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Market Prices, Financial Ratios, and the Prediction of Failure

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The failure of a firm, although infrequent, is extremely costly to suppliers of capital because reorganization or liquidation costs may consume a large portion of the value of the firm. Empirical evidence has indicated that financial ratios signal increases in the probability of failure for as much as five years prior to the failure of a firm.[1] The first half of this paper describes an investigation of the extent to which changes in market prices of stocks can also be used to predict failure. The second half is concerned with the reliance investors place on financial ratios in assessing the solvency positions of firms. Financial ratios and market price changes will not be viewed as mutually exclusive or competing predictors of failure. Instead, an attempt will be made to explore the degree of association between the two predictors.

Sample Design

The same sample of firms was used as in the earlier study of ratios.[2] It consists of 79 failed and 79 nonfailed firms which appeared in *Moody's Industrial Manual* during the period 1954 to 1964, inclusive. For every failed firm in the sample, there is a nonfailed firm from the same industry and from approximately the same asset size class.

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[1] William H. Beaver, "Financial Ratios As Predictors of Failure," *Empirical Research in Accounting: Selected Studies, 1966,* supplement to *Journal of Accounting Research,* 1966, pp. 71–111. For the 79 failed firms in the sample, failure was operationally defined as bankruptcy in 59 cases, preferred stock dividend arrearages in 16 cases, bond default in 3 firms, and one instance of an overdrawn bank account. The terms, *increase in probability of failure* and *deterioration in solvency position,* are used interchangeably throughout the paper.

[2] *Ibid.,* pp. 72–77.

The measure of market price change selected for study is R_{it},[3] where

$$R_{it} = \frac{D_{it} + P_{it} - P'_{it-1}}{P'_{it-1}}$$

P_{it} = price for security i at time t

D_{it} = cash dividend paid on security i between time $t - 1$ and t

P'_{it-1} = price for security i at time $t - 1$, adjusted for capital changes (e.g., stock dividends and stock splits).

Annual rates of return were computed for the failed firms for five years before failure. The computations should be based upon the announcement dates of the financial statements, but no announcement dates could be obtained for over 95 per cent of the firms. The assumption was made that financial statement data were announced 17 weeks after the end of the fiscal year.[4] The first year before failure (year 1) is defined as a 12-month period, lagging the fiscal year by 17 weeks. Because of the stipulation that no more than six months could elapse between the end of the fiscal year and the date of failure,[5] the final day of year 1 is approximately the date the firm announced failure. The other years before failure were similarly defined—i.e., as a 12-month period, lagging the fiscal year by 17 weeks.

Rates of return for the nonfailed firms were computed for the same years as their failed mates. The rates of return were then grouped into years before failure. If year 1 for a failed firm is 4/20/59 to 4/30/60 (i.e., its fiscal year-end is 12/31), the rate of return for its nonfailed mate for that same time period would be assigned to year 1, and similarly for the other years before failure.

The market price components of the rate of return were obtained from the *Bank and Quotation Record, The Financial and Commercial Chron-*

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[3] R_{it} is used throughout the paper to mean the rate of return of the security. The definition assumes discrete compounding. A similar measure, $R'_{it} = \ln (1 + R_{it})$, is the rate of return under continuous compounding. For a discussion of some of the conceptual and empirical considerations concerning rate of return computations for common stock, see Eugene F. Fama, "The Behavior of Stock Market Prices," *Journal of Business*, XXXVIII (January, 1965), 34–105; Benjamin F. King, "Market and Industry Factors in Stock Price Behavior," *Journal of Business*, XXXIX (January, 1966), 139–90; James H. Lorie and Lawrence Fisher, "Rates of Return on Investments in Common Stocks," *Journal of Business*, XXXVII (January, 1964), 1–21.

[4] If the financial statement data became available prior to the end of 17 weeks, there should be no serious effect upon the results since *annual* rates of return are being studied. If the financial statement data did not become available until after 17 weeks, the results will tend to understate the forecasting ability of the rate of return variables.

[5] If more than six months had passed since the most recent financial statements, those statements were said to represent the second year before failure. This applied to only two of the 79 failed firms in the original sample.

TABLE 1
Sample Size

Number of observations	Year before failure				
	5	4	3	2	1
$\bar{F}$[a]	43	46	50	57	62
F	39	47	52	53	51
Total	82	93	102	110	113

[a] $\bar{F}$ denotes nonfailed firms; F denotes failed firms.

icle, and *Barron's*. Where available, closing prices at the end of the month were used. If only bid-ask information was given, the midpoint was used. Since the common stock securities of 75 per cent of the sample firms were traded over-the-counter, price data could not be obtained for all the firms. Information on cash dividends and capital adjustments was taken from *Moody's Industrial Manual.* Table 1 shows the number of firms for which sufficient data could be obtained to compute the rate of return.

Cross-Section Analysis

It seems reasonable to assume that failed firms would have a higher probability of failure over the time horizon than their nonfailed counterparts. In this sense, these firms would be riskier than nonfailed firms, and risk-averse investors would require a higher ex ante rate of return on their investments. Each period, investors would reassess the solvency position of the firm and adjust the market price of the common stock such that the ex ante rate of return in future periods would continue to be commensurate with the higher risk. If, at any time, the firm is in a solvency state worse than expected, there will be a downward adjustment of market price, and the ex post rate of return will be less than the ex ante or expected rate of return. The opposite effect would occur if the solvency position of the firm is better than expected.

Unfortunately, no unequivocal statement can be made about the difference between ex post rates of return for failed and nonfailed firms. The direction and magnitude of the difference will depend upon the size of unexpected deterioration in solvency position. If it is large, the downward adjustment of price may be sufficient to produce ex post returns for the failed firms that are less than those for nonfailed. If there is little or no unexpected deterioration in solvency position, ex post rates of return would be higher for failed firms. It is not possible to state a priori whether the unexpected deterioration will be large, small, or somewhere in between.[6] At any point in time, there is no reason why ex post returns for

[6] Such a specification would require knowledge of the variables used by investors to assess the solvency paths of firms. Hopefully, this study will shed some light on this subject.

TABLE 2

Comparison of Median Values and Interquartile Ranges of R_{it}

Year before failure	Medians			Interquartile range					
				$\bar{F}$			F		
	$\bar{F}$[a]	F	Difference	.25 fractile	.75 fractile	range	.25 fractile	.75 fractile	range
5	.02	.02	+.00	−.12	.39	.51	−.23	.26	.49
4	.02	−.03	+.05	−.10	.32	.42	−.22	.45	.67
3	.11	.00	+.11	−.08	.48	.56	−.30	.35	.65
2	.12	−.08	+.20	−.11	.59	.70	−.57	.36	.93
1	.03	−.26	+.29	−.20	.26	.46	−.54	.26	.80

[a] $\bar{F}$ denotes nonfailed firms; F denotes failed firms.

failed firms should necessarily differ from those of nonfailed firms.[7] However, an examination of the ex post returns will permit an indirect assessment of the magnitude of the unexpected deterioration in solvency position.

Return Analysis—Unadjusted for Market-Wide Events

Table 2 presents summary measures of the distribution of R_{it} in each of the years before failure. The median of the failed returns is below that of the nonfailed, and the difference in medians increases as failure approaches. Although the nonfailed firms exhibit no upward or downward trend, the median of the failed firms drops over time with the largest price decline occurring in the final year.

The evidence indicates that, on the average, the unexpected deterioration in solvency position is sufficiently large to induce lower ex post returns for failed firms. Investors appear to adjust to the new solvency positions of the failed firms continuously over the five-year period, but the largest unexpected deterioration still occurs in the final year before failure. The implication is that investors are still surprised at the occurrence of failure, even in the final year before failure.

Table 2 also indicates that the cross-sectional dispersion of the failed returns is larger than the nonfailed. This finding is consistent with the belief that the failed firms are also riskier in terms of variability of returns as well as default risk.[8]

[7] An analysis of yields to maturity on bonds would avoid this ambiguity. Unfortunately, lack of data on the bond prices of the sample firms precluded this avenue of research.

[8] The analysis of R_{it} pertains to rates of return for a single security for a single time period. The conclusions of such an analysis are not necessarily the same as those that would be drawn from an analysis of the investment performance of a portfolio of failed firms over several time periods. However, such an analysis was conducted for 34 failed firms for which data were available for all five years before

TABLE 3

Comparison of Median Values and Interquartile Ranges for e_{it}

Year before failure	Medians			Interquartile range					
				$\bar{F}$			F		
	$\bar{F}$[a]	F	Difference	.25 fractile	.75 fractile	range	.25 fractile	.75 fractile	range
5	−.07	−.08	+.01	−.21	.07	.28	−.37	+.06	.43
4	−.04	−.13	+.09	−.15	.14	.29	−.30	+.17	.47
3	−.04	−.20	+.16	−.18	.16	.34	−.36	+.23	.59
2	−.01	−.21	+.20	−.16	.26	.42	−.58	+.16	.74
1	−.06	−.38	+.32	−.29	.11	.40	−.63	−.01	.64

[a] $\bar{F}$ denotes nonfailed firms: F denotes failed firms.

Return Analysis—Adjusted for Market-Wide Events

Since the findings may reflect economy-wide conditions, each rate of return was adjusted for the average rate of return earned by common stock securities during the same time period. The average rate of return chosen (hereafter referred to as the market index) was Fisher's Link Relative, an index that is an average of rates of return of all firms on the New York Stock Exchange.[9] The individual rates of return were adjusted by subtracting the Fisher Index from them, and the difference was defined as the residual rate of return, e_{it}, where

$$e_{it} = R_{it} - R_{mt}.$$

e_{it} = residual rate of return for security i from time $t - 1$ to t

R_{it} = defined as before

$$R_{mt} = \frac{\text{Fisher's Index at time } t - \text{Fisher's Index at time } t - 1}{\text{Fisher's Index at time } t - 1}.$$

The residual return represents that portion of R_{it} that cannot be explained by market-wide events as reflected by R_{mt}.[10]

failure. The investment performance was compared with 42 nonfailed firms for which data were available for all five years. The inferences drawn were essentially the same as those drawn here: (1) Both the average and marginal rates of return were lower for the failed firms, and (2) the dispersion of returns was much greater for the failed firms.

[9] The Over-the-Counter Price Index was also considered since 75 per cent of the sample firms come from the same population as the firms comprising the Index. However, the Index includes only 35 firms, and these firms tend to be the "blue chips" of the over-the-counter market. The Fisher Index is more fully described in the article, "Some New Stock Market Indices," by Lawrence Fisher, *Journal of Business*, XXXIX (January, 1966), 191–225.

[10] Defining the residual in this manner implies that the relationship between R_{it} and R_{mt} is linear, that the constant term is zero, and that the slope coefficient is

Table 3 presents the median and interquartile range for the residual rate of return for each year before failure. The results are very similar to those obtained for the unadjusted rates of return (Table 2), except that the differences between the failed and nonfailed firms are slightly sharper in the residual analysis.

Comparison with Ratios

The mean ratios of the failed firms are poorer than those of the nonfailed for five years before failure, and the difference in means increases as failure approaches (see Figure 1).[11] There is no trend in the nonfailed ratios, while there is a marked deterioration in the mean ratios of the failed. This pattern is evident in all the ratios, and its similarity with the return behavior suggests there is an association between returns and ratios. This finding is not surprising since ratios exhibited excellent predictive power in the earlier study, and investors would be expected to incorporate them into their assessments of changes in solvency positions.

However, a comparison of measures of central tendency offers only limited insight. The interpretation of a difference in means or medians can be substantially altered depending upon the extent to which the distributions overlap. Therefore, a dichotomous classification test was conducted for the rate of return variables. In order to classify the firms as failed or not, the data are first arrayed in ascending order. The array is inspected to find an optimal cutoff rate of return—a point that minimizes the percentage of misclassifications. If a firm's rate of return is below/above the cutoff rate, the firm is classified as failed/nonfailed. The classifications are compared with the actual failure status of the firms, and a percentage error is computed. The percentage error is an index of the degree of overlap between the failed and nonfailed distributions—the higher the error, the greater the overlap.

Within the context of the financial ratios, the percentage error could also be interpreted as an index of predictive ability of the ratios because there are a priori reasons for believing that the ratios, if their components are properly measured, should be different for failed and nonfailed firms. As indicated earlier, there is no reason to believe a priori that the rate of return variables should possess similar discriminatory power. Table 4 reports the percentage errors for the unadjusted return, the residual return, and the cash flow to total debt ratio. The first group of error percentages refers to the overall error which includes both failed and nonfailed misclassifications. In every instance, the ratio has a lower

one for all firms. Sharpe has suggested a more general model, but unfortunately the sparsity of data and certain aspects of the failed firms prevent its application. See William F. Sharpe, "A Simplified Model for Portfolio Analysis," *Management Science,* IX (January, 1963), 277–93.

[11] The ratio data were taken from the results of the previous study, Beaver, *op. cit.,* p. 82.

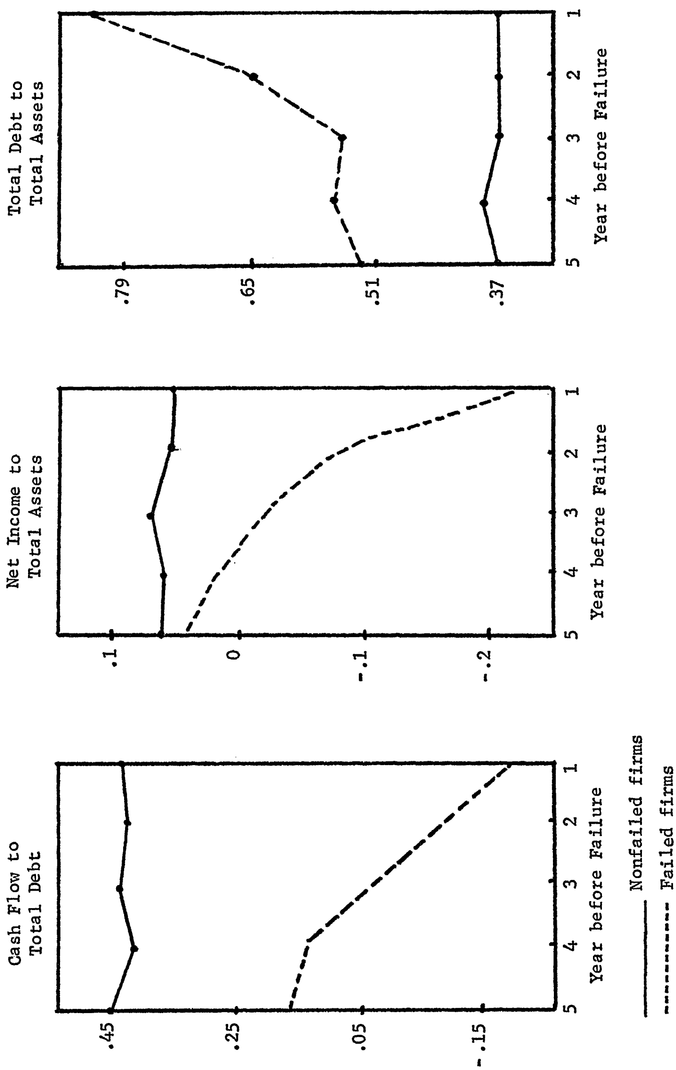

FIG. 1. Mean Value of Three Ratios

TABLE 4

Percentage Errors for Return Variables and the Cash Flow to Total Debt Ratio

	Year before failure				
	5	4	3	2	1
Overall percentage error					
R_{it}	39	40	38	29	31
e_{it}	34	38	34	34	28
CF/TL	22	24	23	21	13
Failed percentage error					
R_{it}	64	64	62	55	35
e_{it}	59	55	50	60	45
CF/TL	43	47	37	34	22
Bankruptcy percentage error					
R_{it}	69	68	64	59	33
e_{it}	65	59	49	62	40
CF/TL	40	48	37	32	22

error than either of the return variables.[12] The second group refers to the percentage of failed firms misclassified. Because the cost of misclassifying a failed firm may be much larger than the cost of misclassifying a nonfailed firm, it could be argued that a variable is a better discriminator of failure if it has a lower error with respect to failed firms, even if its overall error is higher. However, the evidence indicates that the financial ratio also has a consistently lower error for the failed firms. The third group of error data refers to the percentage of bankrupt firms misclassified. Here again the financial ratio has the lowest error.

The evidence consistently indicates that the overlap of the ratio distributions is less than that of either of the return variables. Two additional analyses were conducted to test the strength of the findings: (1) Cumulative residuals and cumulative rates of return over several time periods were examined. (2) The cutoff points were shifted so that the probability of misclassifying a nonfailed firm was constant over each of the three variables (i.e., residual, unadjusted return, and the financial ratio), and then the percentage error for the failed and for the bankrupt firms was computed. In both analyses, the conclusion was the same as that of the initial test—the financial ratio had superior discriminatory power. This result does not imply that the market is ignoring the data nor that one can beat the market by using the financial ratios. This statement is supported by a time series analysis of the data.

[12] The results for the cash flow ratio were taken from the previous study, *ibid.*, p. 90.

Time Series Analysis

The object of the time series analysis is to determine how soon investors (as compared to four financial ratios) can forecast failure. It was assumed that, at one point in time, a substantial deterioration in solvency became evident. This point in time was operationally defined as the year when the first large drop in the market price occurred. A large drop was defined as a negative rate of return so large that very few nonfailed firms ever incurred such a return during the time period studied. Examination of the data indicated that if $R_{it} = -.50$ and $e_{it} = -.60$, only six nonfailed firms fell below either of these values and all but six failed firms fell below one of these values at least once.[13] The analysis was based upon 42 nonfailed and 34 failed firms for which return data were available for all five years before failure. The point in time at which the financial ratios predicted failure was similarly defined. For the cash flow to total debt ratio, the year failure was forecast was defined as the year in which the ratio fell below .02 and never rose above .08 subsequently. The critical values for the net income to total assets ratio were $-.01$ and .05, respectively; for the total debt to total assets ratio, .65 and .45; and for the working capital to total assets ratio, .10 and .30. The number of nonfailed firms for which failure was incorrectly classified and the number of failed firms for which failure was never predicted are reported in Table 5. Forecasts were made for 63 nonfailed and 53 failed firms for which ratio data were available for all five years.

Note that only one critical value was specified for each of the return variables but two values for each of the ratios. The reason is that once the market has impounded the expected solvency deterioration in the price, subsequent rates of return reflect the difference between actual and expected deterioration (i.e., unexpected deterioration). Therefore, a subsequent improvement in the rate of return does not necessarily imply an improvement in solvency position. Since the financial ratios reflect the actual solvency position, an improvement in the ratio implies an improvement in solvency position. To insure that an unequivocal forecast of failure is made by the ratio, a second critical value had to be specified.

The discriminatory power of the ratios is evident in the results reported in Table 5. Critical ratios could be found such that few nonfailed or failed firms were misclassified. The evidence supports the contention that ratios do reflect the underlying events that affect solvency position and that they can be used as surrogates for the probability of failure. An examination of the number of failed firms for which a failure forecast was never made indicates that the cash flow and net income ratios

[13] Falling below either of the critical points was sufficient for a failure forecast.

TABLE 5

Comparison of Market Forecasts of Failure with Those of Four Financial Ratios

Item[a]	Financial ratio[b]			
	CF/TL	*NI/TA*	*TD/TA*	*WC/TA*
+5	0	0	0	3
+4	1	1	2	5
+3	4	3	2	3
+2	2	2	7	3
+1	5	7	2	4
0	9	6	12	7
−1	4	5	3	2
−2	1	2	1	0
−3	1	1	0	0
−4	2	2	0	1
−5	0	0	0	1
Total	29	29	29	29
No. of +'s less no. of −'s	+4	+3	+9	+14
No. of nonfailed firms misclassified[c]	0	3	3	4
No. of failed firms misclassified[c]	5	4	15	18

[a] Value of item is year before failure in which the market forecast failure minus year in which the ratio forecast failure.

[b] No. of times each value of the item occurred for each of the ratios.

[c] Out of a total of 63 nonfailed and 53 failed firms for which financial ratios were available for all five years.

had approximately the same predictive power, the debt-asset ratio ranked next, and the working capital ratio was the poorest of the four.[14]

Table 5 also provides some evidence for comparing the forecasting ability of investors (as reflected in the rate of return variables) and financial ratios. The item in the first column is the year before failure when investors forecast failure minus the year in which the ratio forecast failure. A positive value indicates investors forecast before the ratio did, a minus value indicates the opposite. The remaining columns indicate the number of times the value of the item occurred for each of the ratios. For example, in seven instances investors forecast failure two years in advance of the debt-asset ratio (i.e., the number in the fourth row, fourth column). Each of the four ratio columns totals 29, the num-

[14] The earlier study also arrived at the same conclusion, and, moreover, the ranking of the ratios according to discriminatory power was also the same. See Beaver, *op. cit.* The ranking is based on an analysis of the percentage errors obtained in a dichotomous classification test and on an analysis of the likelihood ratios implied by each ratio.

ber of failed firms for which both rate of return and ratio data could be obtained for five years before failure.

Table 5 summarizes the results by reporting the number of positive values minus the number of negative values. For each of the four ratios, the number of positive values exceeds the number of negative values. The implication is that investors forecast failure sooner than any of the ratios. This index of forecasting ability assigns an equal weight to each positive and negative value without respect to the magnitude of the value. If other weighting systems were introduced, essentially the same inference would be drawn. Note also that the ranking of the ratios in terms of inferiority to the return forecasts produces the same ranking.

Another way of analyzing the data is to compare the average length of time from the year of the failure forecast to the date of failure. This is reported in Table 6 for each of the forecasting variables. The market has the longest lead time (2.45 years), i.e., it has superior forecasting ability. Ranking the ratios according to the length of the lead time again produces the same ranking as before. Although return forecast has the longest lead time, it is important to note that the net income and cash flow ratios lag by only a small margin (.14 and .28 years, respectively).

To gain additional insight into the association between the ratios and the return variables, contingency tables were constructed for the return forecasts versus those of the four ratios (see Table 7). If there were perfect association between the market forecasts and those of the ratios, all 29 forecasts would fall along the diagonal. The number of diagonal elements are 9, 6, 12, and 7 for each of the ratios, far less than would be expected under perfect correlation. However, the hypothesis of complete independence can also be rejected. By comparing the number of diagonal

TABLE 6

Year in Which Failure Was Predicted for Twenty-Nine Failed Firms

Year before failure	Number of firms for which failure prediction was made				
	Market	*CF/TL*	*NI/TA*	*DBT/TA*	*WC/TA*
5	6	4	5	5	3
4	4	2	2	1	1
3	3	5	4	1	0
2	6	6	8	3	2
1	4	8	6	4	5
0[a]	6	4	4	15	18
Total forecasts	29	29	29	29	29
Mean (years)	2.45	2.17	2.31	1.45	.97

[a] This row indicates number of failed firms for which the variable never predicted failure.

TABLE 7

Contingency Tables for Market Forecasts Versus Those of Four Ratios

	Year market predicted failure						Total
	0	1	2	3	4	5	
Year CF/TL ratio predicted failure							
0	3	0	0	1	0	0	4
1	2	1	2	1	1	1	8
2	0	1	2	1	0	2	6
3	0	1	1	0	2	1	5
4	1	0	0	0	1	0	2
5	0	1	1	0	0	2	4
Total	6	4	6	3	4	6	29
Year NI/TA ratio predicted failure							
0	2	0	1	1	0	0	4
1	2	1	2	0	0	1	6
2	1	1	1	2	1	2	8
3	0	1	1	0	2	0	4
4	1	0	0	0	0	1	2
5	0	1	1	0	1	2	5
Total	6	4	6	3	4	6	29
Year TD/TA ratio predicted failure							
0	6	1	4	1	2	1	15
1	0	2	0	1	1	0	4
2	0	1	1	0	0	1	3
3	0	0	1	0	0	0	1
4	0	0	0	0	0	1	1
5	0	0	0	1	1	3	5
Total	6	4	6	3	4	6	29
Year WC/TA ratio predicted failure							
0	5	2	3	3	2	3	18
1	0	0	2	0	0	3	5
2	0	1	1	0	0	0	2
3	0	0	0	0	0	0	0
4	0	0	0	0	1	0	1
5	1	1	0	0	1	0	3
Total	6	4	6	3	4	6	29

and immediately off-diagonal elements with the number that would be expected under complete independence, it is apparent that the observed number is significantly greater than expected. The expected number versus the actual number is 12.6 versus 18 (cash flow ratio), 12.3 versus 18 (net income ratio), 11.0 versus 17 (debt-asset ratio), and 9.6 versus 13 (working capital ratio).[15] Also, an analysis of the (0, 0) element of each table indicates that the market variables and each of the ratios misclassify the same firms to a greater extent than would be expected, assuming independence. The expected versus the actual frequencies are .83 versus 3 (cash flow ratio), .83 versus 2 (net income ratio), 3.1 versus 6 (debt-asset ratio), and 3.7 versus 5 (working capital ratio).

Interpretation of the Findings

That investors forecast failure sooner than ratios is consistent with the contention that investors use the ratios in assessing the solvency positions of the failed firms. This is further supported by the association between the ratio and return forecasts that was observed in the analysis of the contingency tables.

The lack of perfect association between the forecasts indicates that investors either respond to nonratio sources of information, they did not use the ratios as they are used here, or both. These findings should not be surprising. Even the strongest advocates of financial ratios would not contend that ratios are the *only* source of relevant data about the firm. Nor is it likely that investors, when using ratios, look only at one ratio or only at its most recent value. In fact, research in progress tentatively suggests that a multiratio model, consisting of the most recent value of the cash flow ratio and the first differences of the previous values, possesses greater predictive power than any single ratio.

If the time series test is taken at face value, on balance the value of additional information, or more complex ratio models, is not great. However, some question exists as to the appropriateness of the test as an index of forecasting ability. At least two assumptions are implicit in the use of the test: (1) There is one point in time at which there is a substantial deterioration in the expected solvency position of the failed firms. (2) This point in time occurred no sooner than five years before failure. If recognition of changes in solvency position is a gradual process covering several years, the year in which failure was forecast has no meaning. Moreover, there is no reason why the initial recognition of failure could not have occurred prior to five years before failure. Either situation would lead to a misspecification of forecasting ability and may explain those failed firms for which a failure forecast was never made.

A question also arises regarding the interpretation of those instances where the ratio forecast failure before the return variables. Could the investor have taken advantage of the ratio information by selling these securities short? The evidence must be regarded as inconclusive. Apart

[15] The probability of the actual number occurring, assuming complete independence and an underlying binomial distribution, is .10 (cash flow ratio), .10 (net income ratio), .01 (debt-asset ratio), and .20 (working capital ratio).

from the limitations of the test, the point to keep in mind is that what is apparent ex post may not be so apparent ex ante. In the case of the net income ratio, there were 10 failed firms where the ratio forecasts failure but the market does not (see Table 5). However, there were also three instances where the ratio forecast failure for a nonfailed firm. Can the investor distinguish ex ante between these two situations? If not, then he will probably suffer a loss by selling nonfailed securities short.[16] Moreover, the number of nonfailed firms in the sample was approximately the same as failed firms. In reality, nonfailed firms outnumber failed firms by a factor of 100 to 1. Hence, the investor would suffer a loss on 300, not 3, nonfailed firms if he attempted to sell short every firm where the ratio forecast failure but the return variable did not. In short, the evidence does not suggest a scheme for beating the market. If such a scheme exists, additional research will be necessary to uncover it.

Concluding Remarks

The findings of the cross-section and time series analyses are uniformly consistent with respect to the two major contentions: (1) Investors recognize and adjust to the new solvency positions of failing firms. (2) The price changes of the common stocks act as if investors rely upon ratios as a basis for their assessments, and impound the ratio information into the market prices.

The dramatic price decline in the final year before failure and the lack of perfect association between the price changes and the ratios suggest avenues for future research. More knowledge is needed about the nonratio information investors rely upon and how investors use the ratio information in a multivariate context. The results of such research hopefully would provide greater insight into predicting investor behavior and ultimately into improving their forecasting and decision-making ability.

[16] In order to break even by selling short (even ignoring transactions costs and interest charges), the price of a security must go down by approximately 9 per cent or more because the alternative to selling short is to invest in the market which has earned an average of 9 per cent over the last 40 years. See Lorie and Fisher, *op. cit.*