Default Probabilities
Internal ratings and recovery rates

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The ratings that are published by rating agencies are only available for (relatively) large companies.

Many SMEs do not issue publicly traded bonds, therefore they are not rated.
As we have seen, the internal-rating based (IRB) approach of Basel II and III allow banks to use internal methods to determine the probability of default of a counterparty.

This is why most banks have their own procedures to assess the creditworthiness of their corporate and retail clients.

This is a necessity, when external information is not available.

If, for a client, an external rating is also available, the bank can choose the one to be used (internal or external).
Internal ratings

- Internal-rating approaches typically rely on profitability and balance sheet ratios.

- Since a bank (but every company in general) is interested in the capability of its counterparty to service its debts, the liquidity of each client is extremely important.

- In simple terms: cash is more important than profits, in repaying a debt.
Altman’s Z-score

- Introduced in 1968 by Edward Altman, Altman’s Z-score is the prototype of internal-rating methods.

- There exist different versions of Altman’s Z-score, depending on the type of company/client under scrutiny.

- In simple terms, it is a financial distress index, and it is considered an essential tool of fundamental analysis.

- The typical time horizon is 1 year.

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Using discriminant analysis, over the years Altman (and many other after him) have proposed different ways of computing the Z-score.

For example, for publicly traded manufacturing companies, the Z-score reads

\[ Z-score = 1.2R_1 + 1.4R_2 + 3.3R_3 + 0.6R_4 + 0.999R_5 \]

- Working Capital/Total Assets
- Retained earnings/Total Assets
- EBIT/Total Assets
- Sales/Total Assets
- Market value of equity/Book value of total liabilities
How to read the Z-score?

* The use of the Z-score is rather simple: you simply plug-in the value of the profitability and balance sheet ratios you need and you get a number.

* This number must be compared with some specific thresholds, which are obtained by analyzing historical data about the financial distress and the default of companies.

* These thresholds depend on the type of Z-score you use.

* For the previous example:

\[
Z - score = 1.2R_1 + 1.4R_2 + 3.3R_3 + 0.6R_4 + 0.999R_5
\]

<table>
<thead>
<tr>
<th>1-year time horizon</th>
<th>VERY HIGH PD</th>
<th>HIGH PD</th>
<th>ALERT</th>
<th>VERY SMALL PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>-∞</td>
<td>1.8</td>
<td>2.7</td>
<td>3</td>
<td>+∞</td>
</tr>
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The accuracy of Z-scores is around 80%-90%
Consider a corporate client for which we know the following:

\[ R_1 = 0.352, \quad R_2 = 0.448, \quad R_3 = 0.0896, \quad R_4 = 1.233, \quad R_5 = 1.731 \]

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\[
1.2 \times 0.352 + 1.4 \times 0.448 + 3.3 \times 0.0896 + 0.6 \times 1.233 + 0.999 \times 1.731 = 3.8143
\]

the answer is no.

our corporate client seems to be in a healthy condition, and it will not default in the near future.
The internal tools actually used by banks

• Banks use their own formulas and proprietary tools.

• However, most of these are just modifications of Altman’s Z-score, or they are obtained using similar techniques.

• Alternatively, banks may use instruments they buy from external providers. Some examples are Merton’s model, Moody’s KMV model, Credit Suisse CR+ and so on.
  We will see these models in the next weeks.

• As we can expect, internal ratings are also used by rating agencies to assign a rating to bonds, especially when they first appear.
Recovery rates

• Your counterparty goes bankrupt.

• Do you lose it all?
The recovery rate is “the amount of credit recovered through foreclosure or bankruptcy procedures in event of a default, expressed as a percentage of face value”.

For a bond it is typically the price at which it trades about 30 days after default, as a percent of the face value. The average recovery rate for bonds is around 35-40%.

For loans and mortgages with first lien on assets, it is usually around 65%.
As one could imagine, recovery rates are very negatively correlated with default rates (\% defaults) on the market. This means that during a crisis, when many companies and individuals go bankrupt, recovery rates dramatically decrease.

A paper by Altman et al. (2005) shows that when the default rate on speculative-grade bonds is around 1\% per year, then the recovery rate can get as high as 55\%. But, if the default rate rises up to 10\%, then the recovery rate immediately drops to less then 30\!%

Thank You