

Z Score - A measure to evaluate corporate bankruptcy

INTRODUCTION

The Altman Z-Score is a quantitative balance-sheet method of determining a company's financial health. Z score is a formula for predicting corporate bankruptcy. The Z-score formula for predicting bankruptcy was published in 1968 by Edward I. Altman, who was, at the time, an Assistant Professor of Finance at New York University. The formula may be used to predict the probability that a firm will go into bankruptcy within two years. Z-scores are used to predict corporate defaults and an easy-to-calculate control measure for the financial distress status of companies in academic studies. The Z-score uses multiple corporate income and balance sheet values to measure the financial health of a company.

BACKGROUND TO THE Z-SCORE

The Z-score is a linear combination of five common business ratios, weighted by coefficients. The coefficients are estimated by identifying a set of firms which had declared bankruptcy and then collecting a matched sample of firms which had survived, with matching by industry and approximate size (assets).

Altman applied the statistical method of discriminant analysis to a dataset of publicly held manufacturers. The estimation was originally based on data from publicly held manufacturers, but has since been re-estimated based on other datasets for private manufacturing, non-manufacturing and service companies.

The original data sample consisted of 66 firms, half of which had filed for bankruptcy under Chapter 7 in USA. All businesses in the database were manufacturers, and small firms with assets of < \$1 million were eliminated.

In its initial test, the Altman Z-Score was found to be 72% accurate in predicting bankruptcy two years prior to the event. In subsequent tests over 31 years up until 1999, the model was found to be 80-90% accurate in predicting bankruptcy one year prior to the event.

In 2009, Morgan Stanley strategy analyst, Graham Secker, used the Z-score to rank a basket of European companies. He found that the companies with weaker balance sheets underperformed the market more than two thirds of the time. Morgan Stanley also found that a company with an Altman Z-score of less than 1 tended to underperform the wider market by more than 4%.

The results indicated that, if **the Altman Z-Score is close to or below 3, it is wise to do some serious due diligence before considering investing**. The Z-score results usually have the following "Zones" of interpretation:

1. Z Score above 2.99 -"Safe" Zones. The company is considered 'Safe' based on the financial figures only.
2. $1.8 < Z < 2.99$ -"Grey" Zones. There is a good chance of the company going bankrupt within the next 2 years of operations.
3. Z below 1.80 -"Distress" Zones. The score indicates a high probability of distress within this time period.

The Z-score has subsequently been re-estimated based on other datasets for private manufacturing companies, as well as non-manufacturing / service companies.

CALCULATION

A. FOR PUBLIC COMPANIES

The Z-score formula for publically traded companies is as follows

$$Z = 1.2T1 + 1.4T2 + 3.3T3 + 0.6T4 + 1.0T5$$

1. $T1 = \text{Working Capital} / \text{Total Assets}$. This measures liquid assets as firm in trouble will usually experience shrinking liquidity.
2. $T2 = \text{Retained Earnings} / \text{Total Assets}$. This indicates the cumulative profitability of the firm, as shrinking profitability is a warning sign.
3. $T3 = \text{Earnings Before Interest and Taxes} / \text{Total Assets}$. This ratio shows how productive a company in generating earnings, relative to its size.
4. $T4 = \text{Market Value of Equity} / \text{Book Value of Total Liabilities}$. This offers a quick test of how far the company's assets can decline before the firm becomes technically insolvent (i.e. its liabilities exceed its assets).
5. $T5 = \text{Sales} / \text{Total Assets}$. Asset turnover is a measure of how effectively the firm uses its assets to generate sales

B. FOR PRIVATE COMPANIES

The usefulness of the original Z score measure was limited by two of the ratios. The first ratio is T4, the Market Value of Equity divided by Total Liabilities. Obviously, if a firm is not publicly traded, its equity has no market value. To deal with this, there is a revised Z score for private companies:

$$Z1 = .717*T1 + .847*T2 + 3.107*T3 + .42*T4A + .998*T5 \text{ (in this case, } T4 = \text{Book Value of Equity / Total Liabilities).}$$

C. FOR MANUFACTURING COMPANIES

The other problem is X5, Assets Turnover. This ratio varies significantly by industry. Jewelry stores, for example, have a low asset turnover while grocery stores have a high turnover. But since the Z Score expects a value that is common to manufacturing, it could be biased in such a way that a healthy jewelry store looks sick and a sickly grocery store looks healthy.

To deal with these problems, Altman used his original data to calculate two modified versions of the Z Score, shown above. The Z Score is for public manufacturing companies; the Z1 Score is for private manufacturing companies; and the Z2 is for general use.

$$Z2 = 6.56*X1 + 3.26*X2 + 6.72*X3 + 1.05*X4A$$

Now lets us break down the Z score elements

1. Working Capital/Total Assets (WC/TA)

This ratio is a good test for corporate distress. A firm with negative working capital is likely to experience problems meeting its short-term obligations because there simply is not enough current assets to cover those obligations. By contrast, a firm with significantly positive working capital rarely has trouble paying its bills.

2. Retained Earnings/Total Assets (RE/TA)

This ratio measures the amount of reinvested earnings or losses, which reflects the extent of the company's leverage. Companies with low RE/TA are financing capital expenditure through borrowings rather than through retained earnings. Companies with high RE/TA suggest a history of profitability and the ability to stand up to a bad year of losses.

3. Earnings Before Interest and Tax/Total Assets (EBIT/TA)

This is a version of return on assets (ROA), an effective way of assessing a firm's ability to squeeze profits from its assets before factors like interest and tax are deducted.

4. Market Value of Equity/Total Liabilities (ME/TL)

This is a ratio that shows - if a firm were to become insolvent - how much the company's market value would decline before liabilities exceed assets on the financial statements. This ratio adds a market value dimension to the model that isn't based on pure fundamentals. In other words, a durable market capitalization can be interpreted as the market's confidence in the company's solid financial position.

5. Sales/Total Assets (S/TA)

This tells investors how well management handles competition and how efficiently the firm uses assets to generate sales. Failure to grow market share translates into a low or falling S/TA.

INTERPRETATION OF ALTMAN S Z-SCORE

The Altman Z-Score is a measure of a company's health and likelihood of bankruptcy.

1. Z-SCORE ABOVE 3.0 –The Company is considered 'Safe' based on the financial figures only.
2. Z-SCORE BETWEEN 2.7 and 2.99 – 'On Alert'. This zone is an area where one should 'Exercise Caution'.
3. Z-SCORE BETWEEN 1.8 and 2.7 – Good chance of the company going bankrupt within 2 years of operations from the date of financial figures given.
4. Z-SCORE BELOW 1.80- Probability of Financial Catastrophe is Very High.

ILLUSTRATION- WORLDCOM

To demonstrate the power of the Z-score, let's look at how it holds up with a tricky test case. Consider the infamous collapse of telecommunications giant WorldCom in 2002. WorldCom's bankruptcy created \$100 billion in losses for its investors after management falsely recorded billions of dollars as capital expenditures rather than operating costs.

Here we calculate Z-scores for WorldCom using annual 10-K financial reports for years ending December 31, 1999, 2000 and 2001. Indeed, WorldCom's Z-score suffered a sharp fall. Also note that the Z-score moved from the gray area into the danger zone in 2000 and 2001, before declaring bankruptcy in 2002.

Input	Financial Ratio	1999	2000	2001
X1	Working capital/ Total Assets	-0.09	-0.08	0
X2	Retained earnings/Total Assets	-0.02	0.03	0.04
X3	EBIT/Total Assets	.09	.08	.02
X4	Market Value/Total Liabilities	3.7	1.2	.50
X5	Sales/Total Assets	0.51	0.42	0.3
Z-score	2.5	1.4	.85	

But WorldCom management cooked the books, inflating the company's earnings and assets in the financial statements. What impact do these shenanigans have on the Z-score? Overstated earnings likely increase the EBIT/total assets ratio in the Z-score model, but overstated assets would actually shrink three of the other ratios with total assets in the denominator. So the overall impact of the false accounting on the company's Z-score is likely to be downward.

ILLUSTRATION-BORDERS GROUP

As an example of how to calculate and interpret the Z-Score, we use Border's Group, which filed for bankruptcy on February 16, 2011. While hindsight is always 20/20, we can use this case to see whether the Z-Score would have raised a red flag regarding the company's solvency.

Table below shows the financial statement data required to calculate

Z-Scores for Borders. We provide five years of data to give an idea of the trend in Borders' Z-Score prior to its bankruptcy filing in 2011. In 2006, Borders was in the "gray area" with a score of 2.81. The score declined steeply in 2007 to 2.00, as earnings before interest and taxes (EBIT) went negative and working capital and retained earnings also dipped. Borders' Z-Score fell every year between 2006 and 2010, landing in the danger zone at 1.79 in 2010. The next year, the company was bankrupt.

When analyzing the Z-Score of a company, it is important to analyze the trend over time. In the case of Borders, the steady decline should have been a warning sign to investors.

Financial Data (in \$ millions)

Year	2006	2007	2008	2009	2010
Sales	4080	4110	3820	3280	2820
Earnings Before Interest & Taxes	173	-137	6.6	-149	-94.9
Current Assets	1640	1720	1510	1070	988
Total Assets	2570	2610	2300	1610	1430
Current Liabilities	1310	1600	1470	994	928
Total Liabilities	1640	1970	1830	1350	1270
Retained Earnings	614	438	250	63.8	-45.6

Year	2006	2007	2008	2009	2010
Working Capital ÷ Total Assets	0.13	0.05	0.02	0.05	0.04
Retained Earnings ÷ Total Assets	0.24	0.17	0.11	0.04	-0.03
Earnings Before Interest & Taxes ÷ Total Assets	0.07	-0.1	0	-0.1	-0.07
Market Value of Equity ÷ Total Liabilities	0.85	0.51	0.19	0.02	0.06
Sales ÷ Total Assets	1.59	1.57	1.66	2.04	1.97
Z-Score	2.81	2	1.96	1.86	1.79

WHERE Z SCORES FALLS SHORT

Finally, the Z-score is not perfect and needs to be calculated and interpreted with care. For starters, the Z-score is not immune to false accounting practices. As WorldCom demonstrates, companies in trouble may be tempted to misrepresent financials. The Z-score is only as accurate as the data that goes into it.

The Z-score also isn't much use for new companies with little or no earnings. These companies, regardless of their financial health, will score low. Moreover, the Z-score doesn't address the issue of cash flows directly, only hinting at it through the use of the net working capital-to-asset ratio. After all, it takes cash to pay the bills.

Finally, Z-scores can swing from quarter to quarter when a company records one-time write-offs. These can change the final score, suggesting that a company that's really not at risk is on the brink of bankruptcy.

CONCLUSION

To keep an eye on their investments, investors should consider checking their companies' Z-score on a regular basis. A deteriorating Z-score can signal trouble ahead and provide a simpler conclusion than the mass of ratios. Given its shortcomings, the Z-score is probably better used as a gauge of relative financial health rather than as a predictor. Arguably, it's best to use the model as a quick check of financial health, but if the score indicates a problem, it's a good idea to conduct a more detailed analysis.

Source: Investopedia, Stockpedia, extracts from paper of Altman published in 2000, wikipedia