An Analysis and Critique of the Methods Used by Rating Agencies

Report of FIB Credit Working Party

Presented to the Joint Faculty and Institute of Actuaries
2004 Finance & Investment Conference
29 June 2004

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1. **Scope**

The main purpose of this paper is to outline the methodologies used by the main credit rating agencies when arriving at insurer and long-term debt ratings. For the long-term debt ratings, the treatment of pensions is also discussed. There is also some comment on the validity of the methodology used.

2. **Users and Uses of Credit Ratings**

2.1 *Introduction*

Ratings play an important role in today’s capital markets. They have helped foster the dramatic growth, stability and efficiency of international and domestic bond markets, which now encompass more than $50 trillion of rated bonds and other fixed-income securities.

Credit ratings are designed to provide independent and objective opinions – not recommendations – on the future ability and legal obligation of issuers to make timely payments on their financial commitments. Ratings also provide a reliable frame of reference for investment decisions by enhancing transparency and efficiency in debt capital markets. They do this by reducing the information asymmetry between borrowers and investors, and in doing so help protect investors.

For most companies, there are two kinds of rating; however, for insurance companies, there are three. The first two, issue and issuer ratings, are similar to those for other kinds of companies; however, agencies also rate the financial strength of insurance companies in respect of their ability to meet their obligations to policyholders. These Insurer Financial Strength Ratings (“IFSRs”) were first issued in 1971. Having initially covered only life insurers, IFSRs are now given for all kinds of insurance companies, including life, non-life, health and reinsurers.

IFSRs reflect each agency’s long-term opinion on relative credit risk, focussing on expected loss, and considering primarily the guaranteed benefits or financial obligations to policyholders. They differ from issue and issuer ratings in that policyholders are considered senior debt, ranking above bondholders on bankruptcy. This means that in the UK a life fund may be considered much more secure than the company that owns it, due to the fact that the money in the fund can often only be accessed by shareholders via the 90:10 gate.

Debt ratings and IFSRs for an insurance company can be different. This will reflect the different seniority of claims on the event of liquidation. Usually the starting point is the IFSR and then debt securities will be rated lower. Debt issued by holding companies is also usually lower, as the creditors in the holding company are usually subordinate to those in the subsidiary.
There seems to be room for actuaries to move into this field – bringing rigour, expertise in understanding and modelling of risks, and a deep knowledge of insurance business. However, there are some barriers that need to be overcome: for example, cultural issues, the focus on “soft” factors such as management ability, and intangible risks such as operational risk.

2.2 Users of Credit Ratings

The main users of credit ratings are:

- investors;
- issuers/borrowers;
- intermediaries;
- regulators;
- savers;
- governments;
- financial media; and
- policyholders generally through IFAs, agents, brokers and risk managers.

In addition, a host of other market observers and participants use credit ratings to inform myriad business-related decisions.

2.3 Uses of Credit Ratings

Insurance company ratings are intended to clarify the security of insurance contracts to various stakeholders. According to Swiss Re’s 4/2003 Sigma report, ratings are a response to market imperfections and are a low cost way of analysing and monitoring companies. Market imperfections arise from the fact that insurance contracts are complex; rating agencies provide a market response that reduces the multiplication of effort by interested parties. Having said this, many investment house analysts have set up their own teams to either cross check and/or enhance the work of the rating agencies.

Credit ratings on debt instruments also play a key role in the investment-making decision process: issuers via intermediaries benchmark pricing against ratings, whilst investors look to ratings as an important element in the overall decision to invest in a security, rather than a recommendation to buy, sell or hold. Investors often must abide by guidelines that restrict investment to debt of a specific minimum rating; typically BBB/Baa or higher – so-called investment grade. Moreover, some investors are unwilling to buy securities issued by unrated companies because they find they are unable to evaluate the credit quality of the issuer due to insufficient publicly available information.

Another factor driving the use of ratings is disintermediation – the direct investment of funds in a company rather than through a bank – which has built up considerable momentum during the past decade. Ratings are a factor in disintermediation as they can represent a first stage towards lessening dependence on bank financing.
Ratings also help to achieve a favourable cost of capital. A credit rating enables the issuer to tap a large and liquid source of funds. The result is generally a lower average cost of finance and greater control over the terms of financing.

Finally, an unprecedented wave of company failures has occurred in the wake of recent difficulties in many of the world’s most important economies. Creditors, particularly in the wake of the Asian and Russian crises of the late 1990s, have faced significant losses. In these circumstances it is natural for investors to express a heightened concern as to credit quality. This trend has provided an additional boost to the development and use of credit ratings worldwide.

Further uses for ratings include:

- communicating creditworthiness to counterparties;
- determining an independent benchmark for shareholders and bondholders;
- acting as a pricing benchmark for relative value across issuers and industry sectors;
- aiding secondary market liquidity;
- acting as a portfolio management tool for investors; and
- acting as a management tool for capital planning.

In the case of IFSRs, the principal users of the ratings will be financial advisers (IFAs in the UK), who will use the ratings as a guide to the security of their clients' investments. They will influence the initial recommendation for a product from a particular company, and any downgrade may lead to a recommendation to surrender. More sophisticated investors will use the ratings themselves to select companies from whom to buy policies and to monitor those policies.

2.4 Problems and Issues

2.4.1 Circularity

As the market for company issued debt as grown, so has the reliance on debt ratings. Many new bond issues now include references to ratings in their terms. For example a bond may be issued paying a 7% coupon, with a clause stating that if the issuer’s rating drops below AA, the coupon will become 10%. Such clauses are known as “trigger clauses”. This can lead to dangerous circularity – if a ratings agency drops the company to BBB, triggering higher interest payments, the burden of the extra interest payments may cause the company further problems, leading to a further downgrade (and potentially triggering a further increase in interest payments). At a recent conference in London, Standard & Poor’s acknowledged this issue, and said it was studying the potential effects.

2.4.2 Global Inconsistency
The larger ratings agencies have offices in every major centre around the world. In many cases these offices operate completely independently. Each office may have its own models and criteria, with only a common basic framework. This reflects the global insurance business as much as any shortcoming of the ratings agencies – differing regulatory and reporting environments and local quirks of business make achieving consistency difficult.

2.4.3 Anticipation of Default

Enron maintained investment grade credit ratings from S&P, Moody’s and Fitch until several weeks before its collapse. The ratings agencies are frequently accused of reacting to events, rather than predicting them. However, agencies must make judgement calls based on what they are told by a company’s management. If the management is successfully perpetrating a fraud, then it is perhaps unreasonable to expect the rating team to discover it. However, calls for the agencies to be more aggressive in their investigations continue.

2.4.4 Rating Agency Power

The decisions made by the rating agencies can have a large impact in the market for bonds. In particular, downgrading a bond below investment grade can precipitate selling by a number of investors who are not permitted to hold speculative grade debt. In addition, even those investors who are not forced to sell may be discouraged from holding on as the bonds are removed from their benchmark index. Conversely, there may be added interest from those investors who are benchmarked against the high yield indices. Consequently, the market can be volatile around this period as investors reallocate their portfolios.

Two particular examples are the case of Railtrack and Ahold. In the case of Railtrack, Standard & Poor's cut the rating on its bonds from A to C in 2001 after the UK Government said it would guarantee repayment only to bondholders that gave up some rights. Consequently, the bonds were removed from a number of benchmark indices and a number of investors sold them at deflated prices. Subsequently, the bonds were rerated all the way back to AA before they were redeemed early a year later. The Dutch food retailer Ahold was rapidly downgraded by Moody's to sub-investment grade in 2003 after the company announced that profits had been inflated, mostly at its US food service unit. Having previously been criticised for being too slow to react to news, they now faced criticism that they had gone too far the other way. There were fears that forced selling by investors could become part of a downward spiral of credit problems. However, a year later Ahold bonds still maintain this sub-investment grade rating.

3. The Main Rating Agencies

3.1 Standard & Poor’s
Standard & Poor’s, which has its origins in 1860, was formed by a merger of Standard Statistics and Poor’s Publishing Company in 1941. It was acquired by the McGraw-Hill Companies, Inc in 1966. Debt ratings were first assigned to corporate bonds in 1916, sovereign debt followed soon after and municipal bond ratings in 1940. It is the world’s foremost provider of independent credit ratings, indices, risk evaluation investment research and valuations, employing over 1,250 analysts.

3.2 Moody’s

Moody’s Investors Service was incorporated in 1914 and by 1924 was producing “Moody’s Ratings” covering nearly all of the US bond market. In the 1970’s, ratings were expanded to cover the commercial paper market and bank deposits. It is now among the world’s most respected, widely utilised sources for credit ratings, research and risk analysis. It covers approximately 136,000 corporate, government and structured finance securities.

Moody’s KMV, a subsidiary of Moody’s Corporation, is a provider of quantitative credit analysis tools to lenders, investors and corporations. It has the largest public and private company default and loss database in the world. Amongst its services are data collection and analysis tools, stand-alone credit risk measurement tools, credit valuation tools and portfolio credit risk analytics.

3.3 Fitch IBCA

Fitch Ratings traces its roots to the Fitch Publishing Company established in 1913. In the 1920’s, it introduced the “AAA to D” rating scale. In 1997, it merged with IBCA Limited as the first part of a plan to become a global full-service alternative to Moody’s and S&P.

3.4 AM Best

AM Best was founded in 1899 and is a worldwide insurance-rating and information agency. It specialises in reports and ratings of insurance companies, as well as fixed-instrument debt ratings that cover bonds, notes, securitisation products and other financial instruments issued by insurers and reinsurers.

4. Rating Definitions

4.1 Introduction

Each agency has its own definition of the different ratings. However, the definitions are similar. For IFSRs, the ratings are broadly grouped into “secure” and “vulnerable”, and for long-term debt ratings into “investment grade” and “speculative grade” (also known as high yield or “junk”), although these distinctions are not always explicitly made by the rating agencies.
A summary of the ratings for the main agencies is given below:
## 4.2 Insurer Financial Strength Ratings

<table>
<thead>
<tr>
<th>AM Best</th>
<th>Fitch IBCA</th>
<th>Moody’s</th>
<th>Standard &amp; Poor’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>A++, A+</td>
<td>Superior</td>
<td>AAA</td>
<td>Exceptional</td>
</tr>
<tr>
<td>A,A-</td>
<td>Excellent</td>
<td>AA</td>
<td>Aa</td>
</tr>
<tr>
<td>B++, B+</td>
<td>Very Good</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>BBB</td>
<td>Good</td>
<td>Baa</td>
</tr>
</tbody>
</table>

### Secure

### Vulnerable

<table>
<thead>
<tr>
<th>B, B-</th>
<th>Fair</th>
<th>BB</th>
<th>Moderately Weak</th>
<th>Ba</th>
<th>Questionable</th>
<th>BB</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>C++, C+</td>
<td>Marginal</td>
<td>B</td>
<td>Weak</td>
<td>B</td>
<td>Poor</td>
<td>B</td>
<td>More Vulnerable</td>
</tr>
<tr>
<td>C, C-</td>
<td>Weak</td>
<td>CCC, CC, C</td>
<td>Very Weak</td>
<td>Caa</td>
<td>Very Poor</td>
<td>CCC</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>D</td>
<td>Poor</td>
<td>DDD, DD, D</td>
<td>Distressed</td>
<td>Ca</td>
<td>Extremely Poor</td>
<td>CC</td>
<td>Highly Vulnerable</td>
</tr>
<tr>
<td>E</td>
<td>Regulatory Supervision</td>
<td>C</td>
<td>Lowest</td>
<td>R</td>
<td>Regulatory Supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Liquidation</td>
<td></td>
<td></td>
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<tr>
<td>S</td>
<td>Suspended</td>
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<td></td>
</tr>
</tbody>
</table>

### Within-category modifiers

| N/A     | +/-     | 1,2,3 (1 high, 3 Low) | +/- |

Sources: rating agency websites
### 4.3 Long-Term Debt Ratings

<table>
<thead>
<tr>
<th>AM Best</th>
<th>Fitch IBCA</th>
<th>Moody’s</th>
<th>Standard &amp; Poor’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investment Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aaa, aa</td>
<td>Superior</td>
<td>AAA</td>
<td>Aaa</td>
</tr>
<tr>
<td>a</td>
<td>Excellent</td>
<td>AA</td>
<td>Aa</td>
</tr>
<tr>
<td>bbb</td>
<td>Very Good</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BBB</td>
<td>Baa</td>
</tr>
<tr>
<td><strong>Speculative Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bb</td>
<td>Fair</td>
<td>BB</td>
<td>Ba</td>
</tr>
<tr>
<td>b</td>
<td>Marginal</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>ccc, cc</td>
<td>Weak</td>
<td>CCC,CC,C</td>
<td>Caa</td>
</tr>
<tr>
<td>c</td>
<td>Poor</td>
<td>DDD,DD,D</td>
<td>Ca</td>
</tr>
<tr>
<td>d</td>
<td>Regulatory</td>
<td></td>
<td>C</td>
</tr>
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<td></td>
<td>Supervision/</td>
<td></td>
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<tr>
<td></td>
<td>Liquidation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Within-category modifiers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sources:** rating agency websites
5. **Insurance Company Ratings Approaches**

5.1 *Standard & Poor’s*

5.1.1 The Ratings Process

The ratings process given here for insurance companies is similar to that used for companies that operate in other industries. It is also similar to that used by other rating agencies. It can be summarised as follows:

- the insurer approaches S&P to request a rating;
- a lead analyst and rating team is assigned, and a preliminary review is done using publicly available data;
- the rating team meets with the insurer’s management, to gain insight into the business, and to assess the management team;
- drawing on public and non-public information, the rating team conducts a detailed analysis of the company;
- this analysis is then presented to a rating committee, which, after discussion, assigns a rating;
- this rating, and the analysis behind it, is then communicated to the insurer;
- companies being rated for the first time can refuse to publish the analysis, or appeal (perhaps presenting more information);
- following the initial assignment of a rating, the rating is held under continuous surveillance. There will be at least an annual review, and, if information that might affect the company’s rating becomes available, the company may be placed on credit watch, pending an outcome.

5.1.2 Meetings with Management

Management meetings serve two purposes. Firstly, they give analysts access to information that may not be in the public domain, allowing them to interpret better the information from company accounts and other sources. Secondly, they give an opportunity to assess the management of the company. Generally, the meetings are attended by high-level management such as the chief actuary and chief financial officer, and their perceived competency will have an impact on the rating. An example of an agenda for the management meeting is:

- management and corporate strategy;
- business review/operating performance/underwriting;
- investments – portfolio strategy going forward, performance in the past, asset-liability management;
- capitalisation – short and long term needs;
- liquidity;
- reinsurance – current reinsurance program and any possible problems; and
- reserving – methodology used to establish reserves.
5.1.3 Ratings Analysis

S&P uses a number of criteria to rate companies. These may include:

- capital needs;
- financial flexibility – a measure of the company’s options under stress, including its access to the capital markets and its credibility in those markets;
- business position – both by comparison with its peer group within the industry, and S&P’s assessment of the prospects for the industry as a whole. Note that the analysis team has access to the business plans of most or all of the industry (since it will rate almost every company in the industry) and is thus in a unique position to evaluate the competitive position of the company;
- management ability;
- operating performance – both past and projected;
- investments/assets – including an assessment of any off-balance sheet positions which may be disclosed during meetings; and
- liquidity

During the ratings analysis, each of these criteria is rated on the AAA – C scale, historically and prospectively. The final rating will be an average.

S&P stresses that although quantitative models are used to evaluate some of these criteria, qualitative adjustments are also made where necessary.

The models that are used vary by territory and by insurer type, although they are fairly simplistic compared to some of the models now in use by UK life and general insurance companies. However, CP195 in the UK means that all life insurers will have an internal model upon which S&P will be able to draw during the analysis.

The existing model for life insurers in the UK produces a capital adequacy ratio (“CAR”). This CAR should be at least 100% in order to support a ‘BBB’ rating. The ratio is given by:

\[
\text{CAR} = \frac{\text{total adjusted capital} - \text{asset risks for non-profit business}}{\text{asset risks for profit business + pricing + reserving + general business with profit business risks + risks}}
\]

Total adjusted capital is assessed on a realistic basis, starting with shareholders’ equity as reported in the company’s Companies Act accounts and adding any other provisions which can be regarded as capital. There are some complications around the use of the funds for future appropriation (“FFA” – money inside the with-profits fund which has not yet been attributed to either policyholders or shareholders) as capital, such as how much is attributable as capital, and in respect of which risks. Partial credit will be given for goodwill, reserving margins and claims equalisation provisions from non-life business lines.
This amount of capital is then compared with the amounts needed to cover various risks. The model assumes 4 kinds of risk, denoted:

- Asset risk (C-1)
- Pricing risk (C-2)
- Reserving risk (C-3)
- Business risk (C-4)

Note that the charge for asset risks for non-profit business is simply subtracted from the TAC, giving a conservative assessment of available capital for these risks. The risks for with-profit business are counted in with other general risks. This is a contrast to most other territories, where all asset risks are subtracted from TAC in the numerator of the ratio, and reflects the relatively high levels of asset risk carried by UK with-profits funds.

The amounts attributed for the risks C-1 to C-4 are calculated in a simple manner – asset risks are taken as a percentage of assets held, based on their volatility and credit-worthiness. Additional charges may be made for large holdings or concentrations of risk. Other risk charges are calculated as a percentage of premiums, or mathematical reserves, or both. The percentage varies by risk type and business line. Credit is given for reinsurance.

The parameters of the model change from time to time as S&P monitors information from the industry. The model is of the back-of-the-envelope variety, but given the limited time, resources and familiarity with the business of the companies S&P is rating, it is sufficient to get a broad view of capital requirements and adequacy. S&P does emphasise that this model is only one part in their assessment of ratings.

In various territories models also exist to project operating performance, evaluate liquidity, and so on. However, S&P always emphasises that qualitative adjustments and judgement by its analysts is vital in establishing the final rating.

5.2 Moody's

Moody’s considers a number of qualitative factors in its assessment. At the highest level, this can include sovereign risk and regulatory changes. For a large multinational group, cash flows can be generated in many different countries and there could be regulatory restrictions on the repatriation of these to the home country. Each part of a group’s operations is considered within the context of the country of origin, following which the interrelationships between the parts are considered. There is also the fact that potential changes to tax, regulatory and accounting can affect the competitiveness of a company and the industry in general. The way in which different regulatory authorities deal with company failures is also considered, and ratings might be higher in countries where policyholder guarantee funds exist; however this is only likely to be true for companies with poor ratings.

Moody’s reviews the industry’s strength by considering factors such as:
• concentration in the industry;
• competition for the industry from other industries;
• barriers to entry;
• the level of national protectionism; and
• growth of the industry.

It also considers the following company specific factors such as:

• franchise value – a company’s competitive position, brand, distribution, size of company, products, efficiency; any competitive advantages over competitors;
• distribution channels – the methods by which an insurance company delivers its products;
• strategic focus – long-term vision, strategies for raising capital, risk-return appetite, views on shareholder value creation; management’s views on where growth and profitability will come from, how profit targets are measured and defined;
• management – the strength of the management team and track record in dealing with changes and implementing strategies;
• governance – the role and strength of the Board of Directors, and the interests of large shareholders (which may be contrary to policyholder interests); and
• organisational structure – the relationship of the company with its parent, subsidiary, or affiliate companies, since non-insurance subsidiaries may have an impact on profitability and the capital position of the insurer; includes potential support from other companies whether explicit or implicit.

Moody’s also considers a number of quantitative factors, in particular:

• capital adequacy
• profitability;
• investment risk and asset quality;
• ALM, underwriting, options and guarantees;
• solvency and liquidity; and
• use of reinsurance.

Moody’s analyses profitability results from all reporting methods (including embedded value and statutory profits) with a view to assessing the expected long-term profitability of the business and the risk of deviation from the long-term view. Moody’s primary focus is on regulatory statutory profits as they believe this better reflects the underlying cash-flows from the business and the ability of the company to service debts and liabilities.

It also reviews the asset portfolio of the insurer to consider any credit or market risk arising from mismatches with the liabilities. The diversity and marketability of the portfolio is also considered. Moody’s takes particular interest in what it perceives as
excessive reliance on one type of asset, for example commercial mortgages, private placements or mortgage-backed securities. Strategic investments are also considered.

Moody’s analyses the liability structure of the company looking at guarantees and options that may exist in the liabilities, and the degree to which the liabilities are sensitive to the market conditions and consumer sentiment about the company. Depending on the nature of the liabilities Moody’s may look for a cushion of a large portfolio of liquid assets.

It also has a particular focus on economic capital, that is, the resources available to the insurance company to meet its policyholder liabilities. This is not the same as accounting capital. Moody’s defines free capital as that which is available and exceeds the liabilities for guaranteed policyholder benefits. Moody’s does not use a capital adequacy model for assigning ratings, so a given solvency ratio does not give rise to a certain credit rating.

Moody’s does not place a great reliance on regulatory capital, which it believes has two main shortfalls: firstly it misses a number of risks inherent in the business (for example asset and liability mismatches); secondly Moody’s prefers to ignore some sources of statutory capital, such as future profits. These views are linked to Moody’s treatment of certain capital raising techniques:

- securitisation of an embedded value is considered to be credit neutral in most cases; and
- financial reinsurance is regarded by Moody’s as balance sheet “window-dressing” and usually diminishing the quality of reported capital.

Most statutory capital financial ratios can be improved by borrowing funds from a holding company. Moody’s therefore believes that holding company financial leverage must be considered when evaluating the insurance company: if the holding company is highly geared, then it could place significant demands on the insurance company to provide cash which could increase the business risk.

5.3  *Fitch IBCA*

5.3.1 Introduction

The Fitch’s rating takes into account the company’s current and future financial position. Therefore a mixture of quantitative and qualitative approach is used. The evaluation of the financial strength and credit quality is based on the company’s ability to meet all of its obligations.

Fitch’s rating methodology centres on the following areas:

- industry review;
- operational review;
- organisational review;
- management review; and
5.3.2 Industry Review

It is crucial to understand the position of the company reviewed within the industry in which it is operating. This will reveal the trends affecting the industry and how this will impact on the individual company. The evaluation focuses on:

- the level of competition;
- the basis for competitive advantage;
- barriers to entry;
- relative bargaining power;
- other industry fundamentals which will affect pricing and cost;
- for non-life insurers, the potential “tail” losses and pricing skills; and
- regulatory, legal and accounting framework.

These areas are regularly reviewed in light of changing operating environment.

5.3.3 Operational Review

In this area a significant amount of qualitative judgement is used to evaluate the operation of the company’s business. The analysis includes both the company’s past and current business and how it is expected to evolve in the future. The areas assessed are:

- distribution capabilities and mix;
- lines of business and changes in mix;
- market position, share and growth;
- franchise value and brand quality;
- expense efficiency and operational scale;
- underwriting and related pricing expertise;
- product mix and speed to market with unique product offerings; and
- administrative and technological capabilities.

These areas are assessed by meeting the senior management of the company with a view to gaining insight into the business and performance targets of management.

5.3.4 Organisational Review

The legal structure of an organisation can have a major impact on capital management, cash flows and overall credit quality. Rated entities are first considered on a “stand-alone” basis, and the ratings are then adjusted to allow for:

- parent financial strength and flexibility;
- upstream dividend requirements;
- potential need to divert capital to other subsidiaries;
- business synergies;
strengths and weaknesses of subsidiary companies; and
formal and guarantees and history of support.

5.3.5 Management Review

The review of the management of a company is crucial in determining the success of the business. The review focuses on the following:

- strategic vision;
- appetite for risk;
- credibility and track record for meeting expectations;
- controls and risk management capabilities;
- depth, breadth and succession plans; and
- accomplishments of key executives.

5.3.6 Financial Review

This is mostly a qualitative assessment of the company financial strength. However, interpreting the results requires subjective and qualitative judgement. Fitch reviews financial statements, management reports and company projections. The main areas for review are:

- operating performance;
- capital adequacy;
- investments;
- asset/liability and liquidity management; and
- financial flexibility.

The main thrust of the operating performance review is to evaluate the profitability of the company. To do this, Fitch looks at all profitability measures such as:

- expense ratio;
- return on assets;
- return on embedded value; and
- return on capital and surplus.

In order to assess the company’s continuing profitability Fitch assesses the products sold, the company’s exposure to market risk, and the management of the business in terms of underwriting and pricing flexibility.

Fitch also looks at the diversification of the company’s earnings, as diversified earnings are less volatile in aggregate than concentrated ones. All these measures are considered in the context of the market conditions and the stated strategy of the company.

The assessment of capital adequacy focuses on the level and quality of the insurer’s statutory capital position on both a legal entity and a consolidated basis. The level of
capital is considered in relation to profitability and company risk exposures, as well as considering the capital required for business growth.

The investment review looks at credit, market and liquidity risk. The company’s investment guidelines and management control are analysed to understand the future development of the asset portfolio. Credit risk is examined by looking at the company’s high-risk investments relative to the total investment portfolio and capital base. Fitch also assesses the diversification of the investment portfolio. Market risk is assessed in terms of the change in the market valuation of the portfolio and the impact of this volatility to capital levels of the company. To evaluate liquidity risk, the marketability of investment is assessed. Fitch is also interested in the balance sheet valuation of assets that have a limited secondary market. A study of past investment performance is also used to assess the company’s experience in pursuing its investment strategy.

The sound management of the asset and liability position is crucial to an insurance company. Fitch assesses the key financial risk of the company in relation to its liability risk. It also assesses the impact on the asset allocation of writing new business and of any shift in products sold. It also reviews the use of derivatives in the investment portfolio. Potential cash calls on the company are also assessed in relation to the cash that can be raised in adverse conditions.

Financial flexibility relates to the ability of the company to raise capital internally or externally. The evaluation of the company’s financial flexibility is linked to the financial leverage of the company. To measure financial leverage, Fitch uses traditional balance sheet method by studying ratios of debt to equity, debt plus preferred shares to equity, debt to total capitalisation, and debt plus preferred to total capitalisation. The cash flow measurement of leverage will also be used, such as ratio of debt to earnings before interest, taxes, depreciation and amortisation. The maturity structure of the company debt is also assessed to determine the timing and amount of debt repayment. The agency also looks at the committed and uncommitted lines of credit asset, asset securitisation and other funding methods available to the company. Each banks’ agreement is studied with close attention paid to the facility tenure, financial covenants and any material adverse change in the language of the agreement. Fitch also evaluates the debt service coverage profile of the company using interest and fixed charge ratio based on operating earnings, cash flow and dividends.

5.4 AM Best

5.4.1 Introduction

Alfred M Best began rating property insurers in 1906 and life insurers in 1928. It is one of the oldest rating insurance rating agencies in the world and differs for the other major three rating agencies, namely S&P, Moody’s and Fitch in three ways.
Firstly, it only specialises in rating insurance companies and benchmark a sole sector compare to say, S&P or Moody’s where benchmarking could quite likely to be across all financial institutions and other industrial sectors.

Secondly, it has traditionally focused on providing IFSRs and has only recently begun rating bond issues under the credit rating criteria. Its IFSR scale for secure credits ranges from A++ to B+ (6 notches) and its vulnerable credits scale ranges from B to S (“suspended”) (10 notches) with rating modifiers and affiliation codes to indicate status and type of rating where appropriate. Rating outlooks are also assigned for an intermediate period, generally 12 to 36 months.

Thirdly, although it rates nearly all US insurance companies, its international (non-US) coverage is somewhat limited. According to Swiss Re economic Research & Consulting estimates, AM Best ratings covered 44% of global revenue shares for insurance ratings in 2002. However, it is not accredited as a Nationally Recognised Statistical Rating Organisation (“NRSRO”), so it could be perceived to have less credibility than the other major rating agencies, which do have this accreditation.

AM Best assigns three types of ratings: IFSRs, debt ratings and public data ratings to property and casualty (“P&C”) and life and health (“L&H”) insurers only. Assignment of a rating involves qualitative and quantitative analysis based on:

- balance sheet strength;
- operating performance; and
- business profile.

This analysis is carried out taking into account any parent/subsidiary relationships. Subsidiaries are classified as one of three types:

- core – these receive the same rating as their parent;
- strategic – these do not necessarily receive their parent’s rating, but their stand alone ratings benefit from the affiliation; and
- ancillary – these are viewed as opportunistic, and rarely receive their parent’s rating.

5.4.2 Balance Sheet Strength

The analysis in this area includes an analysis of the company’s underwriting, financial and asset leverage.

Underwriting leverage is generated from current premium writings, annuity deposits, reinsurance and loss or policy reserves. These are monitored to analyse changes in trends and magnitudes.
Financial leverage through debt is analysed as this affects the likelihood that there will be a strain on earnings or cash flow. This is carried out at both holding company and operating company levels.

Asset leverage – the exposure of a company’s surplus to investment, interest rate and credit risks – is also assessed in terms of its impact on balance sheet strength.

AM Best also carries out a number of capitalisation tests. There are some differences depending on the type of insurance company being analysed, but the tests can include:

- change in net premiums written (“NPW”);
- NPW and deposits to total capital;
- NPW to policyholders’ surplus (“PHS”);
- net liability to PHS;
- capital and surplus to liabilities;
- net leverage;
- ceded reinsurance leverage;
- gross leverage;
- change in capital; and
- Best’s capital adequacy ratio (“BCAR”).

Other areas considered are:

- the quality and appropriateness of the reinsurance program;
- the adequacy of loss/policy reserves;
- the quality and diversification of assets; and
- liquidity.

5.4.3 Operating Performance

The key measure of operating performance for AM Best is profitability. This is assessed on statutory, GAAP, IAS and other regulatory and accounting bases. The key tests considered vary significantly between different types of insurance company; however, they will generally include various measures of expense, claims and earnings as proportions of assets, income and surplus.

5.4.4 Business Profile

Business profile becomes more important the higher the rating of the insurer. It is also more important for insurers writing longer term business. Key business profile issues are:

- spread of risk;
- composition of revenue;
- competitive market position;
- management experience and depth;
- insurance sector risk; and
- event risk.

6. Long-Term Debt Ratings Approaches

6.1 Standard & Poor’s

6.1.1 Description of Approach

An S&P credit rating is Standard & Poor’s opinion of the general creditworthiness of an obligor based on the risk factors they consider to be relevant. It is important to note that it is in the end an opinion and that the rating process is therefore as much an art as it is a science. The rating is based on a combination of quantitative, qualitative and legal analyses.

An analytical framework consisting of several categories is designed to ensure that all major issues are considered. This framework is divided into business analysis and financial analysis. The various aspects of these two areas are scored and then an overall business risk profile and financial risk profile score is determined. The scoring system varies between analysts with some using letter symbols and others numeric. There are no formulae for combining scores to arrive at the rating. At times the rating may be strongly influenced by financial measures, whereas at other times business risk may dominate.

In addition to the scores, each analyst reviews business fundamentals, the competitive position and evaluate management and strategies. A rating is only provided if S&P believes it has sufficient information from which to draw credible conclusions. A team of analysts is responsible for reviewing all the relevant information. The lead analyst then makes a recommendation, which is then voted on by a committee generally consisting of five to seven voting members. Once the committee has agreed the rating, it can be appealed prior to publication if new information is available.

6.1.2 Main Inputs

The analyst’s framework is divided into two main categories: business analysis and financial analysis.

Within the business analysis category the following factors are considered:

- industry characteristics;
- competitive position; and
- management.

Included in this part of the analysis are industry prospects for growth, the pattern of business cycles and the vulnerability to changes. The industry risk profile generally sets an upper limit on the rating for a participant in the industry: ‘AAA’ debt ratings are unlikely to be assigned to companies with the majority of their business in high risk
industries. The nature of the competition is different for different industries, so too the factors analysed are as well. In addition, some factors may hold special significance for particular companies; for example, an over reliance on one facility or product line could lower the credit rating.

If a company operates in more than one industry, then each business line is analysed separately. The final credit rating depends on the correlation between the industries involved. Also of importance here is the ability of the company to manage a diverse business successfully.

Management is assessed on two levels: the ability to successfully manage the company; and the attitude of the company to risk.

The level of financial risk is looked at once the level of business risk has been established, since it is the level of business risk that determines the acceptable level of financial risk for any rating category.

Within the financial risk analysis category the following factors are considered:

- financial characteristics;
- financial policy;
- profitability;
- capital structure;
- cash flow protection; and
- financial flexibility.

Financial risk is generally measured quantitatively through the use of financial ratios. Benchmarks for these ratios vary greatly by industry, and adjustments are usually necessary. Guidelines are set for given ratios for levels of business risk: a company with a strong business profile can afford to take on added financial risk and still maintain the same credit rating. These ratio guidelines are different from the ratio medians that are published, because the ratio medians average the different risk profiles. The guidelines are not meant to be exact and each ratio can be a relatively small part of the overall judgment.

6.1.3 Monitoring and Adjustment

Once published, all ratings are subject to a monitoring process. This includes the review of any new information and an annual review meeting with management. It may be necessary to change a rating in light of new information or a change in management. If a change is necessary, then a comprehensive review will then be undertaken in the same manner as when the rating was first derived.

6.1.4 Treatment of Post Retirement Benefits

The determination of post retirement benefits requires many assumptions and detailed calculations. In recognition of this, S&P does not try and place a precise value on these
liabilities: the latest reported information is analysed, in particular the assumptions that have been used to determine the liabilities. In general, the focus is on reported assumptions, namely the discount rate, wage inflation, expected investment return and medical inflation. If however there is a large gain or loss versus actuarial assumptions reported then further investigation may be warranted. S&P assesses assumptions by comparing the assumptions used to those used by similar companies. In addition they check that the gaps between assumptions in particular the discount rate and wage inflation look reasonable. If assumptions are perceived to be out of line with the peer group, then quantitative adjustments will be made to normalise assumptions. In general these are done using rules of thumb, such as a 1% increase in the discount rate causing a 10% to 15% decrease in the liabilities. S&P believe that the projected benefit obligation (“PBO”) understates the true economic liability as it does not take into account any future benefit improvements. The analyst estimates the additional liability based on the companies past practice of granting such improvements.

In addition to the adjustments above, S&P has devised its own adjustments to ratios to take into account post retirement liabilities. In general the principles behind these adjustments are:

- all forms of unfunded liabilities are regarded as debt-like;
- all plan assets and liabilities are combined, with over-funded plans therefore being netted off against under-funded plans;
- the emphasis is placed on the PBO as this represents the fullest measure of the unfunded liability; and
- whilst S&P regard unfunded liabilities as debt-like, surplus in over-funded plans is not viewed as a cash equivalent: whilst an over-funded plan is considered to have a positive impact on credit quality there may be a limit on the amount of benefit the company can receive from the surplus.

It is encouraging to see S&P making an allowance for pensions in its ratings. There is of course a question mark over whether the PBO is the correct measure for the liabilities, since salary links can be cut (reducing to the liability to the accrued benefit obligation or “ABO”), and the AA-rate used in the PBO is arguably too weak. It could be that these effects cancel out, so the PBO is an appropriate measure; however, the choice of the PBO is more likely to be down to pragmatism and the fact that the published PBO is an accurate enough measure for the calculation of most credit ratings.

It is interesting to note that S&P does not make any explicit allowance for the asset allocation of the pension scheme in its assessment. Asset allocation is important, since bondholders should be concerned with downside risk, and any pension scheme mismatching increases this risk. It could be argued that since the company does not have any direct control over the asset allocation, then it should not be taken into account; however, companies will often have indirect control over the asset allocation, and even if they do not, the risk that it presents still exists.
In order to get a measure of profitability, regardless of the accounting standard used for reporting, the service cost is treated as an operating cost, the interest cost as a finance charge, any amortisation elements are eliminated and any increase or decrease in liability resulting from benefit changes is recognised immediately. The expected return on assets is eliminated and replaced by the actual return over the reporting period. The actual return is netted off against the interest expense only up to the amount of interest reported, unless the return is negative in which case the full amount is added. This approach can lead to volatile results, so results are often adjusted for expected return assumptions being higher than the norm, and a cautious view is taken of pension credits where these are a material source of earnings. However, the volatility should not be seen as a bad thing: it has always existed, but now it can actually be seen.

6.2  Moody's

6.2.1  Description of Approach

Moody’s uses both top-down and bottom-up approaches to arrive at credit ratings. It starts with the macro-economic picture (considering the broad political, economic and industry environment), moves on to an assessment of each company’s operating and competitive position, and ends with the company’s financial position and strategy.

Although historical information used, the focus is on forward financial protection. The broad approach used is similar for all industries, and the diagram below sets out this approach; however, the exact factors used differ extensively from industry to industry. One way to demonstrate this is to look at the methodology used for two such industries.

Moody’s Rating Analysis Pyramid

![Moody's Rating Analysis Pyramid Diagram]
6.2.2 Industrial Companies

The basic questions for industrial companies (as for all companies) are:

- what is the risk to the bondholder of not receiving timely payment of principal and interest; and
- how does that level compare with other debt securities?

These questions revolve around cash generation, and the management’s ability to sustain cash generation in the face of adverse business conditions is considered very important.

The framework used by Moody’s for analysing industrial companies is broken into the following sections:

- industry trends – this involves considering factors such as the vulnerability to economic cycles, competition, barriers to entry, cost factors and vulnerability to technological changes;
- national political and regulatory environment – this includes home country business practices, regulatory and deregulatory trends, government guarantees and support, and monetary policy and exchange rate factors;
- management quality and attitude to risk taking – this includes assessment of strategic direction, financing philosophy, conservatism, track record, parent/subsidy relations, succession planning and control systems;
- basic operating and competitive position – this refers to the outlook for relative market share, diversification by business lines/revenue streams and cost structure;
- financial position and sources of liquidity – this includes the need, source and quality of backup facilities; and
- company structure – in particular, the importance of the subsidiary to the parent;

These are not exhaustive and are intended to be a guide for the analyst.

6.2.3 Retail Companies

Moody’s views retailing as a high-risk business, being highly volatile and competitive. The key qualitative factors reviewed in this sector are:

- market segments – barriers to entry and the degrees to which the retailer is subject to fashion, cyclical, seasonal and product obsolescence risks;
- market position – detailed assessment of the competition;
- execution ability – effective management of customers, employees and operations;
- diversification – including product, format, geographic and funding types;
- strategic vision; and
- financial risk.

The quantitative measures considered are:
- cash flow sources;
- trends in sales and productivity;
- sources of profitability;
- turnover of productive assets;
- capital structure and leverage; and
- impact of off-balance sheet transactions and contingent liabilities

As can be seen, there are many similarities between the approaches, but also many differences, and this is reflected throughout the rating methodologies.

6.2.4  Treatment of Post Retirement Benefits

Moody’s addressed the issue of pensions earlier than most rating agencies, issuing a detailed note on the subject in 1998. The basic principle outlined in this note is that all reported pensions costs are converted to a PBO. This means that if future salary increases had not been included in the pensions costs, then an adjustment would be made. This is helpful, as it ensures that pensions are treated consistently between firms and countries. As with S&P, it is arguable that the correct statistic is the ABO, which does not include any allowance for salary increases – as Moody’s points out in the same note, whilst in most jurisdictions, employees’ current wages and salaries gain preferential treatment in liquidation, vested pension benefits are not included in this preferential satisfaction.

If the assumptions used are very different from national averages or actuarial statistics, then the analyst discusses this with issuer and, if necessary, makes allowance for the difference. Examples given by Moody’s are of Japan, where the discount rate may be too high in an effort to minimise the pensions liability, and Germany, where the discount rate may be too low in an effort to maximise the tax deductibility of pensions contributions. If either of these are present, then the analyst tries adjusts the effective discount rate towards the level of the market rate.

Moody’s also looks at leverage allowing for pensions, in particular with reference to any deficit (surplus being treated as negative deficit). It is assumed that any deficit is funded using issuance of debt and equity in proportion to the firm’s existing capital structure, so the presence of a deficit is assumed to leave the basic leverage unchanged. However, other leverage-related measures do change. The formulae for pensions-adjusted measures are:

\[
\text{net leverage} = \frac{\text{debt} + \text{pension scheme deficit}}{\text{debt} + \text{equity} + \text{pension scheme deficit}}
\]

\[
\text{dynamic leverage} = \frac{\text{retained cash flow} – \text{change in pension reserves}}{\text{debt} + (\text{reported leverage} \times \text{pension scheme deficit})}
\]
interest coverage = \frac{\text{EBIT} - \text{net pension interest cost}}{\text{interest expense} + (\text{interest rate} \times \text{reported leverage} \times \text{pension scheme deficit})}

Note that there is no allowance for the asset allocation of the pension scheme in this quantitative analysis. Indeed, even the deficit is not treated as being entirely bond-like.

Moody's also published a 2003 note on pensions in relation to UK and IAS GAAP. A number of good points were made in this note, some of which do not appear in the earlier note. In particular, it is noted that "the downside risk of investment strategies decided on by trustees and fund managers (and not the corporate's management) are financial risks for the company. This financial risk could lead to additional, possibly substantial, cash contributions to be made by the company, which is to some extent outside the control of corporate management". The analysis in this note of companies reporting under FRS17 includes five categories:

- analysing unfunded pension obligations;
- estimating the cash flow impact of pension contributions and its effect on measures such as retained cash flow ("RCF") and funds from operations ("FFO");
- analysis of immature versus mature pension scheme deficits;
- detecting outlying or aggressive pension scheme assumptions; and
- other considerations.

The focus is on contributions paid relative to service and interest cost. Adjustments are made to, for example, RCF and FFO if:

- the scheme is equity concentrated and relatively mature;
- the scheme’s contributions are significantly below the service cost
- the scheme’s contributions and actual returns on assets are materially below the service and interest costs

Moody's believes that equity investment is less risky for immature schemes than mature ones, since the time horizons are long so pension schemes “can enjoy the risk premium without suffering from the effects of volatility of returns”. However, since pension schemes are marked to market regularly, any time diversification that did exist would not necessarily be of any benefit. It is encouraging, though, that the asset allocation of the pension scheme is taken into account at all.

6.3  Fitch IBCA

6.3.1  Introduction

As with other rating agencies Fitch uses both qualitative and quantitative analysis to assess the business and financial risks of debt issuers. The ratings are an assessment of each issuer’s ability to service debt in a timely manner. Analysis typically involves at
least five years of operating history and financial data, as well as company and rating agency forecasts of future performance. Each company’s performance is compared to that of others in its peer group, and sensitivity analysis is carried out to assess a company’s ability to cope with changes in its operating environment.

6.3.2 Qualitative Analysis

Fitch look at a number of qualitative factors when rating companies. These include:

- industry risk;
- operating environment;
- market position;
- management; and
- accounting.

Fitch determines a company’s rating within the context of each company’s industry fundamentals. The riskiness of an industry can lead to a ceiling for ratings within that industry.

It also explores the possible risks and opportunities in a company’s operating environment resulting from social, demographic, regulatory and technological changes.

Fitch believes that several factors determine a company’s ability to withstand competitive pressures, including its market share, product dominance and pricing power.

Fitch’s assessment of management focuses on corporate strategy, risk tolerance and funding policies. Corporate goals are evaluated to determine management style. Factors considered are the mix of debt and equity in funding growth, the company’s ability to support increased debt and the strategic fit of new assets.

The rating process includes an examination of accounting policies and the extent to which they accurately reflect a company’s performance. The areas considered include:

- consolidation principles;
- valuation policies;
- inventory costing methods;
- depreciation methods;
- income recognition and reserving practices;
- pension provisions;
- treatment of goodwill; and
- off balance sheet items.

6.3.3 Quantitative Factors

This part of Fitch’s analysis focuses on a company’s policies in relation to areas such as operating strategies, acquisitions and sales, gearing, dividend policy and other financial
goals. The focus is on a company’s ability to generate cash. This is reflected by the use of ratios that measure profitability and coverage on a cash flow basis.

The analysis of trends in a number of ratios is regarded as more relevant than the single observation of a single ratio.

While earnings form the basis for cash flow, adjustments are made for items like non-cash provisions and contingency reserves, asset write-downs with no cash impact and one-time charges.

Fitch looks at capital structure to determine a company’s reliance on external financing. To assess the credit implications of a company’s level of gearing, Fitch considers the nature of a company’s business environment and the funds from operations. Because industries differ significantly in their capital needs and ability to support high levels of gearing, the assessment of capital structure is based on industry norms. The evaluation of debt adjusts for off balance sheet debt, such as borrowings of partly owned companies and, to an extent, pension scheme deficits (which are discussed in more detail later).

Fitch use the following measures for assessing the following factors:

- **earnings:**
  - EBITDA (earnings before interest, taxes, depreciation and amortisation);
  - EBITDAR (EBITDA plus gross rental expense);
  - after-tax cash flow; and
  - net free cash flow;

- **coverage ratios:**
  - EBITDA/gross interest expense;
  - EBITDA/cash interest expense;
  - EBITDA/net interest expense; and
  - EBITDAR/(interest and gross operating rents);

- **gearing measures:**
  - debt/EBITDA;
  - (debt and present value of operating leases)/EBITDAR;
  - net debt/equity; and
  - total debt/total capitalisation

- **profitability ratios:**
  - operating income/revenues;
  - EBITDA/revenues
  - return on equity

6.3.4 Treatment of Post Retirement Benefits

In March 2003, Fitch entered the European pensions debate with the publication of its views on the issue. Its overall opinion was that the fall in pension scheme asset values was likely to cause no more than rating outlook changes for those companies most affected. For the UK pension schemes, the main items that Fitch considers are:
- whether the scheme is defined benefit or defined contribution;
- the distribution of investments between equity and other investments;
- the split of the fund between current employees, deferred pensioners and current pensioners;
- whether the scheme is still open to new members;
- assumed rates of return, discount rates, and other rates applied;
- the size of the FRS17 deficit relative to the net assets of the company; and
- the requirement to make good any deficit

From the above, the review appears to be more qualitative; however, Fitch does now assess the quantitative impact of a pension fund deficit on a corporate by adding that deficit to its financial indebtedness when calculating measures of gearing. It also calculates additional financial ratios, adding any pension fund deficit to net debt and comparing that to the cash flow generating ability of a company.

The standard EBITDA/interest ratios are adjusted by adding pension contributions and the imputed interest cost of servicing the liability to interest expenses. The ratios adjusted are EBITDA/net interest and EBITDA/gross interest.

The adjusted coverage ratios do not have the same degree of effect on Fitch ratings as the adjusted gearing measures. Fitch say that the servicing of pension liabilities does not represent a fixed charge on a business in the same way that interest expenses do, and they will vary over time.

As with other rating agencies, the quantitative aspect of the analysis is restricted to the deficit and does not consider the asset allocation of pension schemes. Clearly, this will affect the riskiness of corporate debt.

7. Other Approaches to Credit Rating

7.1 Introduction

In the previous sections we have considered in some detail the approaches of the main credit rating agencies. This section looks very briefly at other approaches to long-term debt rating.

There is a school of thought that relies on market information to assess the credit risk of a bond or obligor. The approaches here can be split into two broad categories; the reduced form model and the structural model. The structural model is also known as Merton’s model, of which Moody’s KMV and CreditGrades are popular commercial applications. A description of market information models forms 7.2.

In 7.3, we look at credit scoring models, and we conclude in 7.4 by introducing the idea of hybrid models.
7.2 Market Information Models

7.2.1 Introduction

In the analysis of credit risk, default events are triggered when a firm’s assets fall to a sufficiently low level relative to the notional amount of outstanding debt. There are two main market-information approaches to quantify credit default risk. The essence of both approaches is that market prices tend to provide superior estimates of default risk compared to credit analyst and rating approaches.

7.2.2 Structural Models

In the structural model explicit assumptions are made about the evolution of the individual elements of a firm’s capital structure: its debt and its equity. The market information that is used to define the dynamics of the capital structure is observed equity prices and equity option volatilities. This model aims to both quantify default risk and explain the cause of default.

Intuitively, two of the most important factors when considering the credit risk of an obligor, that is, the likelihood that it will default on its borrowings, are leverage ratios and the volatility of the value of a company’s assets.

Leverage ratios are key variables in any credit rating or credit scoring system since they give a snapshot of a company’s ability to repay its debt. Some of the main ratios are:

- EBITDA/interest coverage;
- total debt/EBITDA;
- total debt/capital; and
- total debt/market enterprise value.

Volatility of the value of a company’s assets is crucial since a company will be insolvent when the value of its assets is less than the face value of its debts, and a volatile asset value will make this more likely.

Structural models combine the crucial information on leverage and asset volatility to provide a mathematical description of credit risk where the output is a measure of default probability.

The original form of what has become known as the structural model is the Black-Scholes-Merton model. With this model, default occurs at the maturity date of the debt in the event that the issuer’s assets are less than the face value of the debt, as illustrated below.
The Black-Scholes-Merton Model

The total value of the firm’s assets is approximated as the sum of the market value of equity and the book value of liabilities, and the asset value is assumed to follow a stochastic process (geometric Brownian motion). The main “unknown” here is the asset volatility; however, we can observe the volatility of the equity price, or the implied volatility of an equity option if this exists. As a rough approximation, we can estimate the asset volatility as the equity volatility scaled down by the equity/asset ratio. Better approximations are available, but this captures the essence of the idea.

The KMV model is a popular commercial application based on the Merton model. It is used to calculate one-year default probabilities known in the KMV literature as Expected Default Frequencies ("EDFs"). The main variations from the Merton model are as follows:

- KMV uses a percentage of the face value of long-term debt plus current liabilities rather than the actual amount of debt due for repayment within one year;
- the model estimates the probability of hitting this default boundary at any point over the year, not just the probability of being below it at the one-year point (known as a “first passage” model); and
- an empirical estimation of default probability is used rather than an explicit (lognormal) distribution of asset value at the time horizon.

The CreditGrades model is similar to the KMV model and is another practical implementation of the structural model. The standard structural model gives default probabilities that are too low for short time horizons (since the stochastic process for the asset value is based on geometric Brownian motion). CreditGrades adjusts for this by modelling uncertainty in the level of the default boundary.
Structural models have proved useful as an early warning indicator of default for firms rated BBB and below; however, better rated firms do not seem to have sufficient leverage for changes in equity value or equity volatility to give a significant enough indicator, although this may be different for different points in the leverage cycle.

The structural model is also generally considered inappropriate for financial institutions. Banks in particular are highly leveraged but still have a low default probability due to capital and regulatory requirements.

7.2.3 Reduced-Form Models

Reduced-form models do not aim to explain why a firm defaults; instead, default probabilities and the default process for an obligor are implied from the market prices of bonds or credit default swaps of that obligor.

These models decompose observed credit spreads to detect the term structure of default probabilities. The default probability is modelled using a default intensity function that best fits the yield curve data. The credit spread is the premium included in the yield on zero-coupon, risky debt over the yield on a zero-coupon risk-free bond of the same maturity. If credit spread is purely compensation for credit risk exposure, then credit spread is compensation for probability of default (“PD”) multiplied by 100% minus the recovery rate of the bond, also known as loss given default (“LGD”).

These market-implied default probabilities are risk-neutral probabilities, by which we mean probability assessments under which the market value of a security is the expectation of the discounted present value of its cash flows, with discounting at the risk-free rate. Reduced-form pricing is one of the cornerstones of the pricing of exotic credit derivatives.

Credit pricing depends on risk-neutral default probabilities. However, for credit ratings we want to assess real-world actual default probabilities implied by credit spreads. One procedure for doing this can be obtained by combining the reduced-form models with the structural approach described earlier.

7.3 Credit Scoring Models

Credit scoring is a statistical exercise that attempts to classify the creditworthiness of borrowers according to the value given by a function of key financial ratios. The best known of these is the Altman Z-Score model, developed in the 1960s, which illustrates the approach well.

The Z-score is given by a formula:

\[ Z = 1.2 X_1 + 1.4 X_2 + 3.3 X_3 + 0.6 X_4 + 1.0 X_5 \]
where $X_1 = \text{working capital/total assets}$; $X_2 = \text{retained earnings/total assets}$; $X_3 = \text{earnings before interest and tax ("EBIT")/total assets}$; $X_4 = \text{market value of equity/book value of total liabilities}$; and $X_5 = \text{sales/total assets}$.

There are many variants on this approach using different ratios and different weightings based on observation of:
- the statistical significance of various alternative functions;
- correlation between the main variables;
- the predictive accuracy of the model; and
- some judgement.

7.4 Hybrid Models

By hybrid models, we mean models that seek to combine the traditional and market information approaches.

One of the important features in the structural model is the definition of the default boundary or point. When an asset value path goes below a certain critical value, then default occurs with certainty. Hybrid models use accounting information and other fundamental credit information to better identify the default point as a function of the residual debt capacity of the firm. In brief, the default probability can be estimated as:

- the probability of default from a Merton-type model; plus
- the probability that a solvent firm defaults on its obligations due to events such as changes in regulations, lawsuits, catastrophic changes in business environment and severe industry downturns; less
- The probability that an insolvent firm does not default due to an ability to refinance and roll-over debt (which could be a function of, for example, return on assets, current liabilities/current assets and so on), or the existence of committed bank lines (i.e. prior agreement that a bank loan would be available if required), bail outs by parents or by regulators (e.g. national airlines).
References and Further Reading

All of the information on rating agency methodology is available from sites of each of the agencies:

www.ambest.com
www.fitchibca.com
www.moodys.com
www.moodyskmv.com
www.sandp.com