

Low Carbon Portfolio – Fixed Income analysis

We propose to use Altman Z-scores to model the credit risk impacts of the low-carbon transition.

This will be accomplished by assessing the impact of modelled changes in revenues, cost and profit flows on company Z-scores, under each low-carbon transition scenario (e.g. 2°C 2020 Action). The approach builds upon the economic system and value stream modelling already completed as part of the equity analysis. This note consists of 3 sections:

- Section 1.1.1: methodology overview
- Section 1.1.2: description of analytical options based on scope
- Section 1.1.3: data requirements for each option

1.1.1 Methodology

The Altman Z-score is a measure of firm solvency (bankruptcy risk), which we will use to estimate the effect of the low-carbon transition on corporate debt default risk.

The Altman Z-score is defined as:

$$Z = 1.2 X1 + 1.4 X2 + \mathbf{3.3 X3} + \mathbf{0.6 X4} + \mathbf{1 X5}$$

where (terms in **bold** are affected by low-carbon transition scenario modelling):

$$X1 = \frac{\text{Working Capital}}{\text{Total Assets}}, X2 = \frac{\text{Retained Earnings}}{\text{Total Assets}}, \mathbf{X3 = \frac{EBITDA}{Total Assets}}$$

$$\mathbf{X4 = \frac{Market Value of Equity}{Total Liabilities}}, \mathbf{X5 = \frac{Net Sales}{Total Assets}}$$

Company-level value stream model results (discounted cashflow analysis) from the existing equity analysis allows us to **estimate the impact of each climate scenario on the Altman Z-score, through terms X3, X4 and X5 above**. The change in Altman Z-score under each climate transition scenario can be estimated using the change in these elements, and **the assumption that X1 and X2 are constant across low-carbon transition scenarios**. This is set out below (where NPA = the No Policy Action scenario):

$$\begin{aligned} \Delta Z^{2DS} &\equiv Z^{2DS} - Z^{NPA} \\ &= X1^{2DS} + X2^{2DS} + X3^{2DS} + X4^{2DS} + X5^{2DS} - X1^{NPA} - X2^{NPA} - X3^{NPA} - X4^{NPA} - X5^{NPA} \\ &= (X3^{2DS} - X3^{NPA}) + (X4^{2DS} - X4^{NPA}) + (X5^{2DS} - X5^{NPA}) \\ &= \Delta X3^{2DS} + \Delta X4^{2DS} + \Delta X5^{2DS} \end{aligned}$$

Altman Z-score values are often interpreted as reflecting bankruptcy risk levels – some common thresholds are shown in Box 1. The outputs from this analysis could be presented in this format, or in the form of explicit default probabilities based on empirical estimates of the relationship between Altman Z-scores and default probabilities.

Box 1. Rule of thumb thresholds for Altman Z-scores

- $Z \geq 3$ indicates the firm is safe based on financial data
- $3 > Z \geq 2.7$ suggests the firm is probably safe from bankruptcy, but caution is required
- $2.7 > Z \geq 1.8$ indicates the firm is likely to be bankrupt in the next 2 years
- $Z \leq 1.8$ suggests the company is likely to already be bankrupt

1.1.2 Analytical scope / levels

The above methodology could be applied at 2 potential levels of granularity, depending on data availability:

- **Asset-level (individual corporate bonds) Z-scores:**
 - Calculate Z-scores in No Policy Action scenario, and under each climate scenario based on modelled changes in EBITDA, market value of equity and net sales
 - This produces estimates of default risk under each scenario, at the asset-level, allowing for comparisons between fixed income instruments within each sector, and against the thresholds identified in Box 1
- **Sector-region (corporate bond subclass) Z-scores:**
 - Calculate Z-scores in No Policy Action scenario for corporate bond subclasses (sector-region) based on sector-average or company archetype data, and under each climate scenario based on the sector-average or company archetype's modelled changes in EBITDA, market value of equity and net sales
 - This yields estimates of default risk under each scenario, at the asset-class level
 - **This analysis could be performed based on sector-average data, or through archetype companies (~3) within each sector**

1.1.3 Data requirements

Table 1. Data requirements for the modelling approaches proposed in Section 1.1.2

| Approach | Data lines required | Coverage |
|---|---|---|
| Asset-level Z-scores | <ul style="list-style-type: none"> — Current assets, current liabilities — Total assets, total liabilities — EBITDA — Retained earnings — Market value of equity (market cap) — Net sales | Asset-level for all corporate bonds issued by MSCI ACWI constituents |
| Sectoral Z-scores (sector-average approach) | <ul style="list-style-type: none"> — Current assets, current liabilities — Total assets, total liabilities — EBITDA — Retained earnings — Market value of equity (market cap) — Net sales | Sector-average data based on current TRBC system sector definitions |
| Sectoral Z-scores (archetypes approach) | <ul style="list-style-type: none"> — Current assets, current liabilities — Total assets, total liabilities — EBITDA — Retained earnings — Market value of equity (market cap) — Net sales | 2 – 5 typical companies within each sector (for instance, Shell, Exxon and Total for oil & gas), based on current TRBC system sector definitions |

Source: Vivid Economics