

# MANAGING A RETURN TO FINANCIAL HEALTH

*Edward I. Altman and James K. La Fleur*

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When Jim La Fleur took the helm at GTI, it was a company hovering on the edge of bankruptcy. By using the Altman Bankruptcy Predictor Model in an active way to set strategy, La Fleur was able to return the company to a sound balance sheet. This is a case report of a marriage of an academically developed model and a corporate strategy designed to manage a financial turnaround.

Statistically verified predictive models have long been used in the study of business. Generally, these models are developed by scientists and tested by "observers," who do not interact with, or influence, the measurements of the model. Consequently, the models, when valid, have predicted events with satisfactory accuracy, and thereby enjoy a reasonable degree of confidence among business analysts.

This "passive" use of predictive models overlooks the possibility of using them actively. In the "active" use of a predictive model, the role of the observer is shifted to that of a "participant." For example, a manager may use a predictive model that relates to business affairs of a company by deliberately attempting to influence the model's measurements. The manager, acting as a participant—rather than as an observer—makes decisions suggested by the parameters of the model to control the prediction of the model.

In the specific case we will discuss, the Altman Bankruptcy Predictor Model was used actively to manage the financial turnaround of a company, GTI

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Corporation, that was on the verge of bankruptcy.<sup>1</sup> A series of management decisions were made over a period of five years to foil the model's prediction of bankruptcy. These decisions, many of which were specifically motivated by considering their effect on the financial ratios in the model, led directly to the recovery of the company and the establishment of a firm financial base.

The success in the active use of this specific model suggests that it may be worthwhile to consider the "active approach" to the use of other appropriate predictive models.

## Predicting Bankruptcy With the Z-Score

Working with an original sample of bankrupt manufacturing firms and a control sample of healthy entities, Altman (1968) utilized a combination of traditional financial ratio analysis and a rather sophisticated statistical technique known as discriminant analysis to construct and test a financial model for assessing the likelihood that a firm would go bankrupt. The model combined five financial mea-

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<sup>1</sup> Michael Ball has written about GTI in the context of a small business management ("Z Factor: Rescue by the Numbers," *Inc. Magazine*, Dec. 1980, pp. 45-59). C. Hofer has written about turnaround situations in general ("Turnaround Strategies," *The Journal of Business Strategy*, Summer 1980, pp. 19-31).

asures utilizing both reported accounting and stock market variables to objectively arrive at an overall measure of corporate health. Developed in 1968, the model has proven to be remarkably durable and is still accepted as an important indicator for analysts and decisionmakers in many spheres of work. Where it had not been tested and verified is in the application of its underlying theory for the very firms that are being examined. This article attempts to fill in the gap.

Discriminant analysis is a multivariate technique that analyzes the characteristics (e.g., financial ratios) of two or more populations or groups (e.g., corporations) in order to identify and weight the important measures that will most accurately classify the original observations into their identified groups. These groupings are qualitative in nature (e.g., bankrupt vs. nonbankrupt, Aaa vs. A rated bonds). The trick is to maximize the classification accuracy of the original test observations and to test the model on many relevant types of holdout or test samples, which are utilized to verify the statistical reliability of the model. The final test relates to the old adage that the "proof is in the eating." That is, how well has the model predicted the fate of observed companies in periods after the model was developed?

The Altman Z-Score model is a linear analysis in that five measures are objectively weighted and summed up to arrive at an overall score that then becomes the basis for classification of firms into one of the a priori groupings. As an example, Exhibit 1 shows a two-variable analysis where measures of profitability and liquidity are plotted for a sample of healthy (x) and sick (o) firms. The discriminant model selects the appropriate weights which will separate as far as possible the distance between the average values of each group while at the same time minimizing the statistical distance of each observation (the individual x's and o's) and its own group mean. Each observation is then "projected" on the line (AB) which best discriminates between the two groups.

<sup>2</sup> For a technical explanation of the procedure and discriminant analysis in general, see W. Cooley and P. Lohnes, *Multivariate Procedures for the Behavioral Sciences* (New York: John Wiley, 1962); Edward I. Altman, *Corporate Bankruptcy in America* (Lexington, Mass.: D.C. Heath, 1971); R. Eisenbeis and R. Avery, *Discriminant Analysis and Classification Procedures: Theory and Applications* (Lexington, Mass.: D.C. Heath, 1972). For the application of classification techniques to business, banking, and finance, see Edward I. Altman, R. Avery, R. Eisenbeis and J. Sinkey, *Application of Classification Techniques to Business, Banking and Finance* (Greenwich, Conn.: JAI Press, 1981).

The Bankruptcy Predictor Formula (Z) is a relatively straightforward equation where:

$$Z = 1.2 X_1 + 1.4 X_2 + 3.3 X_3 + 0.6 X_4 + 1.0 X_5;$$

Z = overall index of corporate health;

X<sub>1</sub> = working capital divided by total assets;

X<sub>2</sub> = retained earnings divided by total assets;

X<sub>3</sub> = earnings before interests and taxes divided by total assets;

X<sub>4</sub> = market value of equity divided by book value of total liabilities; and

X<sub>5</sub> = sales divided by total assets.

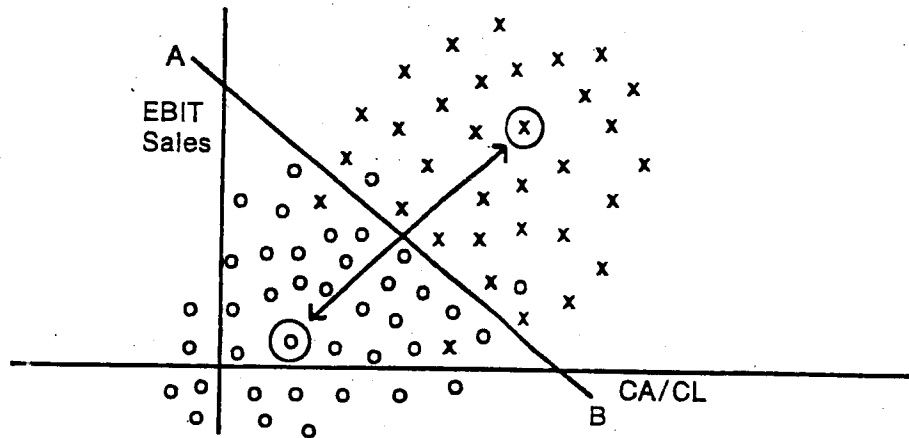
Each of these financial ratios is defined in Appendix A, where the information content of the ratio and its insertion into the formula is described.

If ratios calculated from a company's financial statement and stock market results are inserted into the formula, a single number will result, which typically has a range from -5 to +10. Scores above 10 are possible, primarily, if the firm's market value of equity is high combined with relatively small amounts of total liabilities. The range of Z-Scores achieved by firms in Altman's original sample of thirty-three bankrupt and thirty-three carefully matched healthy firms showed that all firms which scored below 1.8 were classified as bankrupt and did actually go bankrupt. Those above 3.0 were classified as healthy and remained continuing entities. Scores between 1.8 and 3.0 are classified into a gray area, which indicates less clearly the firm's ultimate fate. In all cases, the higher the Z-Score, the healthier the firm and the lower probability of failure. Exhibit 2 shows the three zones referred to as safe, gray, and bankrupt, along with the Z-Score for GTI Corporation for the period of 1972 through 1979.<sup>3</sup>

The Bankruptcy Predictor has proven consistently accurate over the period of time since its development. The original bankrupt and nonbankrupt samples and an independent sample of additional bankrupt firms displayed accuracy of 95 percent based on data from approximately one year prior to failure. The accuracy dropped to 72 percent

<sup>3</sup> This model was developed for manufacturing firms, and no claim is made about its expected accuracy for other types of companies. Models such as Zeta (Edward I. Altman, R. Halde- man, and P. Narayanan, "Zeta Analysis, A New Model to Identify Bankruptcy Risk of Corporations," *Journal of Banking and Finance*, June 1977, pp. 29-54) and Gamblers Ruin (J. Wilcox, "The Gamblers Ruin Approach to Business Risk," *Sloan Management Review*, Autumn 1976) claim broader applicability but are proprietary and less easy to use by practitioners armed only with a firm's financial statements, stock price, and a hand-held calculator.

**EXHIBIT 1**  
**Linear Discriminant Analysis: An Example**



o = Bankrupt firms; x = nonbankrupt firms; ⊙ = group mean; and ⊗ = group mean.

based on two-year prior data. Subsequent tests on firms that have gone bankrupt since 1968 have shown an accuracy level of 82 to 85 percent.

One can observe an overall deterioration in the average Z-Score for all U.S. manufacturing companies from the mid-1960s to the present. Firms have become more risky, their average return on investment has shrunk, and the stock market's assessment of the value of equity relative to increased debt has also deteriorated. In other words, the average U.S. company has become more risky, according to the model, than it was over a decade ago. That is good reason for companies to make a careful assessment of strengths and weaknesses in today's highly competitive and high fixed charges environment.

### Applications of the Bankruptcy Predictor

In the twelve years since the bankruptcy model was first developed, various types of practitioners have employed the model for distinctly different objectives. These can be generally categorized as:

- Credit analysis (e.g., accept vs. reject) and loan review for financial institutions;
- Investment analysis (e.g., money manager and investment banker applications);
- Analytical auditing analysis (e.g., going concern assessment);
- Legal analysis (e.g., prudent man and failing company doctrine defenses); and

- Merger target analysis (e.g., both before and during reorganization).

It is beyond the scope of this article to discuss each of these application areas, but they all have one thing in common. They are being used by individuals external to the firms being analyzed. Altman did indicate in his original works that potential application of the Z-Score approach is to objectively assess a firm's own strengths and weaknesses. This could be done at a particular point in time and over time via a trend analysis. Reference was also made to the use of the model internally for accounts receivable management, the analogue to commercial bank credit analysis.

What Altman did not indicate was what management could do with the results of the model once the indication was that a firm was headed toward bankruptcy, that is, that its overall financial profile was consistent with other firms which had gone bankrupt in the past. It took GTI Corporation, and specifically the management strategy formulated and implemented by Jim La Fleur, to turn the model "inside out" and show its ability to help shape business strategy to avert bankruptcy.

### What the Z-Score Told GTI

When Jim La Fleur took charge of the company, GTI had a \$4.4 million net worth and had experienced a \$5.6 million decrease in working capital during the previous half year. The company was

losing money, overburdened by debt, and nearly devoid of cash.

Noticing an article in *Boardroom Reports* about Professor Altman and the Z-Score, La Fleur saw the potential application of the bankruptcy predictor to the problem at hand.

Plugging in the preliminary numbers for the five ratios, La Fleur put the Altman predictor to work for GTI: The resulting Z-Score was 0.7. At that level, the Altman predictor forecast almost certain bankruptcy. When more accurate numbers were inserted into the Z-Score formula, it fell even lower, to 0.38, about half the earlier calculation. The prediction was grave.

### A Tool for Recovery

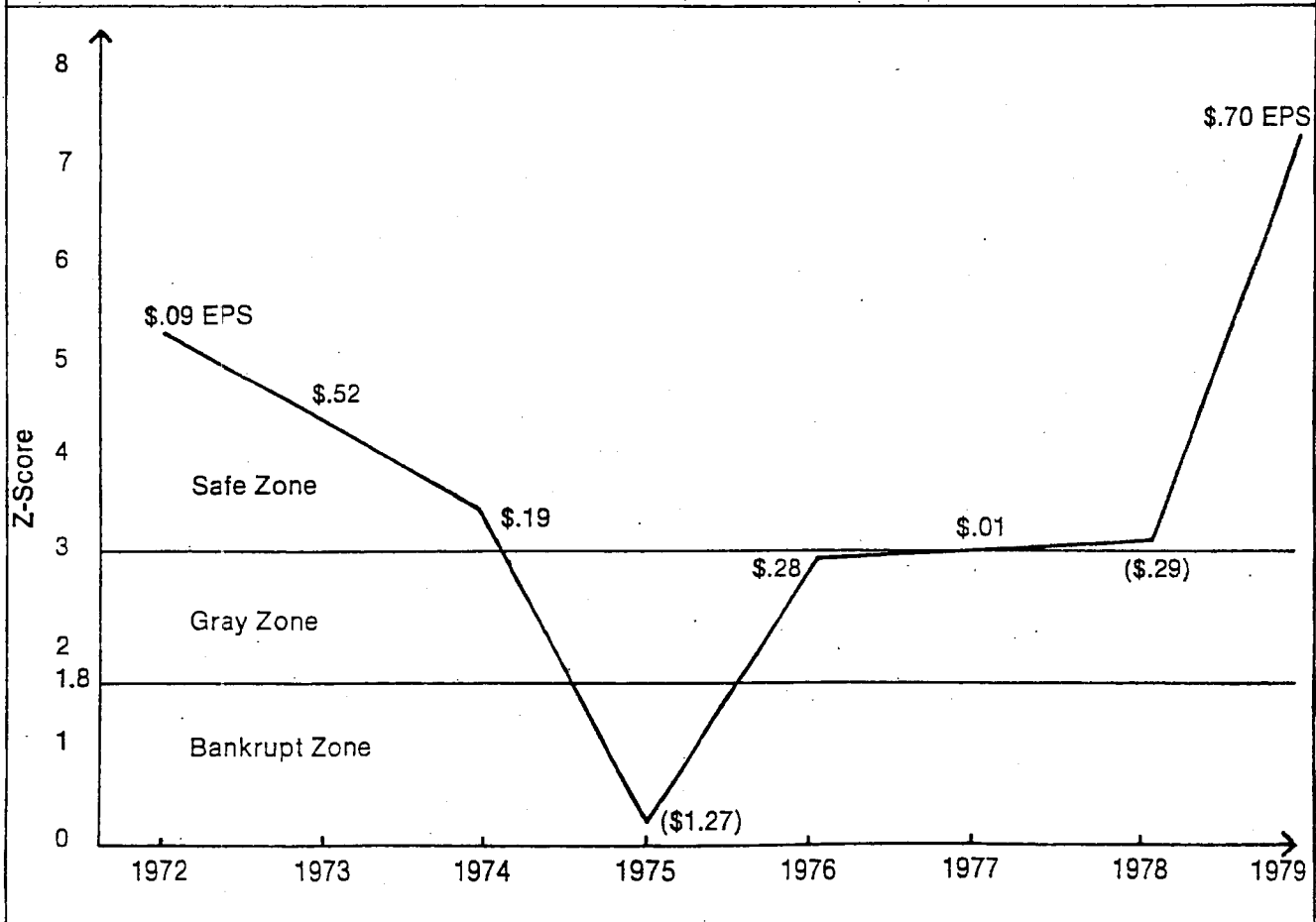
Despite its portent of doom, the Z-Score was also seen as a management tool for recovery. Clearly, the predictor's five financial ratios, the X ratios, were the key to the Z-Score movement, either up or

down. While the previous management had followed an inadvertent strategy, which decreased the ratios and caused the Z-Score to fall, GTI's new management decided to reverse the plunge by deliberate management action to increase the X ratios.

Inherent in the Altman Predictor was the message that underutilized assets could be a major contributor to the deterioration of a company's financial condition. Such deterioration had taken place at GTI over several years. The company's total assets had grown far out of proportion to other financial factors.

By using retrospective analysis, La Fleur concluded that the Z-Score could have predicted GTI's turn toward financial distress. For example, historical data showed that GTI's Z-Score started to dive precipitously two years earlier in 1973 in spite of an increase in earnings per share to \$.52 at the end of 1973 from \$.09 in 1972. The retrospective Z-Score slide became even steeper in 1974, as GTI dropped at year-end to \$.19 in earnings per share. Thus, GTI's Z-Score had been falling for several

**EXHIBIT 2**  
GTI's 1972-1979 Z-Score Curve With Annual EPS Notations



years, as shown in Exhibit 2, even during periods when company's profits were rising. That was further proof of the predictor's validity and suggested its ability to help set strategy to guide the company's recovery.

### The Effects of Growth Fever

For more than two years previously, as a member of the board of directors, La Fleur had cautioned against what appeared to be overaggressive policies of debt and expansion by GTI's operating management. The warnings, unfortunately, had little effect.

Along with most of the industry, GTI had succumbed through the 1960s to a highly competitive growth fever. During those years, many managers focused almost entirely on their P&L statements. They were willing to borrow what was necessary to increase sales and profits. With stock values rising, they expected to obtain very favorable equity funding in the future to pay off the accumulated debt. That strategy served well until economic downturns of 1969 and 1972. Then, with profits falling, many companies had trouble servicing the debt that had looked so easy to handle a few years earlier. But GTI, like many others, continued pursuing the same strategy, despite changed economic conditions. That worked for awhile.

But early in 1975, GTI started losing money. Before that profit slide could be stopped, GTI's 1975 net loss accumulated to over \$2.6 million on sales of \$12 million, a painful loss of \$1.27 per share.

### Taking Quick Action

Then, during the month of May, a member of the audit committee discovered information indicating that the figures for the first quarter of 1975 were reported incorrectly. As the evidence developed during the ensuing audit committee meetings, it was obvious that the company's problems were serious. GTI's auditing firm began a thorough reexamination of the company's first-quarter activities. The auditors quickly confirmed that there was, indeed, a material discrepancy in the figures and set to work revising first-quarter figures.

As chairman of the audit committee, La Fleur contacted the SEC, disclosing the discrepancy and promising to define and correct it. He also asked the American Stock Exchange to halt trading of the company's stock. By finding the reporting errors quickly, GTI had the stock back in trading in

less than ten days. No delisting of the stock ever occurred, and the company even received compliments from some observers on its rapid self-policing action.

At that point, GTI's board of directors chose a new executive team, asking La Fleur to become part of management and take over as chairman and chief executive officer. Having observed GTI going into debt to finance its operations over several previous years, even with record sales and profits on paper, La Fleur determined to find the underlying problems. It didn't take long.

Inventory, out of control, revealed itself as a major contributor to the company's ballooning assets. In many instances, returned goods had been set aside and not properly accounted for. Adding to that difficulty, work-in-process was grossly out of proportion to sales.

### Genesis of Strategy

From this new evidence of excess assets, a recovery strategy began to emerge. It was to find ways to decrease GTI's total assets without seriously reducing the other factors in the numerators of the Z-Score's X ratios: working capital, retained earnings, earnings before interest and taxes, market value of equity, and sales. GTI started looking for assets that were not being employed effectively—that is, not earning money. When identified, such assets were sold and the proceeds used to reduce the company's debt. The effect was a decrease in the denominators of all five X ratios simultaneously. GTI's Z-Score rose accordingly.

While the Altman Predictor was originally designed for an observer's analysis of a company's condition, GTI used it as an aid to managing company affairs. The Altman Predictor actually became an element of active strategy to avoid GTI's impending bankruptcy.

Having evolved the strategy, La Fleur began to implement the action to eliminate GTI's excess assets. Excess inventory was sold as quickly as possible, even at scrap value in some cases.

### Stopping the Cash Bleed

In quick order, GTI's plunge was slowed by stanching its cash bleed. The staffs at two unprofitable West Coast plants were sliced to a skeleton crew within ten days, and the corporate staff at headquarters was pared from thirty-two to six. A year earlier, with company profits at \$1.5 million, the

corporate staff expense had been over \$1 million! All capital programs were frozen. Only the most critical production needs, repair, and maintenance were authorized. GTI asked its creditors for additional short-term credit, then pushed strenuously ahead on its collections. Inventories were placed under strict control. Taking effect, these measures got cash and expenses under control and improved debt service capability.

Reducing costs further took more analysis. A management function/location matrix, a "job-versus-cost" grid, was constructed for each of GTI's plants. The grid showed each executive's job, what work was performed, and how much that job cost the company. When overlaps or duplications were found, jobs were consolidated.

### Finding Lost Profits

Employees were also involved in the turnaround. A simple questionnaire was handed out to the 250 employees of GTI's largest plant in Saegertown, Pennsylvania, asking their opinions on why the plant was no longer profitable. The implied question, of course, was about the underutilized assets that had depressed GTI's Z-Score. The employees knew what was wrong. They were specific about how to improve the use of their machines. Many of the suggestions were implemented, and productivity improved.

Several weeks later, similar questions were asked at GTI's plant in Hadley, Pennsylvania. The employee responses resulted in changing the plant's organization from functional to product line, another move that more effectively employed the company's assets. Because they participated in the changes, the plant's employees really worked to make the reorganization succeed. After a few weeks, the plant began to return to profitability.

Those profits were the forerunner of profits that would be produced in other parts of the company as time went on. The Z-Score, while it did not jump as a result of those profits, did begin to react. By mid-1976, after slanting down for three years, the Z-Score bottomed out and started up. GTI began turning the corner.

### Selling Off a Product Line

Though cost reduction and increased profits had eased the problems, GTI needed stronger recovery actions. The function/location matrix analysis was extended to include products and was used to rate

product profitability throughout the company. Plans were made to eliminate the losers and strengthen the winners. As a result, late in 1976, GTI sold one of its major underutilized assets. GTI's Crystal Base product line had appeared fairly strong, but the product matrix analysis presented a different view. Crystal bases were not complementary to GTI's other products, and though the line was marginally profitable in the past, demand for its products was likely to decrease. The line also appeared to need a great deal of capital to be competitive in the future.

The cash generated by the sale of the Crystal Base product line was used to reduce debt. The consequent simultaneous decrease of both total assets and debt produced a dramatic effect. The Z-Score leaped from under 1.0 to 2.95. In one transaction, GTI zoomed all the way into the Altman Predictor's safe zone.

Although, to outside observers, the company did not appear to turn around for another year and a half, La Fleur felt the firm was on the road to recovery with the sale of the Crystal Base product line. The company had come from almost certain bankruptcy to the stage where it could begin contemplating new products. In less than eighteen months, the Z-Score had climbed from 0.38, in the near-death bankrupt zone, almost all the way to the Z-Score's safe zone.

With heightened confidence in the Altman Predictor, GTI started working to put the Z-Score firmly in the safe zone. Since the company's improving stability and profitability were corroborating the Z-Score approach, GTI's headquarters staff began figuring how a proposed new product or financial transaction would affect the rising Z-Score. Further, GTI extended the product evaluation matrix from simple profit and loss to multiyear projections of return on assets. This involved taking a hard look at projected working capital and capital expenditure requirements product by product. This analysis established what costs would be if the company attempted to expand within its current markets.

### Progress in Operations

While doing this planning, GTI continued to make progress on the operations side, finishing 1976 with \$0.28 earnings per share and an increasing Z-Score as well. In 1977, earnings sagged to \$0.01 per share; but with an improving overall financial condition, GTI's Z-Score continued gradually to rise. The company even bought out a competitor's glass

seal product line with notes simply secured by the acquired assets—with negligible adverse impact on the Z-Score.

Then in 1978, GTI boosted its Z-Score again by shutting down an entire division, which made ceramic capacitors, and selling its assets. That transaction, again based on the strategy of selling underutilized assets to pay off debt, occurred later than it should have. This was a case of emotion interfering with a rational, proven strategy. La Fleur was swayed toward saving this technically interesting product line, though the Z-Score strategy consistently suggested disposal. Though delayed, the difficult disposal decision finally was made.

As a result of the closing of the Capacitor Division and the sale of its assets, GTI's 1978 bottom line sustained a \$.29 per share loss, but the Z-Score increased automatically as the company paid off more debt. As anticipated, operating profits continued to gain throughout the year, paving the way for a strong 1979. Once again, the asset-reduction strategy had worked.

### Into the Safe Zone

Since then, GTI's Z-Score has continued climbing, rising through the Altman safe zone, as 1979 pre-tax profits reached \$1.9 million and \$.70 per share on sales of \$21 million. From a balance sheet viewpoint, GTI's strategy, in five years, had decreased the debt to equity ratio from 128 percent to 30 percent, and increased stockholder's equity from \$3.5 million to \$4.7 million. These and other comparative figures for 1975 and 1979 are shown in Exhibit 3. Currently, the Z-Score is over 7.0, a level ten times higher than it was at the time of the first use of the Altman Predictor. GTI is today a financially sound company pursuing new avenues to controlled growth. In major part, that success came about from implementing a financial strategy suggested by the Altman Bankruptcy Predictor Model.

## APPENDIX

### Z-Score Model Description

#### Variable

$$X_1 = \frac{\text{Working Capital}}{\text{Total Assets}}$$

#### Discussion

Frequently found in studies of corporate problems, this is a measure of the net liquid assets of the firm relative to the total capitalization. Working capital is defined as the difference between current assets and current liabilities. Liquidity and size characteristics are explicitly considered. Ordinarily, a firm experiencing consistent operating losses will have shrinking current assets in relation to total assets.

### EXHIBIT 3 Getting GTI Into the Safe Zone

Comparative Balance Sheet (\$ in Millions)		
	1975	1979
Current assets	5.1	5.3
Total assets	9.6	8.3
Current liabilities	3.7	2.5
Total liabilities	6.1	3.6
Equity	3.5	4.7
Total liabilities and equity	9.6	8.3
Comparative Income Statement (\$ in Millions)		
Net sales	12	21
Cost of goods sold	11	15
Gross profit	1	6
S G & A	(3.5)	(4.1)
Other expenses	(.5)	—
Profit (loss) before taxes	(3.0)	1.9
Miscellaneous Financial Factors (\$ in Millions)		
Working capital	1.4	2.8
Market value of equity	1	15*
Debt/equity	128%	30%
Current ratio	1.38	2.10
Acid ratio	.78	1.29
* 1980 high		

### Conclusion

The authors believe that certain predictive models offer opportunities to be used as management tools. Supporting that view, GTI's employment of the Altman Bankruptcy Predictor has been described as a specific illustration of how an ordinarily passive model can be used actively with substantial success.

With emphasis made on prudent product selection and use, managers are encouraged to search out and review predictive models that relate to their company's activities. Improved business strategies could well result.

$$X_2 = \frac{\text{Retained Earnings}}{\text{Total Assets}}$$

This is a measure of cumulative profitability over time, and the balance sheet figure is used. The age of a firm is implicitly considered in this ratio. For example, a relatively young firm will probably show a low RE/TA ratio because it has not had time to build up its cumulative profits. Therefore, it may be argued that the young firm is somewhat discriminated against in this analysis, and its chance of being classified as bankrupt is relatively higher than another, older firm. But this is precisely the situation in the real world. The incidence of failure is much higher in a firm's earlier years; over 50 percent of firms that fail do so in the first five years of existence. It should be noted that the retained-earnings account is subject to manipulation via corporate quasi reorganizations and stock dividend declarations. It is conceivable that a bias would be created by a substantial reorganization or stock dividend.

$$X_3 = \frac{\text{Earnings Before Interest \& Taxes}}{\text{Total Assets}}$$

This ratio is calculated by dividing the total assets of a firm into its earnings before interest and tax reductions. In essence, it is a measure of the true productivity of the firm's assets, abstracting from any tax or leverage factors. Since a firm's ultimate existence is based on the earning power of its assets, this ratio appears to be particularly appropriate for studies dealing with corporate failure. Furthermore, insolvency in a bankruptcy sense occurs when the total liabilities exceed a fair valuation of the firm's assets with value determined by the earning power of the assets.

$$X_4 = \frac{\text{Market Value of Equity}}{\frac{\text{Book Value of Equity}}{\text{Total Liabilities}}}$$

Equity is measured by the combined market value of all shares of stock, preferred and common, while liabilities include both current and long-term. Book values of preferred and common stockholders equity may be substituted for market values when the latter is not available. The substitution of book values, especially for the common stock component, should be recognized as a proxy without statistical verification, since the model was built using market values (price  $\times$  shares outstanding). The measure shows how much the firm's assets can decline in value (measured by market value of equity plus debt) before the liabilities exceed the assets and the firm becomes insolvent. For example, a company with a market value of its equity of \$1,000 and debt of \$500 could experience a two-thirds drop in asset value before insolvency. However, the same firm with \$250 in equity will be insolvent if its drop is only one-third in value.

$$X_5 = \frac{\text{Sales}}{\text{Total Assets}}$$

The capital-turnover ratio is a standard financial ratio illustrating the sales-generating ability of the firm's assets. It is one measure of management's capability in dealing with competitive conditions.

It should be noted that variables  $X_1$ ,  $X_2$ ,  $X_3$ , and  $X_4$  should be inserted into the model as *decimal fractions*; for example, a working capital/total assets of 20 percent should be written as 0.20. The variable  $X_5$ , however, is usually a ratio *greater than unity*; for example, where sales are twice as large as assets, the ratio is written as 2.0.

Note also that the weights of each of the five ratios are not identical to those found in the original Altman article\* since the ratios in the original paper were specified differently. The reader is referred to the original article only for an in-depth description of the model.

\* Edward I. Altman, "Financial Ratios Discriminant Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance*, Sept. 1968, pp. 589-609.