

# SMART UP

screening for business health



## Module 3

### SPOTLIGHT on Bankruptcy: Z-Score

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# Predicting financial distress and bankruptcy: Z-Score

The Z-Score formula for predicting bankruptcy was published in 1968 by Edward Altman. The formula can be used to predict the probability that a firm will go into bankruptcy within two years. Z-Score uses multiple corporate income and balance sheet values to measure the financial health of a company.

In Tests, Altman Z-Score was found to be 72% accurate in predicting bankruptcy two years prior to the event. In a series of subsequent tests covering three different time periods over the next 31 years (up until 1999), the model was found to be approximately 80-90% accurate in predicting bankruptcy one year prior to the event.

There are different Z-Score Models available for different Sectors

Public Manufacturing Companies

Private Companies

Non-Manufacturers

Emerging Markets

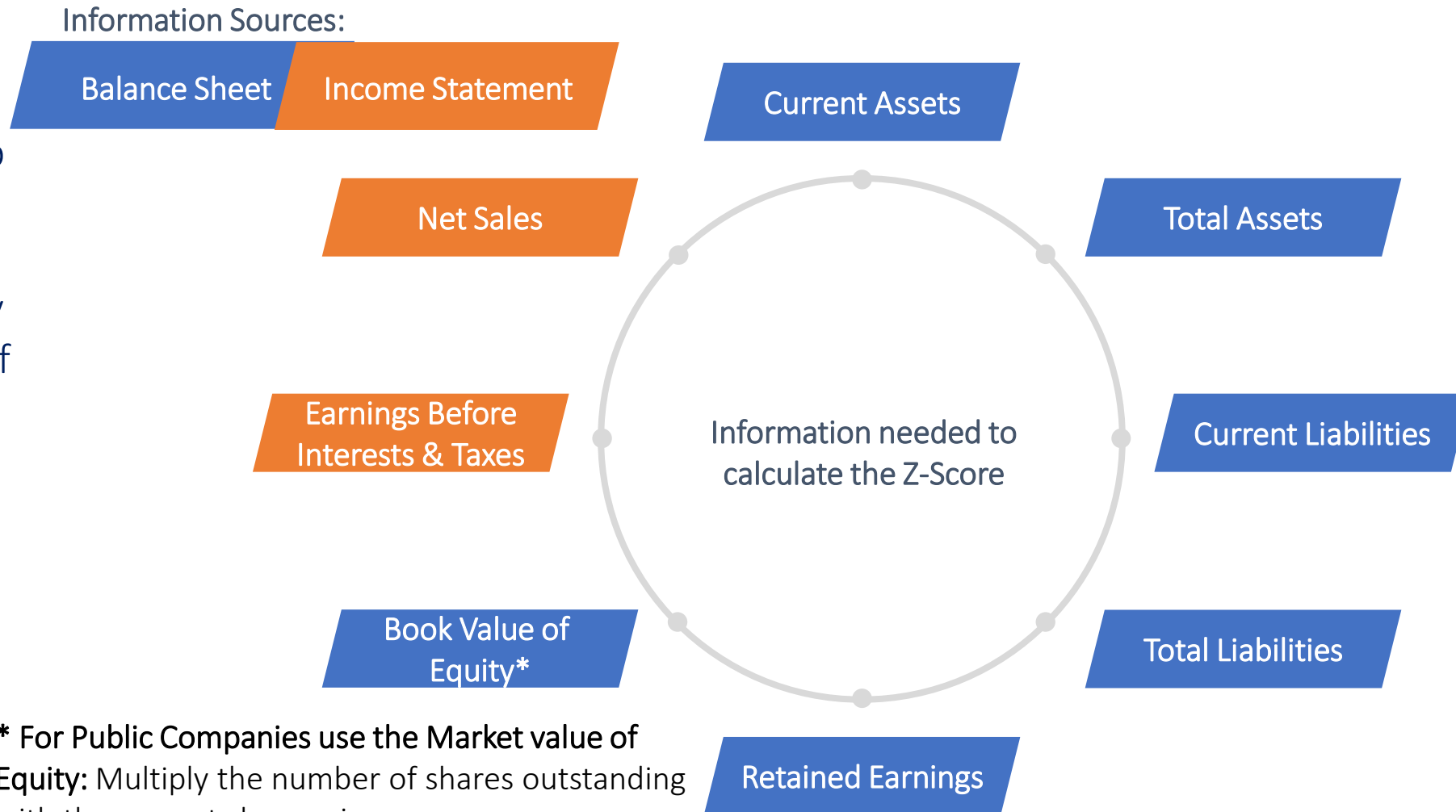
# Predicting financial distress and bankruptcy: Z-Score

Edward Altman combined a set of 5 financial Ratios to come up with the Altman Z-Score. This score uses statistical techniques to predict a publicly traded company's probability of failure.

Later on he adapted the Model for private companies as well.

The used ratios are calculated by 8 variables from a company's financial statement.

\* For Public Companies use the Market value of Equity: Multiply the number of shares outstanding with the current share price



# Altman Z-Score for Public Manufacturing Companies

## Formula

$$Z - Score = \left(1.2 * \frac{Working\ Capital^*}{Total\ Assets}\right) + \left(1.4 * \frac{Retained\ Earnings}{Total\ Assets}\right) + \left(3.3 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets}\right) + \left(0.6 * \frac{Market\ Value\ of\ Equity}{Total\ Liabilities}\right) + \left(0.999 * \frac{Sales}{Total\ Assets}\right)$$

## Interpretation

Red Zone	Grey Zone	Safe Zone
<b>Z-Score below 1.8</b>  Any score below 1.8 indicates huge financial distress. The lower the score, the more danger there is that the company might soon become insolvent.	<b>Z-Score from 1.8 to 2.99</b>  This range is considered a “gray area.” Companies which have a score lying in this range are not very safe. Their finances are not stable and the companies may get into the “danger zone” if there are no improvements.	<b>Z-Score of 3 or above</b>  Score of 3 and above – a score of more than 3 indicates that the company is in the “safe zone.” This means that the company’s financial status is okay. It is financially healthy, and the risk of bankruptcy is low.

\* *With Working Capital = Current Assets – Current Liabilities*



# Altman Z-Score for Public Manufacturing Companies

## Formula

$$Z - Score = \left(1.2 * \frac{Working\ Capital^*}{Total\ Assets}\right) + \left(1.4 * \frac{Retained\ Earnings}{Total\ Assets}\right) + \left(3.3 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets}\right) + \left(0.6 * \frac{Market\ Value\ of\ Equity}{Total\ Liabilities}\right) + \left(0.999 * \frac{Sales}{Total\ Assets}\right)$$

## Example

- Total Assets: 2,000,000
- Working Capital: 3,500,000
- Total Liabilities: 3,900,000
- Retained Earnings: 800,000
- Earnings Before Interests and Tax: 1,200,000
- Sales Total: 3,500,000
- Market Value of Equity: 4,000,000

$$Z - Score = \left(1.2 * \frac{3500000}{2000000}\right) + \left(1.4 * \frac{800000}{2000000}\right) + \left(3.3 * \frac{1200000}{2000000}\right) + \left(0.6 * \frac{4000000}{3900000}\right) + \left(0.999 * \frac{3500000}{2000000}\right)$$

$$Z - Score = (1.2 * 1.75) + (1.4 * 0.4) + (3.3 * 0.6) + (0.6 * 1.026) + (0.999 * 0.175) = 2.1 + 0.56 + 1.98 + 0.6156 + 1.75 = \mathbf{7.004}$$

Interpretation: The Company is in the Safe Zone

\*  $Working\ Capital = Current\ Assets - Current\ Liabilities$

# Altman Z-Score for Privat Companies

## Formula

$$Z - Score = \left(0.717 * \frac{\text{Working Capital}^*}{\text{Total Assets}}\right) + \left(0.847 * \frac{\text{Retained Earnings}}{\text{Total Assets}}\right) + \left(3.107 * \frac{\text{Earnings before Intetest and Tax}}{\text{Total Assets}}\right) + \left(0.420 * \frac{\text{Book Value of Equity}}{\text{Total Liabilities}}\right) + \left(0.998 * \frac{\text{Sales}}{\text{Total Assets}}\right)$$

## Interpretation

Red Zone	Grey Zone	Safe Zone
<b>Z-Score below 1.23</b>  Any score below 1.8 indicates huge financial distress. The lower the score, the more danger there is that the company might soon become insolvent.	<b>Z-Score from 1.23 to 2.99</b>  his range is considered a “gray area.” Companies which have a score lying in this range are not very safe. Their finances are not stable and the companies may get into the “danger zone” if there are no improvements.	<b>Z-Score of 3 or above</b>  Score of 3 and above – a score of more than 3 indicates that the company is in the “safe zone.” This means that the company’s financial status is okay. It is financially healthy, and the risk of bankruptcy is low.

\* *With Working Capital = Current Assets – Current Liablities*

# Altman Z-Score for Private Companies

## Formula

$$Z - Score = \left(0.717 * \frac{\text{Working Capital}^*}{\text{Total Assets}}\right) + \left(0.847 * \frac{\text{Retained Earnings}}{\text{Total Assets}}\right) + \left(3.107 * \frac{\text{Earnings before Interest and Tax}}{\text{Total Assets}}\right) + \left(0.420 * \frac{\text{Book Value of Equity}}{\text{Total Liabilities}}\right) + \left(0.998 * \frac{\text{Sales}}{\text{Total Assets}}\right)$$

## Example

- Total Assets:	350,000
- Working Capital:	250,000
- Total Liabilities:	300,000
- Retained Earnings:	50,000
- Earnings Before Interests and Tax:	200,000
- Sales Total:	350,000
- Book Value of Equity:	250,000

$$Z - Score = \left(0.717 * \frac{250000}{350000}\right) + \left(0.847 * \frac{50000}{350000}\right) + \left(3.107 * \frac{200000}{350000}\right) + \left(0.420 * \frac{250000}{300000}\right) + \left(0.998 * \frac{350000}{350000}\right)$$

$$Z - Score = (0.717 * 0.714) + (0.847 * 0.143) + (3.107 * 0.571) + (0.420 * 0.833) + (0.998 * 1) = 0.512 + 0.121 + 1.775 + 0.350 + 0.998 = \mathbf{3,757}$$

Interpretation: The Company is in the Safe Zone

\* *With Working Capital = Current Assets – Current Liabilities*

# Altman Z-Score for Non-Manufacturers

## Formula

$$Z - Score = \left( 6.56 * \frac{Working\ Capital}{Total\ Assets} \right) + \left( 3.26 * \frac{Retained\ Earnings}{Total\ Assets} \right) + \left( 6.72 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets} \right) + \left( 1.05 * \frac{Book\ Value\ of\ Equity}{Total\ Liabilities} \right)$$

## Interpretation

Red Zone	Grey Zone	Safe Zone
<b>Z-Score below 1.23</b>  Any score below 1.23 indicates huge financial distress. The lower the score, the more danger there is that the company might soon become insolvent.	<b>Z-Score from 1.23 to 2.9</b>  This range is considered a “gray area.” Companies which have a score lying in this range are not very safe. Their finances are not stable and the companies may get into the “danger zone” if there are no improvements.	<b>Z-Score of 2.9 or above</b>  A score of more than 2.9 indicates that the company is in the “safe zone.” This means that the company’s financial status is okay. It is financially healthy, and the risk of bankruptcy is low.

\* *With Working Capital = Current Assets – Current Liabilities*



# Altman Z-Score for Non-Manufacturers

## Formula

$$Z - Score = \left( 6.56 * \frac{Working\ Capital}{Total\ Assets} \right) + \left( 3.26 * \frac{Retained\ Earnings}{Total\ Assets} \right) + \left( 6.72 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets} \right) + \left( 1.05 * \frac{Book\ Value\ of\ Equity}{Total\ Liabilities} \right)$$

## Example

- Total Assets: 400,000
- Working Capital: 10,000
- Total Liabilities: 300,000
- Retained Earnings: -
- Earnings Before Interests and Tax: 40,000
- Book Value of Equity: 25,000

$$Z - Score = \left( 6.56 * \frac{10000}{400000} \right) + \left( 3.26 * \frac{0}{400000} \right) + \left( 6.72 * \frac{40000}{400000} \right) + \left( 1.05 * \frac{25000}{300000} \right)$$

$$Z - Score = (6.56 * 0.025) + (3.26 * 0) + (6.72 * 0.571) + (1.05 * 0.083) = 0.16 + 0 + 0.67 + 0.09 = \mathbf{0.92}$$

Interpretation: The Company is in the Red Zone

\* With Working Capital = Current Assets – Current Liabilities

# Altman Z-Score for Emerging Markets

## Formula

$$Z - Score = 3.25 + \left( 6.56 * \frac{Working\ Capital}{Total\ Assets} \right) + \left( 3.26 * \frac{Retained\ Earnings}{Total\ Assets} \right) + \left( 6.72 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets} \right) + \left( 1.05 * \frac{Book\ Value\ of\ Equity}{Total\ Liabilities} \right)$$

## Interpretation

Red Zone	Grey Zone	Safe Zone
<b>Z-Score below 1.1</b>  Any score below 1.1 indicates huge financial distress. The lower the score, the more danger there is that the company might soon become insolvent.	<b>Z-Score from 1.1 to 2.6</b>  This range is considered a “gray area.” Companies which have a score lying in this range are not very safe. Their finances are not stable and the companies may get into the “danger zone” if there are no improvements.	<b>Z-Score of 2.6 or above</b>  A score of more than 2.6 indicates that the company is in the “safe zone.” This means that the company’s financial status is okay. It is financially healthy, and the risk of bankruptcy is low.

\* *With Working Capital = Current Assets – Current Liabilities*

# Altman Z-Score for Emerging Markets

## Formula

$$Z - Score = 3.25 + \left( 6.56 * \frac{Working\ Capital}{Total\ Assets} \right) + \left( 3.26 * \frac{Retained\ Earnings}{Total\ Assets} \right) + \left( 6.72 * \frac{Earnings\ before\ Interest\ and\ Tax}{Total\ Assets} \right) + \left( 1.05 * \frac{Book\ Value\ of\ Equity}{Total\ Liabilities} \right)$$

## Example

- Total Assets:	400,000
- Working Capital:	-200,000
- Total Liabilities:	300,000
- Retained Earnings:	-
- Earnings Before Interests and Tax:	40,000
- Book Value of Equity:	25,000

$$Z - Score = 3,25 + \left( 6,56 * \frac{-200000}{400000} \right) + \left( 3,26 * \frac{0}{400000} \right) + \left( 6,72 * \frac{40000}{400000} \right) + \left( 1,05 * \frac{25000}{300000} \right)$$

$$Z - Score = 3,25 + (6,56 * -0,5) + (3,26 * 0) + (6,72 * 0,571) + (1,05 * 0,083) = 3,25 + (-3,28) + 0 + 0,67 + 0,09 = \mathbf{0,73}$$

Interpretation: The Company is in the Red Zone

\* With Working Capital = Current Assets – Current Liabilities

# Accuracy and Limitations of the Altman Z-Score

The Z-Score does not give you guarantee – it is based on statistical analysis.

→ Most importantly:  
The Z-Score can only be as accurate as the data used.

How accurate is it?

There is a number of studies that affirm the accuracy of the Z.-Score:

- A prediction of bankruptcy 2 years before it happened had an accuracy of 72% with false positives of 6%
- The overall accuracy is between 80%-90%
- In predicting bankruptcy 1 year before it happened, false positives were recorded at 15%-20%

Limitations

- The Z-Score can only be as accurate as the data used
- It cannot be used for New Companies / Start-Ups: The biggest problem is that there is simply too little data to facilitate this calculation. Two particular variables (Retained earnings and Market value of Equity) are not well captured in a new company, making the Altman Z-Score unusable
- More than that, the sheer age of the model creates room for opponents to discredit it. The business environment in 1968 was very different from the current one → But still the model helps to raise alarms