shumway (1996) finds that NYSE and AMEX firms with high risk of exchange delisting for performance reasons earn higher than average returns, suggesting that the risk of default is systematic. However, Opler and Titman (1994) and Asquith, Gertner, and Sharfstein (1994) find that bankruptcy is mostly due to idiosyncratic factors, which suggests that bankruptcy risk is unrelated to systematic risk. Interestingly, Altman (1993) finds that the bonds of the most distressed firms (defined as high-yielding bonds) earn lower than average subsequent returns, consistent with bankruptcy risk being negatively related to systematic risk.

This study presents more direct and comprehensive evidence about the relation between bankruptcy risk and systematic risk. Measures of bankruptcy risk are derived from existing models of bankruptcy prediction (Altman (1968) and Ohlson (1980)) which have been widely used in other research and in practice. Systematic risk is proxied by subsequent realized returns. As hypothesized in other studies, simple correlations reveal that bankruptcy risk is negatively related to firm size and positively related to book-to-market. Thus, bankruptcy risk could potentially account for the size and the book-to-market effects if bankruptcy risk is a systematic risk priced into returns.

However, a further investigation reveals several findings that are inconsistent with a distress explanation for the size and the book-to-market effects. First, the main result of this study is that bankruptcy risk is not rewarded by higher returns. Surprisingly, firms with high bankruptcy risk earn significantly lower than average returns since 1980.[1] Second, the relation between bankruptcy risk and book-to-market is not monotonic: distressed firms generally have high book-to-market but the *most* distressed firms have lower book-to-market. Thus, a return premium related to bankruptcy risk cannot fully explain the book-to-market effect even if distress were rewarded by higher returns. Third, this study finds that the size effect, strong in the 1960s and 1970s, has virtually disappeared since 1980 (see also Fama and French (1992) and Roll (1995)). Although the disappearance of the size effect is somewhat of a puzzle, pre-1980 evidence suggests that there is no reliable relation between bankruptcy risk and returns that could explain the size effect in earlier years.

Additional tests attempt to distinguish between risk-based and mispricing explanations for why higher bankruptcy risk is associated with lower returns since 1980. Evidence from trading strategies long on healthy firms and short on distressed firms and an examination of longer return windows suggest that mispricing is the more likely explanation for this surprising phenomenon.

The remainder of the study is organized as follows. Section I describes the research design, the sample, and the tests. Section II presents the results. Section III concludes.

[1] I use the terms "bankruptcy risk," "insolvency," and "financial distress" somewhat loosely and interchangeably for the purposes of this study. Altman (1993) discusses the different meanings of these terms.

I. Research Design, Sample Selection, and Empirical Tests

The risk of bankruptcy is systematic only if it is undiversifiable. Portfolio diversification is the key to the general notion of systematic risk as the covariance (or sensitivity) of returns with economy-wide factors (Ross (1989)). Thus, bankruptcy risk is systematic only if the returns of distressed firms are more sensitive to unexpected changes in relevant economy-wide factors.[2] This conjecture seems plausible; for example, more-distressed firms could be more severely affected by economy-wide recessions (pushing many nearly insolvent firms into bankruptcy), and they could also be more favorably affected by economic upturns (saving many nearly insolvent firms from bankruptcy). However, this conjecture is by no means guaranteed and its validity is essentially an empirical question.

This study provides evidence on this question by investigating the empirical relation between risk of bankruptcy and systematic risk. Systematic risk is proxied by subsequent realized stock returns. Measures of bankruptcy risk are derived from existing research. For comparison and sensitivity analysis I use two different models of ranking firms on probability of bankruptcy. The first measure is derived from Altman's (1968) Z-model, which is probably the most popular model of bankruptcy prediction and has been extensively used in empirical research and in practice.[3] The second bankruptcy risk measure is from Model 1 in Ohlson (1980), which has also been successfully used in other research (e.g., Burgstahler, Jiambalvo, and Noreen (1989)).[4] These two models are likely to complement each other well for sensitivity analysis because they are derived in different time periods, using different samples, different independent variables, and different predictive methodologies (multiple discriminant analysis in Altman (1968) versus conditional logit in Ohlson (1980)).[5]

Both of these models are quite accurate in predicting bankruptcy. For example, Altman (1993) demonstrates that his 1968 Z-model predicts correctly

[2] Evidence that more firms fail during the downside of the business cycle is insufficient to conclude that bankruptcy risk is a systematic risk. During hard times all firms are more likely to fail, so there will be more failures, but that does not directly imply that the returns of more distressed firms are more sensitive to the business cycle. In fact, one can construct an example where firms with a higher probability of bankruptcy have *lower* systematic risk compared to firms with lower probability of bankruptcy.

[3] Altman's (1968) model is: $Z = 1.2$(working capital/total assets) + 1.4(retained earnings/total assets) + 3.3(earnings before interest and taxes/total assets) + 0.6(market value of equity/book value of total liabilities) + (sales/total assets).

[4] Ohlson's (1980) model 1 is: $O = -1.32 - 0.407$ log(total assets/GNP price-level index) + 6.03(total liabilities/total assets) − 1.43(working capital/total assets) + 0.076(current liabilities/current assets) − 1.72(1 if total liabilities > total assets, else 0) − 2.37(net income/total assets) − 1.83(funds from operations/total liabilities) + 0.285(1 if net loss for last two years, else 0) − 0.521(net income$_t$ − net income$_{t-1}$)/(|net income$_t$| + |net income$_{t-1}$|). I use this model without adjusting for the GNP price-level index because the tests in this study employ monthly cross sections, within which the index is the same.

[5] Using a measure of bankruptcy risk from Zmijewski (1984), test results are qualitatively similar to those reported later. Thus, this additional specification gives further confidence that the results are robust to the choice of a bankruptcy prediction model.

24 out of 25 bankrupt firms and 52 out of 66 nonbankrupt firms in an out-of-sample prediction. Additionally, Begley, Ming, and Watts (1997) find that Altman's (1968) and Ohlson's (1980) models retain their predictive abilities for COMPUSTAT firms in the 1980s, which comprise most of the firms and years in my sample. Begley et al. are also unable to improve on the predictive performance of the two models by reestimating them with more recent data. Thus, the original models seem to be well-suited for the investigation in this study. Specifically, I use these models to derive bankruptcy measures by applying the original model weights to the model bankruptcy prediction variables. The result is a single composite bankruptcy score that reflects the ex ante probability of bankruptcy for each firm at a given point in time.

The sample consists of all industrial firms available simultaneously on the NYSE, AMEX, and Nasdaq Center for Research in Security Prices (CRSP) tapes and the COMPUSTAT annual industrial and research tapes for the period 1981 to 1995. Both Altman's and Ohlson's models are derived for industrials, so I only include firms with COMPUSTAT Standard Industrial Classification (SIC) codes 1 to 3999 and 5000 to 5999. The sample is restricted to post-1980 years for two reasons. First, Ohlson's model becomes available in 1980. Second, post-1980 years likely offer a more powerful setting for an investigation of bankruptcy risk, as compared to previous years. Specification checks reveal that the CRSP–COMPUSTAT matched sample contains substantially more firms after 1980, which increases statistical power (results not presented). More importantly, the enlargement of the sample comes from mostly younger, smaller, and otherwise marginal firms, which likely have higher ex ante bankruptcy risk. This conjecture is corroborated by the fact that ex post bankruptcy risk (proxied by bankruptcy and performance delistings) is considerably higher after 1980 in my sample. Data in Altman (1993) also show that the rate of insolvency and business failure has dramatically increased since about 1980.

If the risk of bankruptcy is at least partly systematic, then more insolvent firms should have higher average subsequent returns as compared to less insolvent firms. The tests relate subsequent realized returns to bankruptcy probability measures, controlling for size and book-to-market. I include these two control variables because of their well-documented association with returns, and to investigate the hypothesized relation between them and the firm distress risk factor—the latter likely to be related to bankruptcy risk. Size (MV) is defined as log[fiscal year-end price per share (COMPUSTAT item #199) times number of shares outstanding (item #25)]. Book-to-market (B/M) is defined as common equity (item #60) divided by (fiscal year-end price times number of shares outstanding).[6]

[6] Fama and French (1992) and other studies commonly use log(book/market). However, this measure is ill-defined for firms with negative book value of equity, which are likely to be firms with high probability of bankruptcy. Note that the positive/negative book value dichotomy is an explicit prediction variable in Ohlson's model. Therefore, eliminating firms with negative book value is inappropriate in the context of this study. In any case, the results remain qualitatively unchanged in a sensitivity check eliminating negative book values and using log(book/market).

Market value, book-to-market, and bankruptcy scores are computed from COMPUSTAT as of the fiscal year-end of a given year t. To ensure that the accounting data are available to calculate bankruptcy measures, returns are monthly returns beginning six months after the fiscal year-end of year t.[7] For example, a December 31 fiscal year-end firm will match COMPUSTAT data for 1983 with CRSP monthly returns from July 1, 1984 through June 30, 1985. Delisting returns are included in monthly returns. To abstract from the influence of extreme outliers, the top and bottom 1 percent of observations for each variable, except market value, are set at the 1st and the 99th percentile respectively.

For each probability of bankruptcy measure I present two types of evidence: portfolio results and regression results. For the portfolio results, each month firms are assigned to decile portfolios based on the magnitude of their bankruptcy score. Then I calculate mean bankruptcy score, mean subsequent realized monthly return, mean market value, and mean book-to-market for each portfolio. An examination of portfolio means illustrates the economic significance of the results and could reveal potential nonlinearities in the relation between bankruptcy scores and returns.

The statistical tests are Fama–MacBeth (1973) regressions. The cross section of realized stock returns is regressed monthly on a bankruptcy risk measure, market value, and book-to-market using all individual firm observations for that month. A regression coefficient reported in the tables is the average of the coefficients in the monthly cross sections; the t-statistic is equal to the coefficient divided by its time-series standard error. The t-statistics in the multivariate regressions provide the formal tests of statistical significance. Comparison of the results from the multivariate regression and the three univariate regressions (for each of the three independent variables in the multivariate regression) illustrates the interdependencies among bankruptcy risk, size, and book-to-market in explaining security returns.

II. Results

A. *Primary Results*

Descriptive statistics for the test variables are shown in Table I. Probability of bankruptcy scores from Altman's (1968) model are denoted as Z, and those from Ohlson's (1980) model are denoted as O. Panel A illustrates the empirical distributions of the test variables. Generally, the data for all variables are similar to the evidence of other studies employing the same sample and similar variables.

Panel B in Table I exhibits Pearson correlation coefficients, which offer preliminary evidence about the relations between the test variables. As

[7] Ohlson (1980) shows that the financial reports of firms that would go bankrupt are often delayed, sometimes considerably. A six-month lead time seems like a reasonable choice given the evidence in Alford, Jones, and Zmijewski (1994), who show that 98 percent of the 10-K reports are filed by the end of the fifth month after fiscal year-end. In any case, additional tests later reveal that the results are not sensitive to the choice of portfolio formation date and length of return window.

Table I

Descriptive Statistics and Correlation Matrix for the Test Variables

Panel A presents descriptive statistics that illustrate the empirical distributions of the test variables. Returns are monthly returns for the combined sample of NYSE, AMEX, and Nasdaq firms. Z is the measure of bankruptcy risk from Altman (1968). Higher values of Z signify lower probability of bankruptcy. O is a measure of bankruptcy risk from Model 1 in Ohlson (1980). Higher values of O signify higher probability of bankruptcy. MV is log of fiscal-year-end price times number of shares outstanding. B/M is common equity divided by fiscal-year-end price times number of shares outstanding. StdD is the standard deviation for the respective variable. P5, P25, P50, P75, P95 are the 5th, 25th, 50th, 75th, and 95th percentiles of the empirical distribution of the respective variable. For all variables excluding MV, observations exceeding the 99th percentile are set at the 99th percentile, and observations below the 1st percentile are set at the 1st percentile. Panel B displays a Pearson correlation matrix for all test variables. All correlations in Panel B are significantly different from zero at least at the 1 percent level using two-tailed tests.

Panel A: Descriptive Statistics for the Test Variables

Variables	Mean	StdD	P5	P25	P50	P75	P95
Returns	0.91	14.75	−21.51	−7.04	0.00	7.41	26.53
Z	5.31	7.71	0.23	2.37	3.56	5.41	15.39
O	−1.44	3.19	−7.22	−3.05	−1.35	0.23	3.59
MV	4.07	2.10	0.98	2.54	3.86	5.40	7.91
B/M	0.76	0.64	0.09	0.34	0.60	0.99	2.01

Panel B: Pearson Correlation Coefficients for the Test Variables

	Returns	Z	O	MV	B/M
Returns	1.000				
Z	−0.009	1.000			
O	−0.010	−0.197	1.000		
MV	0.005	0.049	−0.271	1.000	
B/M	0.035	−0.216	0.052	−0.305	1.000

expected, Z and O are negatively correlated (−0.197) because Z is a measure of financial strength (higher Z means lower probability of bankruptcy) and O is a measure of financial distress (higher O means higher probability of bankruptcy). The correlations between Z, O, MV, and B/M are consistent with the size and the book-to-market effects being related to some form of firm distress captured in bankruptcy risk: Firms with higher bankruptcy risk tend to be smaller and have higher book-to-market. The correlation between Z and returns is negative, which also agrees with the distress hypothesis. However, the correlation between O and returns is inconsistent with the distress conjecture: Firms with higher bankruptcy risk seem to earn lower than average returns.

Table II offers evidence about the performance of Altman's and Ohlson's models in predicting bankruptcy and other distress in my sample. I use exchange delisting for bankruptcy or liquidation as a proxy for bankruptcy

Table II

Performance of the *Z* and *O* Measures of Bankruptcy Risk in Predicting Bankruptcy and Performance Delistings

Panel A demonstrates the number of bankruptcy and performance delistings as a function of bankruptcy risk portfolio rank. Each month firms are assigned into decile portfolios according to their probability of bankruptcy measure (Z or O). The accounting data for Z and O are assumed to be available six months after fiscal-year end. BLD is the number of bankruptcy and liquidations delistings, PD is the number of performance delistings. Panel B presents the correlations between portfolio rank and the number of bankruptcy and performance delistings for the entire range of portfolios (1 to 10), and separately over portfolios 1 to 5, and 6 to 10.

Panel A: Number of Bankruptcy and Performance Delistings by Decile Portfolios (Port) of the Z and O Measures of Bankruptcy Risk

Predictive Performance of Z			Predictive Performance of O		
Portfolio	Number of Bankruptcy and Liquidations Delistings (BLD)	Number of Performance Delistings (PD)	Portfolio	Number of Bankruptcy and Liquidations Delistings (BLD)	Number of Performance Delistings (PD)
1	34	522	1	8	22
2	17	150	2	0	13
3	8	75	3	4	12
4	2	51	4	4	13
5	5	38	5	5	21
6	5	39	6	4	20
7	4	34	7	6	47
8	4	37	8	2	66
9	3	23	9	10	159
10	5	65	10	38	537

Panel B: Correlations between Rank of Bankruptcy Risk Portfolios (Port) and Number of Bankruptcy and Performance Delistings

Range of Portfolios	corr(Port, BLD)	corr(Port, PD)	corr(Port, BLD)	corr(Port, PD)
1–10	−0.70	−0.63	0.57	0.68
1–5	−0.89	−0.83	−0.11	−0.06
6–10	−0.19	0.42	0.77	0.85

(delisting codes: 400, 572, 574). I also show the performance of the models in predicting a broader measure of distress, called performance delisting (delisting codes: 400, 550 to 585). Performance delisting includes not only bankruptcy but also insufficient capital or market-makers, price too low, delinquency in filing, etc. Panel A in Table II displays the number of bankruptcy and performance delistings as a function of Z or O decile portfolio. The evidence confirms that Z and O are good ex ante measures of probability of bankruptcy and other distress.[8] The number of bankruptcy and performance delistings generally increases with lower Zs and higher Os. The correlations between number of delistings and portfolio rank, shown in Panel B, are high—ranging from 0.57 to 0.70 in absolute value (negative for Z and positive for O). The portfolio rankings and correlation results also demonstrate that the predictive accuracy of these two models varies over the range of the bankruptcy risk variable: Z and O are better predictors of future bankruptcy and performance delistings when ex ante probability of bankruptcy is high—when Z is low (portfolios 1 to 5) and O is high (portfolios 6 to 10). For portfolios with high bankruptcy risk, the correlations between portfolio ranks and the number of delistings are high (ranging from 0.77 to 0.89 in absolute value). In contrast, for portfolios with low bankruptcy risk, the correlations are low and erratic (from 0.06 to 0.42 in absolute value), in three cases with sign reversed from the expected.

Note that the evidence in Table II illustrates the predictive power of the models but it is to be interpreted with caution because the bankruptcy delisting event often does not coincide with the bankruptcy event. Some firms that enter bankruptcy never delist or delist substantially later. For example, Continental Airlines entered Chapter 11 bankruptcy proceedings on December 3, 1990 but it did not delist from the NYSE until May 20, 1992. However, as mentioned earlier, Begley et al. (1997) provide more direct and comprehensive evidence which also suggests that Altman's and Ohlson's models retain their abilities to predict bankruptcy in my sample.

Tables III and IV present the main results for the association between bankruptcy risk and subsequent realized returns. Preliminary tests indicated a considerable difference in the variation of bankruptcy risk and the results between NYSE-AMEX and Nasdaq firms, warranting a separate presentation for these two subsamples. Additional tests reveal that the results for the entire sample are generally a weighted average of the results for the two subsamples (results not presented).

Table III presents portfolio and regression results for the relation between bankruptcy risk and subsequent realized returns, using Altman's Z as a measure of bankruptcy risk. An examination of portfolio results for the NYSE-AMEX firms in Panel A reveals that the firms with the highest probability of bankruptcy (lowest Z) earn lower than average returns, suggesting that bankruptcy risk is not a systematic risk priced into returns. In fact, the mean monthly return for portfolio 1 is only 0.48, which is within the range of the risk-free rate of return. Regression results confirm that firms with higher

[8] Another powerful predictor of performance delistings is firm size (e.g., Shumway (1996)). To test whether the bankruptcy models have distress-predicting power incremental to size, I run two additional tests. The first test restricts the sample to firms with market value less than $200 million, and the second test limits the sample to firms with market value less than $50 million. These two alternative specifications produce results consistent with those reported later in the paper.

Table III

Portfolio and Regression Results for the Relation between Z, Market Value, Book-to-Market, and Subsequent Realized Returns during 1981 to 1995

For the portfolio results, firms are assigned monthly into decile portfolios (Port) according to their probability of bankruptcy (Z). Z is from Altman (1968), where higher Zs signify lower probability of bankruptcy. Rets is one-year-ahead monthly returns (in percent), starting six months after fiscal-year-end. *MV* is log of fiscal-year-end price times number of shares outstanding. B/M is common equity divided by fiscal-year-end price times number of shares outstanding. Portfolio values for Z, Rets, *MV*, and B/M are means for the respective portfolio. The NYSE-AMEX sample (Panel A) has 237,628 monthly observations. The Nasdaq sample (Panel B) has 262,304 monthly observations. Regressions are Fama–MacBeth (1973) regressions with 180 monthly cross sections. A coefficient in these regressions is the average of the coefficients in the monthly cross sections. The t-statistic (in parentheses) is the average coefficient divided by its time-series standard error.

	Portfolio Results				Regression Results			
Port	Z	Rets	MV	B/M	Rets = b_1	+ $b_2{}^*Z$	+ $b_3{}^*MV$	+ $b_4{}^*B/M$
				Panel A: NYSE-AMEX Firms				
1	0.84	0.48	3.99	0.77	Predicted: (+)	(?)	(−)	(+)
2	1.93	0.90	5.01	0.97				
3	2.42	1.21	5.20	0.97	1.06	0.03		
4	2.81	1.34	5.13	0.92	(2.75)	(1.59)		
5	3.19	1.35	5.21	0.87	1.24		−0.02	
6	3.60	1.34	5.11	0.82	(2.38)		(−0.36)	
7	4.12	1.49	5.22	0.73	0.89			0.32
8	4.85	1.42	5.26	0.63	(2.42)			(3.26)
9	6.02	1.34	5.39	0.56	0.44	**0.06**	0.02	0.44
10	11.41	1.07	5.36	0.38	(0.74)	**(3.37)**	(0.32)	(4.59)
				Panel B: Nasdaq Firms				
1	−0.72	0.17	1.88	0.77	Predicted: (+)	(?)	(−)	(+)
2	1.57	0.63	2.50	1.01				
3	2.37	0.87	2.82	1.06	0.81	−0.02		
4	2.96	1.02	2.99	1.02	(2.10)	(−2.62)		
5	3.53	0.96	3.23	0.89	0.92		−0.08	
6	4.19	1.02	3.38	0.80	(2.14)		(−1.22)	
7	5.03	0.92	3.53	0.68	0.08			0.79
8	6.51	1.04	3.68	0.55	(0.18)			(5.97)
9	9.79	0.64	3.86	0.44	−0.14	**−0.01**	0.07	0.87
10	33.43	0.18	3.74	0.31	(−0.25)	**(−1.14)**	(1.03)	(6.58)

bankruptcy risk earn reliably lower returns: the coefficient on Z is positive and highly significant (t-statistic of 3.37).

A comparison of univariate and multivariate regression results demonstrates that the explanatory power of Z is not subsumed by the size and the book-to-market effects. In fact, the coefficients and the t-statistics for both Z

Table IV

Portfolio and Regression Results for the Relation between *O*, Size, Book-to-Market, and Subsequent Realized Returns during 1981 to 1995

For the portfolio results, firms are assigned monthly into decile portfolios (Port) according to their probability of bankruptcy (*O*). *O* is the probability of bankruptcy measure from Model 1 in Ohlson (1980), where higher *O*s signify higher probability of bankruptcy. Rets is one-year-ahead monthly returns (in percent), starting six months after fiscal-year-end. *MV* is log of fiscal-year-end price times number of shares outstanding. *B/M* is common equity divided by fiscal-year-end price times number of shares outstanding. Portfolio values for *O*, Rets, *MV*, and *B/M* are means for the respective portfolio. The NYSE-AMEX sample (Panel A) has 227,748 monthly observations. The Nasdaq sample (Panel B) has 224,046 monthly observations. Regressions are Fama–MacBeth (1973) regressions with 180 monthly cross sections. A coefficient in these regressions is the average of the coefficients in the monthly cross sections. The *t*-statistic (in parentheses) is the average coefficient divided by its time-series standard error.

Portfolio Results					Regression Results			
Port	*O*	Rets	*MV*	*B/M*	Rets = b_1	+ $b_2{}^*O$	+ $b_3{}^*MV$	+ $b_4{}^*B/M$
				Panel A: NYSE-AMEX Firms				
1	−4.62	1.18	5.92	0.56	Predicted: (+)	(?)	(−)	(+)
2	−3.15	1.26	6.21	0.66				
3	−2.52	1.31	6.15	0.72	1.08	−0.07		
4	−2.04	1.36	5.97	0.74	(2.76)	(−1.55)		
5	−1.60	1.28	5.60	0.81	1.23		−0.02	
6	−1.17	1.24	5.23	0.84	(2.38)		(−0.31)	
7	−0.72	1.25	4.90	0.89	0.89			0.32
8	−0.17	1.29	4.35	0.94	(2.26)			(3.29)
9	0.61	1.12	3.81	0.98	0.89	**−0.11**	−0.04	0.32
10	2.63	0.60	2.92	0.57	(1.67)	**(−3.38)**	(−0.72)	(3.53)
				Panel B: Nasdaq Firms				
1	−5.31	1.12	4.10	0.62	Predicted: (+)	(?)	(−)	(+)
2	−3.25	1.10	4.01	0.74				
3	−2.27	1.08	3.77	0.77	0.79	−0.11		
4	−1.52	1.29	3.70	0.88	(2.03)	(−3.73)		
5	−0.90	1.09	3.42	0.93	1.03		−0.07	
6	−0.28	0.95	3.09	0.95	(2.38)		(−1.04)	
7	0.40	0.79	2.75	0.99	0.27			0.67
8	1.21	0.60	2.39	0.93	(0.60)			(5.25)
9	2.44	0.40	2.11	0.77	0.40	**−0.11**	−0.04	0.61
10	6.48	−0.06	2.17	0.38	(0.80)	**(−4.59)**	(−0.67)	(4.90)

and *B/M* increase from the univariate to the multivariate regressions, suggesting that the common variation of *Z* and *B/M* has little relation to returns. Interestingly, the coefficient on *MV* is insignificant in both the univariate and the multivariate regression. This evidence (confirmed throughout the rest of the study) is consistent with other research which also documents that the size effect is weak to nonexistent in the 1980s and 1990s (e.g., Fama and French (1992) and Roll (1995)).

Another interesting finding in Table III is the portfolio evidence about the relation between bankruptcy risk and book-to-market (confirmed for the O results later). As suggested in the discussion of Panel B in Table I, firms with high bankruptcy risk generally have high book-to-market. However, those firms with the *highest* bankruptcy risk (portfolio 1) have a book-to-market lower than that for adjacent high-bankruptcy-risk portfolios (portfolios 2 and 3). The reason is that, unlike market value, book value of the most distressed firms is often completely wiped out by losses or is even negative. Thus, even if firms with high bankruptcy risk have higher returns, the nonmonotonic relation between bankruptcy risk and book-to-market suggests that a distress explanation is unlikely to account for the book-to-market effect.

The coefficient on Z is insignificant for the Nasdaq multivariate regression in Panel B of Table III, suggesting the absence of a meaningful relation between bankruptcy risk and returns. However, an examination of portfolio returns suggests a different conclusion. Portfolio results for Nasdaq firms reveal a clear inverted U-shape for the relation between Z and returns. Both the firms with the lowest Zs and those with the highest Zs earn lower than average returns. Thus, the insignificant coefficient on Z in the Nasdaq subsample is due to the inverted U-shape, rather than to the absence of any relation between Z and returns.

This observation is important because the two sides of the inverted U-shape have a very different pattern of variation in actual bankruptcy risk. The point is that there is only a weak relation between bankruptcy risk and Z for high values of Z (recall that bankruptcy risk is low for high-Z firms). As mentioned earlier, Table II reveals that the variation in ex post bankruptcy risk is strongly concentrated in portfolios 1 to 5, where there is a material probability of bankruptcy, but there is a low and erratic variation in bankruptcy risk for the rest of the portfolios. In other words, the variation in Z for the high-Z portfolios is capturing variation in firm characteristics other than variation in bankruptcy risk. Therefore, it is inappropriate to ascribe the variation in returns from, for example, portfolio 6 (1.02 percent) to portfolio 10 (0.18 percent) as due to variation in bankruptcy risk.

In contrast, it is much more reasonable to ascribe the variation in returns from portfolio 5 (0.96 percent) to portfolio 1 (0.17 percent) to variation in bankruptcy risk because that is the region where most of the variation in bankruptcy risk is likely to occur. A better specified and more powerful test of the relation between bankruptcy risk and returns should exclude the observations for which Z is not a good measure of bankruptcy risk (for which variation in Z is weakly related to variation in bankruptcy risk). Indeed, additional tests that include observations only from portfolios 1 to 5 reveal a significantly positive association between Z and returns (results not presented). In any case, it is clear that low-Z, high-bankruptcy-risk Nasdaq firms do not earn higher than average returns. If anything, they earn lower than average returns.

Table IV presents the results for the relation between bankruptcy risk and realized returns, using Ohlson's (1980) measure of bankruptcy risk. Examination of the portfolio and regression results in Panel A demonstrates a reliably negative association between bankruptcy risk and returns for NYSE-AMEX firms. Similarly to Table III, the average return on NYSE-AMEX firms with the highest bankruptcy risk (portfolio 10) is only 0.60, which is in the range of the risk-free rate of return. For both bankruptcy measures, results seem to indicate that there is an economically large return premium of 0.4 to 0.6 percent per month for avoiding the most distressed NYSE-AMEX firms.

The results for Nasdaq firms (in Panel B) are even more dramatic. Portfolio results show a negative mean return of −0.06 for the most distressed firms (portfolio 10). The difference in monthly returns between firms with low bankruptcy risk (portfolios 1 to 5) and the most distressed firms reaches over 1 percent. The regression results confirm the strong negative association between O and returns (the t-statistic on O is −4.59), which is little affected by the presence of the control variables. For both NYSE-AMEX and Nasdaq firms, the relation between bankruptcy risk and book-to-market is again nonmonotonic, and there is no evidence of a size effect.

The findings in Tables III and IV raise additional issues. Because the size effect is absent after 1980, one question is whether bankruptcy risk can explain the size effect in years when the size effect was strong. Pre-1980 results would also make the evidence more readily comparable to other studies of the size and the book-to-market effects (e.g., Fama and French (1992), (1993), (1995)). To address these issues, I repeat the main tests for the pre-1980 periods with calculable measures of bankruptcy risk, 1965–1980 for Z and 1974–1980 for O.

The pre-1980 results can be summarized in a straightforward manner. There is no reliable relation between bankruptcy risk and returns that could explain the size and the book-to-market effects before 1980 (actual results are not presented).[9] An explanation for why the relation between bankruptcy risk and returns is different before and after 1980 is likely related to the fact that, as mentioned earlier, bankruptcy risk was comparatively low before 1980, and increased substantially thereafter. Tests over all available years, 1965–1995 for Z and 1974–1995 for O, confirm that firms with higher bankruptcy risk earn lower returns, a result evidently driven by post-1980 observations.

[9] The pre-1980 tests use only firms that have been on COMPUSTAT for at least five years to avoid the COMPUSTAT survivorship bias noted in Kothari, Shanken, and Sloan (1995). Also note that the COMPUSTAT bias cannot account for the post-1980 results because Kothari et al. demonstrate that this bias affects mostly pre-1977 observations.

B. Additional Results

The negative association between bankruptcy risk and returns after 1980 could have two possible explanations.[10] First, assuming efficient markets, it suggests that more insolvent firms have lower systematic risk. Second, if there are persistent biases in the pricing of securities (e.g., Lakonishok, Shleifer, and Vishny (1994)), it could signify that the market does not fully impound the available financial distress information. Thus, the most insolvent firms earn lower subsequent returns when this negative information is eventually embedded in prices.

To provide evidence on whether the results are due to variation in systematic risk or incomplete impounding of information, I construct a zero-investment trading strategy based on buying an equally weighted portfolio of firms with low bankruptcy risk and shorting an equally weighted portfolio of firms with high bankruptcy risk. Absent arbitrage opportunities, if firms with high average returns possess characteristics that make them fundamentally riskier than firms with low average returns, then high-return firms should underperform low-return firms in at least some periods (see Lakonishok et al. (1994)). However, the risk explanation is suspect if some firms earn higher returns both on average and consistently.

Firms with high bankruptcy risk are defined monthly as firms in the top decile of bankruptcy risk in the full sample (including NYSE, AMEX, and Nasdaq firms), using Ohlson's (1980) model. I use Ohlson's model because this specification displays the stronger negative association between bankruptcy risk and subsequent returns. The top decile definition is admittedly arbitrary, so I provide results for an alternative strategy that shorts the 20 percent of the firms with the highest bankruptcy risk. Firms with low probability of bankruptcy are defined as the 70 percent of all firms with the lowest probability of bankruptcy.

Results for the zero-investment strategy are presented in Table V. The results for the strategy that defines high bankruptcy risk as membership in the top decile of bankruptcy risk are discussed as main results. The results for the alternative strategy that shorts firms in the top two deciles of bankruptcy risk are presented in the last two columns. Just as in Table IV, firms with high bankruptcy risk earn lower returns than firms with low probability of bankruptcy. The mean monthly return on the trading strategy is 1.17 percent (0.88 percent for the top-two-deciles strategy), significantly different

[10] Using exchange delisting as a proxy for default risk, Shumway (1996) finds that NYSE-AMEX firms with higher delisting risk earn higher returns. I attempt to reconcile the two studies with respect to at least two major issues, prediction model and sample differences, by using Shumway's measure of delisting risk in my sample(s). The results remain qualitatively unchanged for this specification: Firms with a higher delisting risk earn lower than average returns. Thus, the results of this study do not seem to be overly methodology-specific, although Shumway's results are probably either methodology- or sample-specific (Shumway uses a single prediction model, and a sample of NYSE-AMEX firms during 1963 to 1993).

Table V

Returns for Zero-Investment Trading Strategies Long on Firms with Low Probability of Bankruptcy and Short on Firms with High Probability of Bankruptcy

Using Ohlson's (1980) model, all firms are assigned monthly into portfolios with high and low probability of bankruptcy. The 70 percent of the firms with the lowest probability of bankruptcy are designated as Lowest 70 percent probability of bankruptcy. Analogously, the 10 percent (20 percent) of the firms with the highest probability of bankruptcy are designated as Highest 10 percent (20 percent) probability of bankruptcy. Year represents the calendar year of monthly portfolio formation. Ret is the mean monthly return on each portfolio (in percent). Net Ret is the mean return on the low bankruptcy risk portfolio minus the mean return on the high bankruptcy risk portfolio. Mean at the bottom of the net returns columns is the average of annual net returns. t-stat is equal to Mean divided by the time-series standard error of net returns.

Lowest 70 percent Probability of Bankruptcy		Highest 10 percent Probability of Bankruptcy		Highest 20 percent Probability of Bankruptcy	
Year	Ret	Ret	Net Ret	Ret	Net Ret
1981	0.34	−1.35	1.69	−0.86	1.20
1982	2.14	0.45	1.69	1.12	1.02
1983	2.61	1.86	0.75	2.40	0.21
1984	−0.49	−3.53	3.04	−3.01	2.52
1985	2.00	−0.71	2.71	−0.18	2.18
1986	0.72	−0.28	1.00	−0.15	0.87
1987	0.31	−0.65	0.96	−0.82	1.13
1988	1.88	0.16	1.72	0.46	1.42
1989	1.34	−1.08	2.42	−0.52	1.86
1990	−1.22	−2.75	1.53	−2.83	1.61
1991	3.10	4.97	−1.87	4.58	−1.48
1992	1.56	1.78	−0.22	2.12	−0.56
1993	1.53	1.57	−0.04	1.93	−0.40
1994	0.18	−2.43	2.61	−1.47	1.65
1995	1.86	2.23	−0.37	1.86	0.00
		Mean	**1.17**	Mean	**0.88**
		t-stat	**(3.36)**	t-stat	**(3.06)**

from zero at the 0.001 level in a time-series t-test. Additionally, the profitability of this strategy is consistent: Low-bankruptcy-risk firms outperform high-bankruptcy-risk firms in 11 (12) out of 15 years. When negative returns occur, they are mostly small, and none is catastrophic.

Overall, the results in Table V are hard to reconcile with the pricing of risk in efficient markets. Even though transaction costs and institutional arrangements might make the actual shorting of distressed firms problematic in practice, especially for prolonged periods of time, there seem to be substantial and consistent rewards for simply avoiding such stocks.

Table VI

One-Year-Before and Four-Year-After Returns, Conditional on Present Probability of Bankruptcy

Using Ohlson's (1980) model, all firms are assigned monthly into decile portfolios based on their probability of bankruptcy. Portfolio 1 contains the firms with the lowest probability of bankruptcy and portfolio 10 contains the firms with the highest probability of bankruptcy. This table presents a five-year window of average monthly returns, conditional on probability of bankruptcy at the time of portfolio assignment. Preceding-year returns are the mean portfolio monthly returns for the year preceding the month of portfolio formation. One-year-ahead returns are the mean portfolio monthly returns for the year following the month of portfolio formation. Two-, three-, and four-year-ahead returns are defined analogously. Coeff. and t-stat are the coefficient and the t-statistic on O in Fama–McBeth (1973) regressions of returns on O, market value, and book-to-market.

Portfolio	Preceding-Year Returns	One-Year Ahead Returns	Two-Year Ahead Returns	Three-Year Ahead Returns	Four-Year Ahead Returns
1	1.53	1.17	1.17	1.21	1.26
2	1.47	1.21	1.24	1.27	1.14
3	1.55	1.24	1.21	1.26	1.22
4	1.56	1.22	1.35	1.19	1.24
5	1.43	1.21	1.14	1.19	1.32
6	1.31	1.19	1.12	1.30	1.23
7	1.20	1.09	1.23	1.18	1.26
8	0.76	0.92	1.11	1.22	1.27
9	0.11	0.63	0.83	0.92	0.99
10	−1.28	0.06	0.27	0.54	0.67
Coeff.	**−0.275**	**−0.122**	**−0.105**	**−0.081**	**−0.067**
t-stat	**(−12.35)**	**(−4.95)**	**(−4.56)**	**(−3.61)**	**(−3.02)**

An examination of returns beyond the one-year-ahead window used for all previous tests could also provide evidence for whether the results for the most distressed firms are due to risk or to mispricing. If the most distressed firms are fundamentally less risky, and systematic risk is a comparatively stable characteristic of the firm, then one would expect that the most distressed firms today will continue to earn lower than average returns in the future. Additionally, a longer window of returns offers further evidence as to whether the results for the most distressed firms might be due to inappropriate conditioning on information unavailable at the time of portfolio formation.[11]

Table VI presents the results for this approach. Each month all firms are assigned into decile portfolios based on the O measure of bankruptcy risk.

[11] As mentioned earlier, financial reports for bankrupt and nearly bankrupt firms can be substantially delayed. Ohlson (1980) reports that the average lead time between the last fiscal-year end report and bankruptcy is 13 months. The lead time exceeds two years for a few firms in his sample.

Table VI displays the returns in a five-year interval surrounding the portfolio assignment event. One-, two-, three-, and four-year-ahead returns are mean portfolio monthly returns for the indicated year after the month of portfolio formation. Preceding-year returns are the mean monthly portfolio returns for the year preceding the month of portfolio formation. Preceding-year returns serve as a natural benchmark in judging the economic significance of the years-ahead returns. The reason is that both Ohlson's model (based on accounting information) and market prices reflect the well-being of the firm. However, market prices continuously impound new information in real time, but most accounting information becomes available only later and a significant part is not available until the release of the annual report. Thus, one would expect the firms classified as most distressed in any given month to have experienced low or negative returns during the preceding year. Of course, the low returns for the preceding year are not exploitable because the distress rankings are not available until after the portfolio formation. However, once the accounting information is available, one would expect subsequent returns to be commensurate with the systematic risk of the firms.

Table VI confirms that the firms classified as most distressed in any given month (portfolio 10) experience low returns during the preceding year (average of -1.28 percent per month). Thus, market prices correctly reflect the deteriorating financial condition for the firms that end up in the most distressed decile. However, the pattern of returns for subsequent years suggests that market prices do not fully impound the implications of available bankruptcy information. Returns for the most distressed firms increase over time but continue to be significantly lower than those of regular firms for at least four more years. Such a pattern of results is consistent with a risk explanation only if there are extreme long-run shifts in the systematic risk of large subpopulations of firms. However, such evidence is also indicative of a belated and slow adjustment to available information, consistent with other recent findings (e.g., Chan, Jegadeesh, and Lakonishok (1996)). In either case, the longer-window specification gives further confidence that the primary results are robust with respect to the date of portfolio formation and the length of the return interval.

III. Conclusion

A number of studies suggest that the size and book-to-market effects might be proxying for a firm distress risk factor (e.g., Fama and French (1992), and Chan et al. (1985)). The risk of bankruptcy appears to be one natural measure of firm distress. This study uses two existing models of bankruptcy prediction, Altman (1968) and Ohlson (1980), to investigate whether bankruptcy risk is a systematic risk priced in subsequent security returns. The main result from the tests is that bankruptcy risk is not rewarded by higher returns. Thus, the size and book-to-market effects are unlikely to be due to a distress factor related to bankruptcy risk. Surprisingly, firms with high bankruptcy risk earn substantially lower than average returns since 1980. Additional tests reveal that a risk-based explanation is unlikely to fully account for this anomalous result.

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