Systematic Risk Behavior of Financially Distressed Firms

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The apparent decline in systematic or beta risk with the onset of financial distress is a result that has puzzled a number of researchers. This study validates this result with different data and a new criterion for identifying financial distress. An analytical model presented in this study suggests that the leverage-increasing impact of financial distress on systematic risk may be more than outweighed by possible declines in systematic earnings risk associated with such distress, and it provides empirical evidence that is generally consistent with this proposition. The diminution of systematic risk is unaffected by several variants in beta risk estimation, including the index-weighing scheme and allowance for the turn-of-year effect. While numerically large, the average systematic risk decline is not highly significant in a statistical sense due to considerable variation in the behavior of betas from company to company.

INTRODUCTION

This paper investigates the behavior of the systematic risk of financially distressed firms. Conventional wisdom suggests that the systematic risk of such companies should increase, presumably because of increases in leverage associated with financial distress. Analysis shows, however, that changes in systematic risk also depend on changes in the covariances of a distressed firm's earnings with the earnings of the aggregate market. This study find that systematic risk declines with the onset of financial distress, confirming the results of a number of prior studies. This conclusion is insensitive to several alternative forms of systematic risk estimation. The empirical investigation also suggests that this decline is consistent with decreases in systematic earnings risk associated with financial distress.

This paper defines a financially distressed firm as one for which the possibility of bankruptcy and partial elimination of existing shareholder interests is viewed in the marketplace as significant. This *ex ante*, probabilistic conception of financial distress is not translated readily into an objective criterion for identifying distressed firms. It rules out many *ex post* criteria, such as filing for involuntary reorganization, which risk excluding firms the market may have viewed as distressed at some time but that were able to overcome their difficulties.

The *ex ante* approach in this study utilizes a sample of NYSE-listed firms whose bond ratings were reduced to Caa or a lower grade from a higher rating by Moody's some-

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time in the period 1972 through 1982.[1] Although this is not an obvious selection criterion, it is shown to identify a group of firms the market viewed as experiencing financial distress before the rating downgrade. Accordingly, the behavior of the firms' systematic risks is examined as the rerating point is approached. For a subsample of these firms that continued to be listed on the NYSE following the rerating, it is also possible to examine the behavior of the systematic risk after this information became available in the marketplace.

The behavior of distressed firms' systematic risk is significant for at least three reasons. First, it bears upon the behavior of the cost of equity capital for firms in financial distress. According to the capital asset pricing model (CAPM) and most of its variants, the required return on equity capital for a firm is an increasing function of its systematic risk only; nonsystematic risk is not relevant. If financially distressed firms do experience a reduction in systematic risk and the market accords them an improvement in the terms on which equity capital is supplied, then, in effect, the market is supplying such firms with a boost in overcoming financial difficulty.

Second, the notion that the risk associated with financial distress is nonsystematic and hence unimportant in well-diversified portfolios implicitly underlies an investment strategy that has become popular: consciously investing in troubled companies.[2]

Third, as discussed more fully in the next section, the behavior of the systematic risk of financially distressed companies has evidential bearing upon the question of the role of systematic risk considerations in the utility rate-making process.

SELECTED PRIOR RESEARCH

In an early paper concerned with the application of the CAPM to utility rate regulation, Brigham and Crum (1977) argue that low investment returns to shareholders occasioned by adverse business developments tend to bias estimated beta coefficients downward.[3] In support, they cite some casual evidence regarding apparent declines in the beta coefficients of W.T. Grant, Franklin National Bank, Penn Central, and two REITs

[1]Moody's states that "Bonds which are rated Caa are of poor standing. Such issues may be in default, or there may be present elements of danger with respect to principal or interest." With respect to bonds rated B, the next highest category, they state "Bonds which are rated B generally lack characteristics of desirable investment. Assurance of interest and principal payments or of maintenance of other terms of the the contract over any long run period may be small." Apparently the differentiating characteristic is the presence of elements of danger, as in practice Moody's appears to assign the rating of D to bonds in default.

[2]See the *Wall Street Journal* (January 4, 1983) to the effect that investing in companies operating under Chapter 11 bankruptcy proceedings may offer superior investment returns. *Fortune* (June 25, 1984) also discusses this strategy and identifies two mutual funds explicitly designed to exploit it: Merrill Lynch's Phoenix fund and Heine Securities' Mutual Shares.

[3]Brigham and Crum (1977) observe that the average estimated betas of the 24 Moody's utilities only rose from 0.74 in the latter 1960s to 0.75 in the 1971-1975 period while the beta of AT&T declined between the two periods. They argue that, in light of a whole host of problems utilities were experiencing in these years, it is unlikely the required returns to equity for these firms diminished over this period. They assert instead that it is more probable that the betas were underestimated. They state that "It simply boggles the mind to think that a portfolio manager would really think that he was *reducing* his portfolio's risk if he added a REIT stock after their troubles had become apparent, even though their calculated betas had fallen."

around the time they were experiencing financial distress. They conclude that the use of CAPM-based estimates of required returns is inappropriate in rate-making cases.

Hamada (1972), Rubenstein (1973), Galai and Masulis (1976), Kim (1978), and Dejong and Collins (1985) investigate the systematic risk behavior of firms in the context of the CAPM and contingent claims models. This analytical evidence suggests that the systematic risk of a firm should increase with increasing leverage. Some empirical support for this proposition is provided by Hamada and Dejong and Collins.

None of these papers deals specifically with financially distressed firms. It is reasonable to anticipate, however, that the value of the equity would decline relative to the value of the debt for such firms, and, as a consequence, the proportion of debt in the firms' market value capital structures would increase. Thus, the positive effect of leverage on systematic risk would seem to apply to financially distressed firms.

On the other hand, a series of prior empirical studies, by Aharony, Jones, and Swary (1980),[4] Altman and Brenner (1981), and Baldwin and Mason (1983) examine the systematic risk of financially distressed firms and find that the betas of such firms appear to decline with deteriorating financial condition even though the unsystematic risk and total risk are increasing. The findings are attributed to (unidentified) confounding variables, regression of the betas toward the mean, or estimation problems. This empirical result with respect to declining systematic risk has puzzled most investigators, and no plausible explanation has been validated.[5]

THE THEORETICAL RELATIONSHIP BETWEEN FINANCIAL DISTRESS AND SYSTEMATIC RISK

No fully developed theory relates systematic risk of equity securities in the presence of default risk to dimensions of the underlying business enterprise. It is possible to identify some of the issues in this area, however, with a variation of a model proposed by Bowman (1979).

Black and Scholes (1973) and Galai and Masulis (1976) have shown analytically that the beta risk of the equity securities of a company with risky debt, $B_{s,m}$, is:

$$(1) \quad B_{s,m} = [(\delta S/S) / (\delta V_f/V_f)] \, B_{f,m}$$

where:

$[(\delta S/S) / (\delta V_f/V_f)]$ = The elasticity of the value of the firm's stock, S, with respect to its total market value, V_f; and

[4] Aharony *et al.* examine the betas for a sample of 45 firms that subsequently went bankrupt. Altman and Brenner identify a sample of 92 distressed firms using the Z-score model. Baldwin and Mason's analysis is based upon a case study of Massey Ferguson.

[5] The Altman and Brenner (1981) study appears to be the most recent looking directly at the systematic risk of financially distressed firms. A recent paper by Kaplan and Stein (1990) finds what the authors describe as "surprisingly small" increases in equity risk for firms undergoing public leveraged recapitalizations, a result these authors attribute to the new debt bearing a substantial component of the underlying firms' systematic risk. At one time the literature examining restructurings and other corporate events occasionally considered changes in pre- and postevent systematic risk; see, for example, Mandelker (1974). Such risk shifts generally were found to be erratic, and to have marginal impact on results.

$B_{f,m}$ = The systematic risk for the firm as a whole with respect to the market.

This relationship can be rewritten as:

(1a) $B_{s,m} = (\delta S/\delta V_f)\ (V_f/S)\ (B_{f,m})$

or, because $V_f = S + D$, where D is the market value of the outstanding debt, as:

(1b) $B_{s,m} = (\delta S/\delta V_f)\ (1 + (D/S))\ (B_{f,m})$

In equation (1b) the first factor on the right is a measure of the extent to which equity interests share in changes in the value of the firm. As Bowman observes, this factor is bounded from above by 1.0 and is 1.0 only when the firm's debt is default-free. The second factor is the firm's leverage ratio, equal to or greater than 1.0, and it conveys the common observation[6] that the equity beta is a positive function of firm leverage.[7] Galai and Masulis prove that the product of these two factors, which equals the elasticity of the value of the firm's equity with respect to its total market value (the expression in brackets in equation (1)), must be equal to or greater than 1.0. They also establish a result that is relevant for the financial distress question: namely, that the derivative of this elasticity with respect to the value of the firm must be less than 0. That is, *ceteris paribus*, as the firm gets larger (smaller) in market value terms, the responsiveness of changes in equity value relative to changes in the firm's market value decreases (increases).

Bowman has shown that:

$$(2)\quad B_{f,m} = \frac{(V_m/V_f)\ Cov(X_f,X_m)]}{Var(X_m)}$$

$$(2a)\quad = \frac{(V_m/V_f)\ Std(X_f)\ \rho(X_f,X_m)}{Std(X_m)}$$

where:

V_m = Total value of all firms;

X_f and X_m = Economic earnings of the firm and aggregate of firms, respectively;

$Cov(X_f, X_m)$ = Covariances;

$Std(X_f)$ = Standard deviation; and

[6]This is as shown initially by Hamada (1972).

[7]See the exchange between Kim (1978) and Bowman (1979).

$\rho(X_f, X_m)$ = Correlation coefficients.

The factor (V_m/V_f) is greater than 1.0, and its derivative with respect to V_f is less than 0. Substituting equation (2a) into equation (1) gives:

$$(3)\quad B_{s,m} = \frac{[(\delta S/S)/(\delta V_f/V_f)]\,(V_m/V_f)\,\mathrm{Std}(X_f)\,\rho(X_f,X_m)}{\mathrm{Std}(X_m)}.$$

Now, suppose a firm becomes financially distressed. Its total value should decrease due to costs of negotiations and reorganization as well as the expected costs of bankruptcy and possibly a lower expectation on X_f. The elasticity, $(\delta S/S)/(\delta V_f/V_f)$, increases, as does the ratio (V_m/V_f). Thus, the decrease in value unambiguously raises the product of these factors and hence the systematic risk of the equity. These effects may be less than prior researchers may have assumed, and they may be more than offset by changes in the remaining elements in the numerator of equation (3), the systematic component of the firm's earnings.

Equation (3) can be written as:

$$(3a)\quad B_{s,m} = \frac{(\delta S/\delta V_f)(V_m/S)\,\mathrm{Std}(X_f)\,\rho(X_f,X_m)}{\mathrm{Std}(X_m)}.$$

In the presence of financial distress the valuation ratio (V_m/S) in equation (3a) reasonably might be expected to increase by several multiples as the value of the equity declines; that is, it may double or triple.[8] On the other hand, the equity participation ratio $(\delta S/\delta V_f)$, which measures equity's proportionate share of changes in the total value of the firm, may decrease substantially. This equity participation ratio is akin to a call option's delta, the derivative of the option's value with respect to the underlying stock's price. A call option's delta decreases as the option moves from in the money to out of the money. Under the common conceptualization in which equity interests are viewed as holding a call on the firm's assets written by the firm's bondholders, the equity option of financially distressed firms is apt to be deep out of the money and have a small delta. That is, most of the changes in the value of such firms accrue to bondholders rather than to shareholders. Recent indirect evidence suggests that a decline in this delta or equity participation ratio by 70 percent or more is not unrealistic.[9] Therefore, it is possible that

[8] As is shown in Figure 1, the cumulative mean excess return for the sample of distressed firms examined in this study averages around zero until approximately 36 months prior to the bond downrating; over the next 36 months it declines to about -0.6. This latter value implies an increase in the valuation ratio of 2.5.

[9] Kaplan and Stein (1990) look at the implicit betas of debt issued in conjunction with public leveraged recapitalizations and in the process examine the increase in the equity risk of these firms, which they find to be "surprisingly small." Using several estimation methods, their average equity beta goes from 1.02 to 1.47. At the same time the average firm in their sample increased the proportion of senior capital in its capital structure from 0.260 to 0.845, corresponding to an increase in the leverage ratio, the second term in equation (1b), from 1.34 to 6.45. Under the assumption that there was no change in the systematic risk of the firms in their sample, these changes imply a decrease in the equity participation ratio, the first term in equation (1b), from 0.76 to 0.23, a 70 percent decline. The decline in the equity

changes in the product of the valuation and equity participation ratio may rise only by a small amount with the onset of financial distress.

The effect of financial distress on the last two factors in the numerator, $Std(X_f)$ $\rho(X_f,X_m)$, may be negative. Even if the variation in the firm's economic earnings stream increases, as one might anticipate, this effect could be more than offset by a reduction in the correlation between the earnings of the firm and the aggregate of firms. This correlation may drop substantially because the survival of the firm and the level and variation in its earnings stream come to depend more on decisions of managers, customers, suppliers, creditors, and bankruptcy judges—matters that are firm-specific in nature and essentially unaffected by economy-wide considerations.[10] Nevertheless, this possibility does not appear to have been considered in the existing literature on the behavior of systematic risk in the presence of financial distress. This paper examines the behavior of these two elements of earnings risk explicitly.

SAMPLE SELECTION, DESCRIPTIVE CHARACTERISTICS, AND IMPLICATIONS FOR THE ESTIMATION OF SYSTEMATIC RISK

The sample firms had at least one bond issue (including convertible bonds) rerated from a higher rating to the grade of Caa or lower by Moody's during the years 1972-1982 and had common stock traded on the New York Stock Exchange for at least 72 months prior to the rerating.[11] The period 1972-1982 encompasses two moderately severe recessions, periods that were characterized by a higher than normal incidence of financially distressed firms. Unlike the current occurrences of financial distress, a sufficient period of time has passed to allow adequate *ex post* data to be collected on these firms. The 72 month criterion is imposed to insure adequate data for systematic risk analysis. The purpose of the listing criterion is to minimize the effects of infrequent trading on systematic risk estimation.

Thirty-one firms met these criteria. They are identified in Table 1 along with the month of the issue of *Moody's Bond Record* containing the threshold bond rerating, the later of the month first listed on the NYSE or 109 months (9 years) prior to the rerating, and the month last listed on the NYSE.

The recognizable names on the list in Table 1 appear to meet the test of being what reasonable persons would agree, at least in retrospect, were financially distressed firms. A more objective indication that these firms were experiencing financial distress and that this financial distress was comprehended by the marketplace is provided by Figure 1.

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participation ratio is likely to be even greater for financially distressed firms because of the lower chance of the implicit equity call option being exercised.

[10] Altman (1984) reviews a number of what he call "indirect costs" of bankruptcy and argues that their magnitude is substantial. Most of these appear idiosyncratic in nature, such as the cost of lost sales due to diminished customer confidence—which he regards as particularly important. It is interesting that four of the firms whose experience Altman draws on to make his point about lost sales appear in the sample of distressed firms employed in this paper.

[11] Of the 31 bonds causing companies to be included in the sample, 25 initially were rerated Caa, five were rerated to Ca, and one went into defaulted (D) status. By the end of the calendar year in which the rerating occurred, ten issues were in default; by the end of the following year, an additional five had defaulted; while by the third year-end following rerating another two issues defaulted. Thus, 17, or slightly over half, of the companies in the sample had defaulted on their bonds after two to three years.

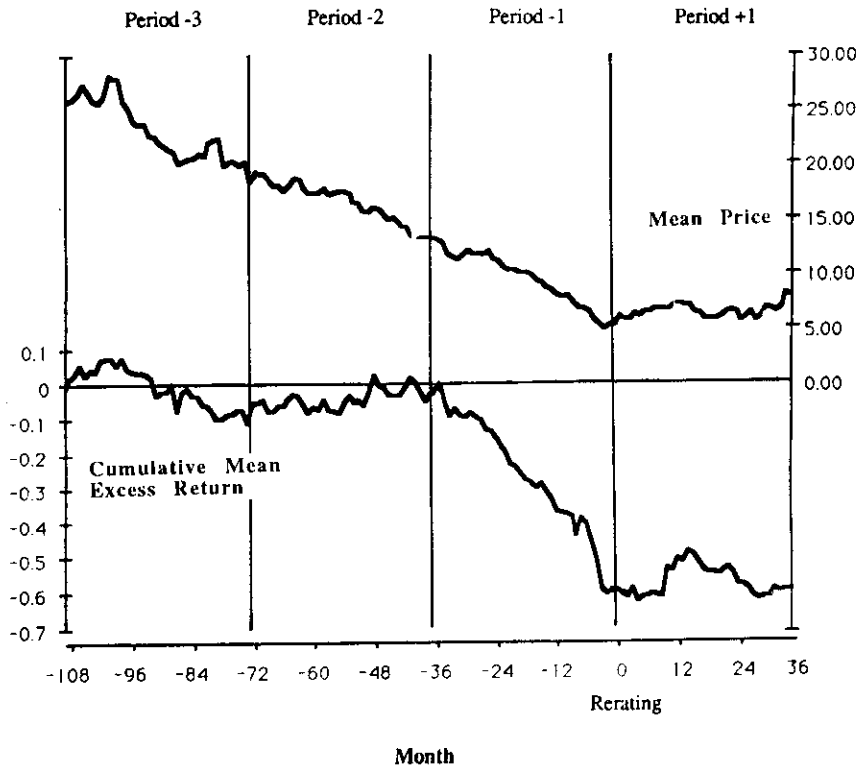
Table 1—Distressed Firm Sample

Name	Month Rerated	First Data Month	Last Data Month
AM International	11/81	10/72	03/82
Allied Supermarkets	09/78	08/69	10/78
American Export Industries	09/72	08/63	09/73
Arlans Department Stores	06/73	05/64	04/73
Braniff International	04/81	03/72	04/82
Buttes Gas & Oil	10/82	09/76	11/85
Cenco	10/75	09/66	06/82
Chrysler	05/80	04/71	12/85
Columbia Pictures Industries	12/73	11/64	05/82
Commonwealth Oil Refining	05/77	04/68	10/77
Continental Air Lines	01/82	12/72	09/82
Duplan	08/76	07/67	07/76
Farah Manufacturing	06/77	05/68	12/85
Fedders	03/82	02/73	12/83
Food Fair	11/78	10/69	09/78
Grant (WT)	10/75	09/66	08/75
International Harvester	11/81	10/72	12/85
Interstate Stores	06/74	05/65	04/74
Lionel	03/82	02/73	02/82
Manville	09/82	08/73	12/85
National Homes	05/79	07/71	12/85
Penn Dixie Industries	12/77	11/68	03/80
Revere Copper & Brass	11/82	10/73	12/85
Seatrain Lines	12/80	11/71	01/81
Texfi Industries	04/78	03/72	12/85
Trans World	02/75	01/66	12/85
United Merchants & Manufacturers	09/77	08/68	12/85
Western Air Lines	01/82	12/72	12/85
White Motor	05/76	04/67	08/80
Wickes Companies	05/82	04/73	04/82
World Airways	06/82	05/73	12/85

Cumulative values of the mean excess rate of return, adjusted by differencing out the CRSP value-weighted index return from the individual securities' monthly total rates of return, are presented for a period extending from 108 months prior to publication of the rerating to 36 months afterward. These data reflect all the sample firms for which returns were available in each of these 144 months. Thus, the cumulative returns can be thought of as providing a crude indication of the investment returns to a portfolio constructed with equal investment in all firms listed in a month relative to the downrating, rebalanced monthly, where the problems associated with foreknowledge of the reratings and the fact that they occur in different months in calendar time are not controlled.

Until 30 months before the publication of the rerating the cumulative excess return of this group of stocks is approximately zero. From this point, however, the cumulative excess returns begin a precipitous decline—by the month of the rerating the cumulative excess return fell to about -0.57, implying a loss of value of 57 percent relative to an unmanaged portfolio over the preceding 72 months. This observation provides justifica

Figure 1—Cumulative Mean Excess Returns and Mean Prices



tion for use of the rerating criterion as well as for assuming that these companies' financial problems were evident to, or anticipated by, the market prior to the downrating.[12]

A similar implication is suggested by the mean actual ending monthly prices (that is, unadjusted for stock splits and dividends) also portrayed in Figure 1. In the period from 108 to 99 months prior to the rerating the mean price fluctuates between approximately $25 and $28, with no obvious trend. After month -99 it begins to decline, however, dropping approximately 50 percent by month -36, and on down to just over $5 by month zero. It seems likely that much of this decline reflects the market's reaction to the financially distressed condition of these firms. Another implication of the low resulting price level is that the stocks' return behavior may be affected by the turn-of-the-year or January

[12]Considerable literature exists showing the equity market appears to anticipated rating changes; see, e.g., Pinches and Singleton (1978).

effect, which Stoll and Whaley (1983) have shown is more of a low price stock effect than a small firm effect. Therefore, in estimation of systematic risk an effort will be made to cope with possible turn-of-the-year effects.

BEHAVIOR OF SYSTEMATIC RISK

Beta coefficients for each sample firm are estimated over as many as four time intervals. The period designated period -1 runs from month -37 through month -2, inclusive, where month zero is the month that Moody's reports the rerating. This period encompasses the three years immediately preceding publication of the bond downrating used to select the sample firms, moving back in time one month to account for the fact that the bond rerating presumably occurred in the month preceding its publication. As indicated previously, the operating assumption is that the financial distress of the sample firms is evident to the market during this period.[13] Period -2 runs from months -73 to -38, or the period approximately six to three years prior to the downrating. Returns during this period are assumed to be representative of the systematic risk of the firms prior to the onset of financial distress. For most firms in the sample it is also possible to estimate betas over the months -109 through -74, and this was done to obtain some idea of the systematic risk behavior during a period further removed from the rerating. This period will be denoted period -3. Finally, for 13 of the sample firms it is possible to estimate beta coefficients for the three years following the downrating, months 1 through 36, period +1.

The first panel of Table 2 shows summary results of estimates of beta coefficients over these four periods using the conventional estimation equation:

$$(4) \quad R_{i,t} = \alpha_i + \beta_i R_{m,t} + e_{i,t}$$

where:

$R_{i,t}$ = Total return of security i in month t; and

$R_{m,t}$ = Corresponding value for the CRSP value-weighted return index.

The second panel shows the results of a conventional approach to controlling for the turn of the year effect. Here the estimation of the equation is of the form:

$$(5) \quad R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_i D + e_{i,t}.$$

where:

D = A dummy variable with the value of unity when month t is January, and zero otherwise.

[13] Not all the sample firms have a complete run of data for this period. Four firms had been delisted from or had trading suspending on the NYSE by month -2; two firms were missing the final two months of returns for this period; and one was missing the final seven months of returns.

Table 2—Results of Beta Estimation

	Period			
	-3	-2	-1	+1
Number of Firms				
Entire Sample	29	31	31	13
Surviving Firms	10	13	13	13
Conventional Betas, Value-Weighted Index				
Entire Sample				
Mean Beta	1.477*	1.653*	1.503*	1.104
Standard Deviation	.730	.604	.589	.734
Mean R^2#	.349	.299	.271	.104
Surviving Firms				
Mean Beta	1.361*	1.788*	1.491*	1.104
Standard Deviation	.532	.696	.455	.734
Mean R^2	.340	.289	.300	.104
January Dummy Betas				
Entire Sample				
Mean Beta	1.452*	1.614*	1.435*	1.018
Standard Deviation	.763	.625	.614	.726
Mean R^2	.400	.380	.329	.155
Surviving Firms				
Mean Beta	1.353*	1.702*	1.446*	1.018
Standard Deviation	.487	.748	.539	.726
Mean R^2	.360	.411	.367	.155
Conventional Betas, Equally Weighted Index				
Entire Sample				
Mean Beta	1.274*	1.499*	1.405*	1.205*
Standard Deviation	.697	.496	.670	.524
Mean R^2	.426	.407	.334	.165
Surviving Firms				
Mean Beta	1.044	1.672*	1.299*	1.205*
Standard Deviation	.418	.561	.378	.524
Mean R^2	.382	.408	.347	.165

* Denotes value significantly different from 1.0

All values of R^2 are adjusted for degrees of freedom

The dummy is intended to adjust the intercept in January and thereby absorb any recurring return effect in January that is unrelated to the level of market returns in that month.[14]

Finally, in the third panel the conventional model is reestimated with the equally weighted CRSP index. The objective in this estimation is to examine the sensitivity of beta coefficient estimation to index choice. Results in the upper portion of each panel of Table 2 are based on all sample firms for which data are available to make the beta estimates, and this number changes from period to period (except periods -2 and -1). The lower portion of each panel reports the results of replicating the analysis for only those

[14]The analysis also was conducted utilizing the January dummy to modify only the estimate of the beta coefficient, not the intercept. Such a model assumes that systematic risk is different in January from that in other months. This estimation gives marginally poorer fits that the model described in the text.

13 firms that had at least 36 months of post-downrating return data on the CRSP NYSE monthly tape.

Regardless of the estimation method, the general pattern of behavior of the mean beta coefficients in Table 2 is similar. The initial betas are substantially greater than 1.0, a result found by other researchers. This result suggests that firms that ultimately experience financial distress are likely to have above average levels of debt and systematic earnings risk—simply put, firms characterized by high financial and/or high operating risk are more apt to experience financial distress. The betas uniformly decline from period -2 to period -1 to period +1, representing a convergence on unity. Betas estimated with the equally weighted index are not as large initially as those estimated with the value-weighted index, nor do they decline as drastically. The mean values for the adjusted R^2 are of the order of explanatory power one customarily encounters with beta estimation of this type in the early periods, but the explanatory power declines substantially in period -1 and period +1. This result is consistent with the declining betas as well as with the increasing total return variation such securities display.

The mean adjusted R^2 for the model with the January dummy exceeds the adjusted R^2 for the basic model by a considerable margin, suggesting that the turn-of-the-year effect is present with this sample of securities. The introduction of the January dummy reduces the period -2 beta somewhat and results in even more rapid regression toward the mean. Results for the surviving firms are similar to those for the entire sample. The period -2 betas appear to be a bit higher for these securities than for the entire sample; thus, the rate of regression of their betas is more rapid than for the overall sample.

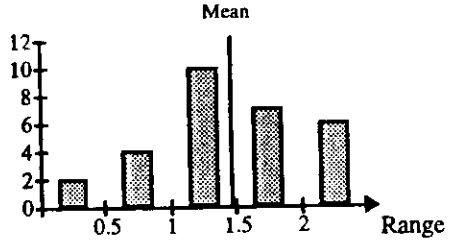
Figure 2 provides evidence on shifts in the shapes of the beta frequency distributions. In period -3 the distribution is approximately normal. Period -2 displays a substantial shift to the right in the distribution. In period -1 the mean remains high with pronounced negative skewness. Finally, a substantial change occurs in the frequency distribution for period +1; the beta distribution is flattened with no obvious point of central tendency.

Table 2 contains an indication of the results of tests of whether the means of the estimated beta coefficients of the distressed firms in each period are significantly different from unity. The test statistic is simply a t-test of the difference in the mean beta and 1.0. The pattern is consistent. The average beta is always significantly greater than 1.0 prior to the downrating (except for the surviving firms in period -3), even though it converges on unity with the passage of time. Only with the equally weighted index estimation are the mean betas significantly greater than unity following the downrating.

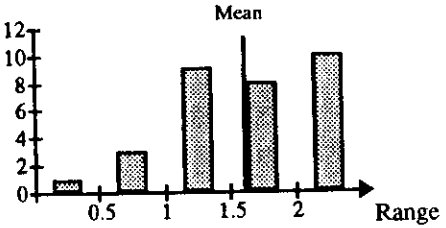
Results of a direct test of shifts in the systematic risk of the distressed firms are provided in Table 3. Underlying this table is a conventional t-test of the paired differences in the estimated beta coefficients in various periods, where the question is whether the mean change (later period beta coefficient - earlier period beta coefficient) is significantly less than zero. The results are again fairly consistent across beta estimation methodologies, but with a somewhat different message: none of the shifts in systematic risk for the entire sample is statistically significant, and for the subsample of surviving firms, only the size of the declines in the betas from the period of 38 to 73 months before (period -2) to immediately after the downrating (period +1) is statistically significant. The exception occurs with the betas estimated using the equally weighted index; for the surviving firms,

Figure 2—Beta Frequency Distributions

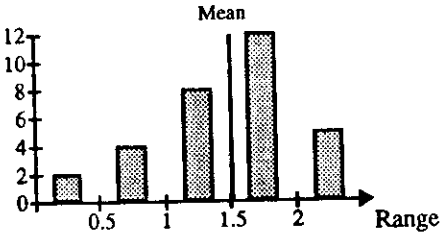
(a) **Period -3**
n = 28



(b) **Period -2**
n = 31



(c) **Period -1**
n = 31



(d) **Period +1**
n = 13

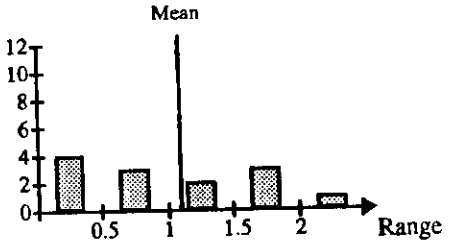


Table 3—Tests of Shifts in Betas of Distressed Firms (Later Beta - Earlier Beta)

	Shift	t-statistic
Conventional Betas, Value-Weighted Index		
Entire Sample		
	Period -3 to Period -2	1.01
	Period -2 to Period -1	-1.24
	Period -3 to Period -1	-.16
Surviving Firms		
	Period -3 to Period +1	-.26
	Period -2 to Period +1	-3.49*
	Period -1 to Period +1	-1.34
	Period -3 to Period -2	1.35
	Period -2 to Period -1	-1.39
	Period -3 to Period -1	.77
January Dummy Betas		
Entire Sample		
	Period -3 to Period -2	1.08
	Period -2 to Period -1	-1.46
	Period -3 to Period -1	-.29
Surviving Firms		
	Period -3 to Period +1	-.62
	Period -2 to Period +1	-3.17*
	Period -1 to Period +1	-1.37
	Period -3 to Period -2	1.40
	Period -2 to Period -1	-1.05
	Period -3 to Period -1	.26
Conventional Betas, Equally Weighted Index		
Entire Sample		
	Period -3 to Period -2	1.42
	Period -2 to Period -1	-.67
	Period -3 to Period -1	1.02
Surviving Firms		
	Period -3 to Period +1	1.19
	Period -2 to Period +1	-2.79*
	Period -1 to Period +1	-.46
	Period -3 to Period -2	2.83*
	Period -2 to Period -1	-2.16*
	Period -3 to Period -1	2.16*

* Denotes rejection of null hypothesis that the mean changes are equal to or less than zero at the $\alpha = .05$ level, one-sided test

the betas increase significantly from period -3 to periods -2 and -1, but decrease significantly from period -2 to periods -1 and +1.[15]

In sum, these results are generally consistent with those of prior studies. Neither the use of an explicit *ex ante* sample selection criterion nor several alternative approaches to systematic risk estimation changes the fundamental conclusion that beta risk on average declines with the onset of financial distress. There is some implication, however, that the statistical significance of this shift may not be as great as may be supposed from prior

[15] In view of the apparent nonnormality of the beta distributions in periods other than -3, a nonparametric Wilcoxon rank-sum test of differences in means also was employed to examine these shifts. The results were consistent with the parametric results reported in the paper.

studies, a result that is possibly attributable to the large errors encountered in estimating systematic risk for financially distressed companies.

THE BEHAVIOR OF EARNINGS RISK

As noted previously, received theory suggests that systematic risk in the equity marketplace is a positive function of both leverage and systematic earnings risk. Prior commentators on the systematic risk of financially distressed firms have concentrated on the leverage dimensions of the relationship. It is possible, however, that declines in the systematic component of earnings risk may more than compensate for the increase in leverage that accompanies the onset of financial distress.

To investigate this possibility formally, quarterly earnings for the sample firms over the periods of interest were retrieved from Compustat's quarterly tapes. The earnings figure employed is Compustat's quarterly item #8, "Income Before Extraordinary Items," a total rather than per-share earnings level figure as the analytical model dictates. This earnings figure is taken before discontinued operations (as well as extraordinary items) and thus is a measure of income from continuing operations. Income from continuing operations, the earnings number most comparable to earnings realizations for firms not experiencing financial distress, appears to be the accounting number that most closely approximates (long-term) economic earnings, is regarded as being on average an unbiased indicator for economic earnings, and is presumably the number of prime importance to equity investors. Although this earnings measure will contain some big bath writedowns of obsolete or low market value (relative to book value) assets, such writedowns will pertain largely to continuing operations, not those that are being shut or spun off. Thus, the number is less subject to downward bias resulting from restructuring efforts associated with financial distress than other published alternatives, including net income. Earnings estimation for these firms is likely to have presented even greater estimation problems than is usual and, consequently, the earnings series should be regarded as only an approximation of the market's perceptions of the actual values during the time periods in question.

These earnings numbers are matched with the corresponding quarterly earnings for the Standard & Poor's 500 index. For companies whose fiscal quarters did not correspond to the calendar quarters on which the S&P 500 earnings are reported, the matching was performed in order to produce an overlap in two of the three months of the quarter. (For example, a company quarter ending in January was matched with the index earnings for the quarter ending in December, as was a company quarter ending in November.) Simple product-moment correlation coefficients are estimated between the two earnings series for each of the 12 quarter periods employed in the beta estimation whenever four or more quarters of earnings are available.[16]

Table 4 reports the means of these correlation coefficients, the standard deviations of the company earnings, and the products of these two terms—that is, the systematic earn

[16]Of the 28 firms with earnings numbers in period -3, 24 had 12 quarters (the maximum number) available; one had 11 quarters; two had ten quarters; and one firm had four quarters—this pattern of availability is representative of the other periods. Elimination of the correlations for firms with fewer than ten quarters of data in each period would not affect the mean correlations reported significantly.

Table 4—Behavior of Estimated Systematic Earnings Risk

	Period			
	-3	-2	-1	+1
Entire Sample				
# Observations	28	31	28	20
Mean $\rho(X_f,X_m)$	.11	.25	-.08	.24
$\rho(X_f,X_m) > 0$	15	22	12	14
Proportion $\rho(X_f,X_m) > 0$	.54	.71	.43	.70
Mean Std (X_f)	4.30	6.72	21.58	30.48
Mean Std $(X_f)\rho(X_f,X_m)$	0.72	3.00	-7.30	3.69
Surviving Firms				
# Observations	12	13	13	13
Mean $\rho(X_f,X_m)$	-.08	.21	-.09	.24
$\rho(X_f,X_m) > 0$	4	8	5	9
Proportion $\rho(X_f,X_m) > 0$	.25	.62	.38	.69
Mean Std (X_f)	7.52	12.29	33.97	43.78
Mean Std $(X_f)\rho(X_f,X_m)$	0.93	6.25	-15.68	7.88

ings risk component in the numerator of equation (3). These results are largely consistent with the proposition that distressed firms' betas decline because of a reduction in systematic earnings risk. In particular, from period -2 to period -1 the mean correlation coefficient between the earnings series drops from 0.25 to -.08; the proportion of correlation coefficients that are positively signed decreases from 0.71 to 0.43; and the standard deviation of the sample firms' earnings increases by a factor of three. Because of the declining correlation, the systematic risk component drops substantially despite the increase in total earnings risk, a result that is consistent with the concurrent decline in estimated betas at this time.[17]

It is interesting and consistent with the analysis that from period -3 to period -2 both the earnings correlation and standard deviation increase, paralleling the increase in estimated betas from the earlier period to the later; these periods precede the onset of financial distress for the sample firms and are less likely to be contaminated by changing leverage effects.

[17]Strictly speaking, the negative sign on the mean correlation coefficient and the systematic risk measure in period -1 implies that the mean beta should be negative in this period, and it is not. The quarterly earnings of the distressed firms tended to decline during this period, whereas the quarterly market index income increased, thereby causing some of the negative earnings correlation. The -.08 correlation is close to zero and probably is viewed best as the mean of estimates of actual unobservable correlation coefficients that are close to or equal to zero.

An element of these earnings risk measures at odds with the analysis is their increase from period -1 to period +1 at the same time that the betas continued to decrease.[18] A potential explanation is that the period +1 values necessarily are based only on surviving firms, firms whose leverage ratios were decreasing with recovery in their stock prices (Figure 1). In order to explore this inconsistency further, the 12 firms for which the relevant data are available in both the period preceding and the period following the rating change are partitioned according to the sign of the change in their estimated beta. Five firms experience an increase in beta, with a mean increase of 0.2530; seven firms' betas decrease, with a mean decline of 1.1546. For the five firms with the increase in beta, the mean change in the earnings correlation measure is an increase of 0.5440 (four increase, one decreases). For the seven firms with a beta decrease, the mean change in the earnings correlation measure, also an increase, is only 0.1357 (three increase, four decrease). The pattern of behavior for the systematic earnings risk component is similar. Thus, despite an increase in systematic earnings risk for both groups, the increase is smaller and less consistently positive for those firms experiencing a beta decrease than for those experiencing a beta increase.

SUMMARY

Like prior studies utilizing other criteria for the identification of financial distress, this investigation finds that the systematic risk of financially distressed firms is initially greater than average but tends to converge to the average value of unity with the onset of financial difficulty. These results are unaffected by the index-weighing scheme and allowance for the turn-of-year effect. This decline in beta risk, while numerically large, is not highly significant in a statistical sense, suggesting considerable variation in the behavior of betas from company to company. The diminution of betas is a result that has puzzled those who have focused on the total risk or leverage consequences of financial distress. Standard approaches to the analysis of systematic risk, however, suggest that it is also a function of the level of systematic earnings risk. This investigation raises the possibility that the leverage consequences of financial distress may be more than outweighed by declines in systematic earnings risk, and it provides empirical evidence that is generally, but not completely, consistent with this proposition.

REFERENCES

1. Aharony, Joseph, Charles P. Jones, and Itzhak Swary, "An Analysis of Risk and Return Characteristics of Corporate Bankruptcy Using Capital Market Data," *Journal of Finance* (September 1980), pp. 1001-1016.

2. Altman, Edward I., "A Further Empirical Investigation of the Bankruptcy Cost Question," *Journal of Finance* (September 1984), pp. 1067-1089.

3. Altman, Edward I., and Menachem Brenner, "Information Effects and Stock Market Response to Signs of Firm Deterioration," *Journal of Financial and Quantitative Analysis* (March 1981), pp. 35-51.

4. Baldwin, Carliss Y., and Scott P. Mason, "The Resolution of Claims in Financial Distress—the Case of Massey Ferguson," *Journal of Finance* (May 1983), pp. 505-516.

[18] Earnings data are available for 20 firms for period +1, the period following the rerating. This research requires, however, that returns data on the NYSE be available for each of the firms, a criterion met by only 13 of the 20 firms.

5. Black, Fisher, and Myron Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy* (May/June 1973), pp. 637-654.

6. Bowman, Robert G., "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables," *Journal of Finance* (June 1979), pp. 617-630.

7. _____, "Reply," *Journal of Finance* (June 1981), pp. 749-750.

8. Brigham, Eugene F., and Roy L. Crum, "On the Use of the CAPM in Public Utility Rate Cases," *Financial Management* (Summer 1977), pp. 7-15.

9. Dejong, Douglas V., and Daniel W. Collins, "Explanations for the Instability of Equity Beta: Risk-Free Rate Changes and Leverage Effects," *Journal of Financial and Quantitative Analysis* (March 1985), pp. 73-94.

10. *Fortune*, "News/Trends: Distress Investing" (June 25, 1984).

11. Galai, Dan, and Ronald W. Masulis, "The Option Pricing Model and the Risk Factor of Stock," *Journal of Financial Economics* (January/March 1976), pp. 53-81.

12. Hamada, Robert, "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stock," *Journal of Finance* (May 1972), pp. 435-452.

13. Kaplan, Steven N., and Jeremy C. Stein, "How Risky Is the Debt in Highly Leveraged Transactions?" *Journal of Financial Economics* (1990), pp. 215-245.

14. Kim, E. Ban, "A Mean Variance Theory of Optimal Capital Structure and Corporate Debt Capacity," *Journal of Finance* (March 1978), pp. 45-64.

15. Kim, Kee S., "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables; Comment," *Journal of Finance* (January 1981), pp. 747-748.

16. Mandelker, Gershon, "Risk and Return: The Case of Merging Firms," *Journal of Financial Economics* (1974), pp. 304-335.

17. Moody's Investor Service, *Moody's Bond Record* (New York).

18. Rubenstein, Mark E., "A Mean-Variance Synthesis of Corporate Financial Theory," *Journal of Finance* (March 1973), pp. 167-181.

19. Pinches, George E., and J. Clay Singleton, "The Adjustment of Stock Price Changes to Bond Rating Changes," *Journal of Finance* (March 1978), pp. 29-44.

20. Stoll, Hans, and Robert Whaley, "Transactions Costs and the Small Firm Effect," *Journal of Financial Economics* (June 1983), pp. 57-88.

21. *Wall Street Journal*, "Heard on the Street," (January 4, 1983).