The Altman Z-Score

The biggest calamity that can befall equity investors is corporate bankruptcy, which wipes out the equity of a firm and knocks the stock’s investment value down to zero. Fundamental analysis attempts to gauge the financial strength of a company using a variety of metrics, many of which we have highlighted in this column. Used in conjunction with one another, financial ratios can often help us to paint a picture of the long-term viability of a firm. However, this is not always the case; sometimes the ratios of a firm give conflicting views. To help eliminate this confusion, NYU professor Edward Altman developed the Z-Score in the late 1960s to explicitly address the likelihood that a company would go bankrupt. In this installment of Fundamental Focus, we discuss how to calculate a company’s Z-Score.

Z-Score Formula

The Altman Z-Score actually consists of five performance ratios that are combined into a single score. These five ratios are weighted using the following formula:

\[ Z\text{-Score} = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \]

Where:

- \( A \) = working capital ÷ total assets
- \( B \) = retained earnings ÷ total assets
- \( C \) = earnings before interest & taxes ÷ total assets
- \( D \) = market value of equity ÷ total liabilities
- \( E \) = sales ÷ total assets

When analyzing the Z-Score of a company, the lower the value, the higher the odds that the company is headed toward bankruptcy. Altman came up with the following rules for interpreting a firm’s Z-Score:

- Below 1.8 indicates a firm is headed for bankruptcy;
- Above 3.0 indicates a firm is unlikely to enter bankruptcy; and
- Between 1.8 and 3.0 is a statistical “gray area.”

Deconstructing the Z-Score

Working Capital to Total Assets

Working capital is a company’s current assets less its current liabilities and measures a company’s efficiency and its short-term financial health. Positive working capital means that the company is able to meet its short-term obligations. Negative working capital means that a company’s current assets cannot meet its short-term liabilities; it could have problems paying back creditors in the short term, ultimately forcing it into bankruptcy. Companies with healthy, positive working capital shouldn’t have problems paying their bills.

Retained Earnings to Total Assets

The retained earnings of a company are the percentage of net earnings not paid out as dividends; they are “retained” to be reinvested in the firm or used to pay down debt. Retained earnings are calculated as follows:

\[ \text{Beginning retained earnings} + \text{net income (net loss)} - \text{dividends paid} \]

The ratio of retained earnings to total assets helps measure the extent to which a company relies on debt, or leverage. The lower the ratio, the more a company is funding assets by

Table 1. Altman Z-Score Calculations for Borders Group

<table>
<thead>
<tr>
<th>Financial Data (in $ millions)</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>4,080.0</td>
<td>4,110.0</td>
<td>3,820.0</td>
<td>3,280.0</td>
<td>2,820.0</td>
</tr>
<tr>
<td>Earnings Before Interest &amp; Taxes</td>
<td>173.0</td>
<td>(137.0)</td>
<td>6.6</td>
<td>(149.0)</td>
<td>(94.9)</td>
</tr>
<tr>
<td>Current Assets</td>
<td>1,640.0</td>
<td>1,720.0</td>
<td>1,510.0</td>
<td>1,070.0</td>
<td>988.0</td>
</tr>
<tr>
<td>Total Assets</td>
<td>2,570.0</td>
<td>2,610.0</td>
<td>2,300.0</td>
<td>1,610.0</td>
<td>1,430.0</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>1,310.0</td>
<td>1,600.0</td>
<td>1,470.0</td>
<td>994.0</td>
<td>928.0</td>
</tr>
<tr>
<td>Total Liabilities</td>
<td>1,640.0</td>
<td>1,970.0</td>
<td>1,830.0</td>
<td>1,350.0</td>
<td>1,270.0</td>
</tr>
<tr>
<td>Retained Earnings</td>
<td>614.0</td>
<td>438.0</td>
<td>250.0</td>
<td>63.8</td>
<td>(45.6)</td>
</tr>
<tr>
<td>Market Value of Equity</td>
<td>1,400.0</td>
<td>1,004.0</td>
<td>350.1</td>
<td>33.1</td>
<td>73.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Z-Score Ratios</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Capital ÷ Total Assets</td>
<td>0.13</td>
<td>0.05</td>
<td>0.02</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Retained Earnings ÷ Total Assets</td>
<td>0.24</td>
<td>0.17</td>
<td>0.11</td>
<td>0.04</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Earnings Before Interest &amp; Taxes ÷ Total Assets</td>
<td>0.07</td>
<td>(0.05)</td>
<td>0.00</td>
<td>(0.09)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Market Value of Equity ÷ Total Liabilities</td>
<td>0.85</td>
<td>0.51</td>
<td>0.19</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Sales ÷ Total Assets</td>
<td>1.59</td>
<td>1.57</td>
<td>1.66</td>
<td>2.04</td>
<td>1.97</td>
</tr>
</tbody>
</table>

| Z-Score                                | 2.81 | 2.00 | 1.96 | 1.86 | 1.79 |

borrowing instead of through retained earnings which, again, increases the risk of bankruptcy if the firm cannot meet its debt obligations.

**Earnings Before Interest & Taxes to Total Assets**

This is a variation on return on assets, which is net income divided by total assets. This ratio assesses a firm’s ability to generate profits from its assets before deducting interest and taxes.

**Market Value of Equity to Total Liabilities**

The ratio of market value of equity to total liabilities shows how much a company’s market value (as measured by market capitalization, or share price times shares outstanding) could decline before liabilities exceeded assets.

Unlike the other ratio components used by the Z-Score, market value isn’t based purely on fundamentals—the market capitalization of a firm is an indication of the market’s confidence in a company’s financial position. Generally speaking, the higher the market capitalization of a company, the higher the likelihood that the company can survive going forward.

**Sales to Total Assets**

The ratio of sales to total assets, more commonly referred to as asset turnover, measures the amount of sales generated by a company for every dollar’s worth of its assets.

In other words, asset turnover is an indication of how efficiently a company is using its assets to generate sales. The higher the number the better, while low or falling asset turnover can signal a failure by the company to expand its market share.

**Border’s Group Analysis**

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 1 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.

**Weaknesses of the Z-Score**

Whenever you use financial ratios to analyze a company, it is important to keep in mind that no analysis technique is perfect, and the Z-Score is no exception.

The biggest drawback, as is the case with all financial analysis, is that the Z-Score is reliant on the quality of the underlying financial statement data. If a company is “cooking the books,” its financial statement data is not a true representation of the strength (or lack thereof) of the company. Remember that the Z-Score is only as good as the data that goes into it (“garbage in, garbage out”).

**Conclusion**

The Z-Score is another tool investors can use to monitor the safety of their investments. As we saw with Borders, a steadily declining score can signal underlying problems with a company. That being said, it is still subject to shortcomings faced by all financial metrics.

At a minimum, however, a low or declining Z-Score should spur you to conduct more in-depth analysis to seek out the root cause.