MOODY'S
INVESTORS SERVICE

RATING METHODOLOGY
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Rating Methodology

Chemicals

This rating methodology replaces the *Chemical Industry* methodology published in March 2019. We have reordered and have made editorial updates to various sections of the methodology, and we have changed the presentation of the scorecard. These updates do not change our methodological approach.

Scope

This methodology applies to companies globally that are primarily* engaged in developing and producing chemicals and related products, including basic chemicals, specialty chemicals and industrial gases. Products range from chemical commodities to highly customized chemicals used in technically demanding applications. Chemical products include plastics and resins; fertilizers and agricultural chemicals; architectural and industrial coatings; flavors, fragrances and food ingredients; pharmaceutical chemicals (i.e. drug intermediates or precursors) and organometallic compounds.

Companies in industries that are primarily engaged in producing and selling end-use products that are derived from chemical inputs are rated under other industry-specific methodologies, including, for example, pharmaceuticals and packaging.[1]

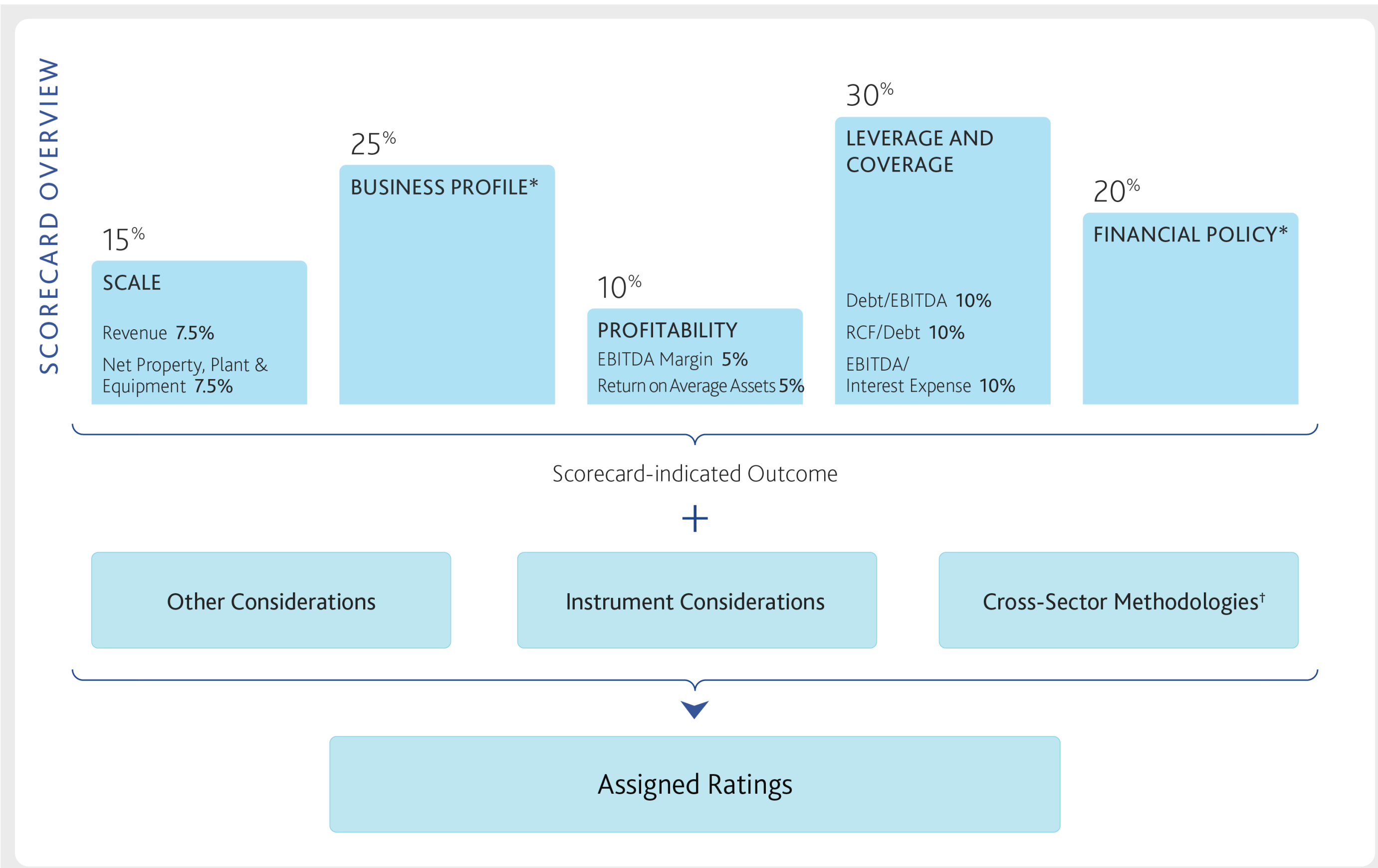
*The determination of a company's primary business is generally based on the preponderance of the company's business risks, which are usually proportionate to the company's revenues, earnings and cash flows.

Rating approach

In this rating methodology, we explain our general approach to assessing credit risk of issuers in the chemical industry globally, including the qualitative and quantitative factors that are likely to affect rating outcomes in this sector. We seek to incorporate all material credit considerations in ratings and to take the most forward-looking perspective that visibility into these risks and mitigants permits.

The following schematic illustrates our general framework for the analysis of chemical companies, which includes the use of a scorecard.[2] The scorecard-indicated outcome is not expected to match the actual rating for each company. For more information, see the "Other considerations" and "Limitations" sections.

Exhibit 1
Illustration of the chemicals methodology framework



* This factor has no sub-factors.
† Some of the methodological considerations described in one or more cross-sector rating methodologies may be relevant to ratings in this sector. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.
Source: Moody's Investors Service

Chemicals scorecard

For general information about how we use the scorecard and for a discussion of scorecard mechanics, please see the "Using the scorecard to arrive at a scorecard-indicated outcome" section. The scorecard does not include or address every factor that a rating committee may consider in assigning ratings in this sector. Please see the "Other considerations" and "Limitations" sections.

Exhibit 2
Chemicals scorecard

	SCALE (15%)		BUSINESS PROFILE (25%)	PROFITABILITY (10%)		LEVERAGE and COVERAGE (30%)			FINANCIAL POLICY (20%)
	Revenue (USD Billion)[1] (7.5%)	PP&E (net) (USD Billions)[2] (7.5%)	Business Profile (25%)	EBITDA Margin[3] (EBITDA / Revenue) (5%)	ROA (Return on Average Assets)[4] (EBIT / Total Assets) (5%)	Debt / EBITDA[5] (10%)	RCF / Debt[6] (10%)	EBITDA / Interest Expense[7] (10%)	Financial Policy (20%)
Aaa	≥ $100	≥ $40	Expected to have highly stable cash flow generation through industry and economic cycles supported by highly diverse specialty product lines with dominant market positions, no concentration of cash flow sources, stable end markets, global leading/low cost operations and structural cost advantages; technological leadership limits threats to competitive position and supports improving existing market positions and new market opportunities.	≥ 60%	≥ 35%	≤ 0.5x	≥ 95%	≥ 40x	Expected to have extremely conservative financial policies (including risk and liquidity management); very stable metrics; essentially no event risk that would cause a rating transition; and public commitment to a very strong credit profile over the long term.
Aa	$50 - $100	$20 - $40	Expected to have very stable cash flow generation across industry and economic cycles supported by diverse specialty product lines with leading market positions, low concentration of cash flow sources, stable end markets, global low cost operations and structural cost advantages; technological leadership results in few threats to competitive position and new market opportunities.	40% - 60%	25% - 35%	0.5x - 1x	60% - 95%	25x - 40x	Expected to have very conservative financial policies (including risk and liquidity management); stable metrics; minimal event risk that would cause a rating transition; and public commitment to strong credit profile over the long term.
A	$15 - $50	$8 - $20	Expected to have stable cash flow generation through industry and economic cycles supported by multiple specialty product lines with large market positions, moderate-to-low concentration of cash flow sources, relatively stable end markets, global predominantly low cost operations and some structural cost advantages; technological leadership results in meaningful barriers to entry.	25% - 40%	15% - 25%	1x - 2x	30% - 60%	15x - 25x	Expected to have predictable financial policies (including risk and liquidity management) that preserve creditor interests; although modest event risk exists, the effect on leverage is likely to be small and temporary; strong commitment to a solid credit profile.
Baa	$5 - $15	$3 - $8	Expected to have moderately cyclical cash flow generation across industry cycles supported by multiple commodity or specialty product lines with significant market positions, moderate concentration of cash flow sources, cyclical end markets, cost competitive operations in more than one region, and limited structural cost advantages; technology and operating know-how moderates competitive threats.	15% - 25%	11% - 15%	2x - 3x	20% - 30%	8x - 15x	Expected to have financial policies (including risk and liquidity management) that balance the interests of creditors and shareholders; some risk that debt-funded acquisitions or shareholder distributions could lead to a weaker credit profile.

	SCALE (15%)		BUSINESS PROFILE (25%)	PROFITABILITY (10%)		LEVERAGE and COVERAGE (30%)			FINANCIAL POLICY (20%)
	Revenue (USD Billion)[1] (7.5%)	PP&E (net) (USD Billions)[2] (7.5%)	Business Profile (25%)	EBITDA Margin[3] (EBITDA / Revenue) (5%)	ROA (Return on Average Assets)[4] (EBIT / Total Assets) (5%)	Debt / EBITDA[5] (10%)	RCF / Debt[6] (10%)	EBITDA / Interest Expense[7] (10%)	Financial Policy (20%)
Ba	$1.5 - $5	$0.6 - $3	Expected to have cyclical cash flow generation across industry cycles supported by two or more mostly commodity product lines with mid-sized market positions; OR moderately high concentration of cash flow sources with cyclical end markets in one region, OR average cost operations focused on one region, very limited structural cost advantages; OR limited differentiation based on technology and know-how.	9% - 15%	7% - 11%	3x - 4x	10% - 20%	2.5x - 8x	Expected to have financial policies (including risk and liquidity management) that tend to favor shareholders over creditors; above-average financial risk resulting from shareholder distributions, acquisitions or other significant capital structure changes.
B	$0.2 - $1.5	$0.025 - $0.6	Expected to have highly cyclical cash flow generation, high reliance on a single commodity product line with modest market positions; OR high concentration of cash flow sources with cyclical end markets in one region; OR average-to-high cost operations with limited geographic diversity or a single plant site and no structural cost advantages OR no real differentiation based on technology and know-how.	4% - 9%	3% - 7%	4x - 6x	5% - 10%	1.5x - 2.5x	Expected to have financial policies (including risk and liquidity management) that favor shareholders over creditors; high financial risk resulting from shareholder distributions, acquisitions or other significant capital structure changes.
Caa	$0.1 - $0.2	$0.005 - $0.025	Expected to have highly volatile cash flow generation, a single commodity product line sold to few customers for limited uses; OR an insignificant market position with concentrated exposure to small cyclical markets OR no pricing power, and a single operating site that has an uncompetitive cost structure OR substantial structural and technological disadvantages.	1% - 4%	0.5% - 3%	6x - 8x	1% - 5%	0.5x - 1.5x	Expected to have financial policies (including risk and liquidity management) that create elevated risk of debt restructuring in varied economic environments.
Ca	< $0.1	< $0.005	Expected to have extremely volatile cash flow generation, a single commodity product line sold to few customers for a single use, OR an insignificant market position with many large competitors, concentrated exposure to a small cyclical market and uncertain demand; OR no pricing power, and a single operating site that has an uncompetitive cost structure OR severe structural and technological disadvantages.	< 1%	< 0.5%	> 8x	< 1%	< 0.5x	Expected to have financial policies (including risk and liquidity management) that create elevated risk of debt restructuring even in healthy economic environments.

[1] For the linear scoring scale, the Aaa endpoint value is $150 billion. A value of $150 billion or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero equates to a numeric score of 20.5.
[2] For the linear scoring scale, the Aaa endpoint value is $60 billion. A value of $60 billion or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero equates to a numeric score of 20.5.
[3] For the linear scoring scale, the Aaa endpoint value is 80%. A value of 80% or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero or worse equates to a numeric score of 20.5.
[4] For the linear scoring scale, the Aaa endpoint value is 75%. A value of 75% or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero or worse equates to a numeric score of 20.5.
[5] For the linear scoring scale, the Aaa endpoint value is 0x. A value of 0x or better equates to a numeric score of 0.5. The Ca endpoint value is 10x. A value of 10x or worse equates to a numeric score of 20.5, as does a negative Debt/EBITDA value.
[6] For the linear scoring scale, the Aaa endpoint value is 120%. A value of 120% or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero or worse equates to a numeric score of 20.5.
[7] For the linear scoring scale, the Aaa endpoint value is 60x. A value of 60x or better equates to a numeric score of 0.5. The Ca endpoint value is zero. A value of zero or worse equates to a numeric score of 20.5.
Source: Moody's Investors Service

Sector overview

Chemical companies constitute diverse sub-industries and use products and technologies that present varying degrees of business risk. The degree of volatility of their business strategies and operating environments is typically reflected in chemical companies' financial returns.

Chemical companies' risks also vary based on the markets they serve because companies are exposed to the economic cycles of the regions in which their products are produced and sold as well as global economic cycles. In the case of global chemical commodities, such as phosphate fertilizers, changes in supply and demand in one region can affect chemical companies' other markets dramatically. A change in regional policies, such as reduced tariffs, can also affect the supply and demand for commodities given the global nature of the market.

The chemical industry also faces supply and price risk from raw materials, which typically have represented the largest component of commodity producers' operating expenses. Many commodity chemical producers have significant exposure to the price of crude oil or natural gas because their key raw materials are derived from petroleum.

Capital spending can vary substantially over time for companies in this industry. Chemical companies with similar product lines typically experience peak market conditions simultaneously and thus generate high levels of cash concurrently. Companies may invest these funds in capital projects that are completed around the same time and add materially to global capacity. These capacity additions may disrupt the supply-demand balance for a product line and lead to substantial price declines.

Discussion of the scorecard factors

In this section, we explain our general approach for scoring each scorecard factor or sub-factor, and we describe why they are meaningful as credit indicators.

Factor: Scale (15% weight)

Why it matters

Scale is an important indicator of a company's revenue-generating capability and its resilience to shocks, such as sudden shifts in demand or rapid cost increases.

Scale also greatly influences a chemical company's market strength and the availability of capital. Additionally, scale is an important indicator of a chemical company's capacity to sustain earnings and generate cash flow. Scale can provide indications of a chemical company's other strengths, including resilience to changes in product demand, cost absorption, research and development capabilities and bargaining strength with customers and raw material suppliers. Scale can also improve a chemical company's ability to service large customers globally, which is an important consideration as many customers seek to reduce their number of suppliers.

How we assess it for the scorecard

Scoring for this factor is based on two sub-factors: Revenue; and Net Property, Plant & Equipment.

REVENUE:

Scale is measured (or estimated in the case of forward-looking expectations) using total reported revenue in billions of US dollars.

NET PROPERTY, PLANT & EQUIPMENT:

Net property, plant & equipment (PP&E) is measured (or estimated in the case of forward-looking expectations) using total reported PP&E, net of accumulated depreciation, in billions of US dollars.

Factor: Business Profile (25% weight)

Why it matters

The business profile of a chemical company is important because it greatly influences its ability to generate sustainable earnings and operating cash flows. Companies with higher levels of volatility in cash flow are typically more susceptible to other types of risks, including new forms of competition Core aspects of a chemical company's business profile are its market position, product and geographic diversity, operational execution as well as technological leadership and market position prospects, all of which can reduce volatility through economic cycles.

The sustainability and strength of a chemical company's market position provide important indications of its ability to attract and keep customers. In some instances, chemical companies with large market share adjust production volumes to help balance supply and demand as a means to stabilize product pricing. Market share that is protected by patent and licensing restrictions or other technological advantages can also help underpin a chemical company's strong, stable cash flows and performance. Companies with value-added products also typically have more stable cash flows. However, current value-added products can over time become more like commodities in their cash-flow generating capabilities.

A diverse product mix and geographic diversity are important because they reduce a company's exposure to new competitors or other adverse market developments that could cause earnings to erode. Geographic diversity helps mitigate a chemical company's operational risks. A company with multiple plants in the same area generally faces greater operational risks than a company whose production facilities are dispersed. Conversely, operational risk typically declines as the number of production sites and their geographic diversity increase, allowing a chemical company to continue operations if some plants are affected by changing government policies, strikes or weather-related events. For example, government regulation may have a positive or negative impact on an individual company or sub-sector of the chemical industry.

Chemical companies with the ability to locate production facilities where they can benefit from low cost raw materials are generally at an advantage during supply and demand imbalances, when raw material price movements can impact margins. Such companies typically experience higher margins over the economic and industry cycles and less earnings and cash flow volatility than similar companies that are more directly affected by higher raw material costs. Additionally, these companies can have a meaningful cost advantage over competitors.

Technological leadership is important because it limits threats to a chemical company's competitive position and supports the improvement of existing market positions and the development of new opportunities. A company's relative strength in these areas is indicative of its ability to maintain a strong competitive position. Technological leadership also supports stronger and more stable operating margins over time.

How we assess it for the scorecard

Scoring for this qualitative factor is primarily based on our expectations for cash flow volatility, which is influenced by the chemical company's existing market position, product and geographic diversity, quality of operational execution, technological leadership and market position prospects. Product and geographic diversity encompass a company's end markets and operations, including supply. Scoring for the business profile factor also typically considers the industry or sub-industry structure, including the number, scale and sophistication of competitors, the nature or basis of competition, historical behavior among competitors and their relations with customers, and barriers to entry and the threat of new entrants.

Our assessment of a chemical company's market share or competitive advantage is typically based on its market share in the regions where it operates as well as its ability to sustain its position. We typically define regions based on the end-markets for the producer's products and market conventions for pricing indicators. For more basic chemicals, a region is typically a continent or a large portion of a continent, while for highly specialized chemicals a region may be smaller geographic area. Our assessment of value-added products typically considers where a product or group of products are in their life cycles.

We also typically assess the business profile factor by considering the concentration of a chemical company's primary business unit or product line. Companies with a single commodity product line are typically subject to more earnings and cash flow volatility than those with multiple commodity product lines or a mix of commodity and specialty product lines whose business cycles, pricing and demand function independently.

In assessing the regulatory risk for a company, which can affect its cost structure and market opportunities, we typically consider the policy dynamics in the regions of operations, both for supply and end-market operations. Considerations such as prohibition of some chemical products or higher taxes may increase the risk of negative shocks to a company's business profile.

In assessing a chemical company's competitive position, we typically consider its costs and the ability to control costs. Companies exposed to volatile raw material prices that represent a significant portion of the cost of goods sold may experience dramatic swings in earnings or cash flow.

Generally, we do not expect a given chemical company's business profile to exactly match the attributes listed for a given scoring category. We typically assign the factor score based on the alpha category for which the issuer has the greatest number of characteristics. However, there may be cases in which one characteristic is sufficiently important to a particular issuer that it has a large influence on the factor score. For example, reliance on a single plant is likely to limit the score for this factor to the B or Caa category because the operating risk in these cases is typically very high.

Factor: Profitability (10% weight)

Why it matters

Profitability is an important indicator of a chemical company's strength and durability and can reflect the competitiveness of its product portfolio. It thus provides some indication of a chemical company's ability to withstand economic downturns, reinvest in fixed assets and service debt and other obligations. Relative cost position is important for chemical companies because in cyclical or economic downturns, product prices often decline to the point where only companies with lower costs generate meaningful cash flow.

Profitability can be an important indicator of how much value a company's products add and whether they are specialty in nature or commodity-like, or of its operating cost efficiency. Specialty products tend to have more stable, higher margins over time, while commoditized products can have volatile margins that range from very high to very low. A chemical company's operating cost position is a function of a number of characteristics that include its size, access to low-cost raw materials, location of assets, labor costs and capital invested. Low-cost producers are better able to survive in a downturn and are also better positioned to grow when opportunities arise.

This factor comprises two sub-factors:

EBITDA Margin

The ratio of earnings before interest, taxes, depreciation and amortization to revenue (EBITDA/Revenue) is an important measure of profitability and can indicate a company's ability to withstand downturns in the economy, reinvest in fixed assets and pay debt and other obligations.

Return on Average Assets

Return on average assets (ROA), defined as the ratio of earnings before interest and taxes to total assets (EBIT/Total Assets), is an indicator of a company's ability to generate consistent and meaningful returns from its asset base, which is important in this capital-intensive industry.

How we assess it for the scorecard

Scoring for this factor is based on two sub-factors: EBITDA Margin; and Return on Average Assets.

EBITDA MARGIN:

The numerator is earnings before interest, taxes, depreciation and amortization (EBITDA), and the denominator is revenue.

RETURN ON AVERAGE ASSETS:

The numerator is earnings before interest and taxes (EBIT), and the denominator is total assets averaged over two years.

Factor: Leverage and Coverage (30% weight)

Why it matters

Leverage and cash flow coverage measures provide important indications of a chemical company's financial flexibility and long-term viability. Strength in this area is an indicator of a company's investment capabilities, and its ability to withstand business cycle fluctuations and respond to unexpected challenges.

This factor comprises three quantitative sub-factors:

Debt / EBITDA

The ratio of total debt to earnings before interest, taxes, depreciation and amortization (Debt/EBITDA) is an indicator of debt serviceability and financial leverage. The ratio is commonly used in this sector as a proxy for comparative financial strength.

RCF / Debt

The ratio of retained cash flow to total debt (RCF/Debt) is an indicator of a company's cash generation (before working capital movements and capital expenditures, and after dividends payments) relative to its debt burden.

EBITDA / Interest Expense

The ratio of EBITDA to interest expense (EBITDA/Interest Expense) is an important indicator of a company's ability to meet its interest obligations.

How we assess it for the scorecard

Scoring for this factor is based on three sub-factors: Debt/EBITDA; RCF/Debt; and EBITDA/Interest Expense.

DEBT / EBITDA:

The numerator is total debt, and the denominator is EBITDA.

RCF / DEBT:

The numerator is retained cash flow, and the denominator is total debt.

EBITDA / INTEREST EXPENSE:

The numerator is EBITDA, and the denominator is interest expense.

Factor: Financial Policy (20% weight)

Why it matters

Financial policy encompasses management and board tolerance for financial risk and commitment to a strong credit profile. It is an important rating determinant, because it directly affects debt levels, credit quality, the future direction for the company and the risk of adverse changes in financing and capital structure.

Financial risk tolerance serves as a guidepost for investment and capital allocation. An expectation that management will be committed to sustaining an improved credit profile is often necessary to support an upgrade. For example, we may not upgrade the ratings of a company that has built flexibility within its rating category if we believe the company will use that flexibility to fund a strategic acquisition, cash distribution to shareholders, spin-off or other leveraging transaction. Conversely, a company's credit rating may be better able to withstand a moderate leveraging event if management places a high priority on returning credit metrics to pre-transaction levels and has consistently demonstrated the commitment to do so through prior actions. Liquidity management[3] is an important aspect of overall risk management and can provide insight into risk tolerance.

How we assess it for the scorecard

We assess the issuer's desired capital structure or targeted credit profile, its history of prior actions, including its track record of risk and liquidity management, and its adherence to its commitments. Attention is paid to management's operating performance and use of cash flow through different phases of economic and industry cycles. Also of interest is the way in which management responds to key events, such as changes in the credit markets and liquidity environment, legal actions, competitive challenges or regulatory pressures. Considerations include a company's public commitments in this area, its track record for adhering to commitments and our views on the ability of the company to achieve its targets.

When considering event risks in the context of scoring financial policy, we assess the likelihood and potential negative impact of M&A or other types of balance-sheet-transforming events. Management's appetite for M&A activity is assessed, with a focus on the type of transactions (i.e., core competency or new business) and funding decisions. Frequency and materiality of acquisitions and previous financing choices are evaluated. A history of debt-financed or credit-transforming acquisitions will generally result in a lower score for this factor. We may also consider negative repercussions caused by shareholders' willingness to sell the company.

We also consider a company's and its owners' past record of balancing shareholder returns and debtholders' interests. A track record of favoring shareholder returns at the expense of debtholders is likely to be viewed negatively in scoring this factor.

Other considerations

Ratings may reflect consideration of additional factors that are not in the scorecard, usually because the factor's credit importance varies widely among the issuers in the sector or because the factor may be important only under certain circumstances or for a subset of issuers. Such factors include financial controls and the quality of financial reporting; corporate legal structure; the quality and experience of management; assessments of corporate governance as well as environmental and social considerations; exposure to uncertain licensing regimes; and possible government interference in some countries. Regulatory, litigation, liquidity, technology and reputational risk as well as changes to consumer and business spending patterns, competitor strategies and macroeconomic trends also affect ratings.

Following are some examples of additional considerations that may be reflected in our ratings and that may cause ratings to be different from scorecard-indicated outcomes.

Regulatory Considerations

Companies in the chemical sector are subject to varying degrees of regulatory oversight. Effects of these regulations may entail limitations on operations, higher costs, and higher potential for technology disruptions and demand substitution. Regional differences in regulation, implementation or enforcement may advantage or disadvantage particular companies. Our view of future regulations plays an important role in our expectations of future financial metrics as well as our confidence level in the ability of a company to generate sufficient cash flows relative to its debt burden over the medium and longer term. Regulatory considerations may also play a role in our assessment of a company's business profile. In some circumstances, regulatory considerations may also be a rating factor outside the scorecard, for instance when regulatory change is swift.

Environmental, Social and Governance Considerations

Environmental, social and governance (ESG) considerations may affect the ratings of issuers in the chemical industry. For information about our approach to assessing ESG issues, please see our methodology that describes our general principles for assessing these risks.[4]

Increasing environmental requirements and efforts to reduce greenhouse gas emissions (known as carbon transition risk) may lead to higher costs for certain sub-industries within the chemical industry. Stricter regulations may entail limitations on operations, greater potential for technology disruptions and demand substitution, and additional investment requirements to meet regulatory standards.

In the chemical industry, air, soil and water pollution regulations typically are the primary environmental areas of risk to the sector, but regulations and legal liability vary considerably across the various sub-sectors of the industry and between the developed and developing economies. The chemical sector includes petro-chemicals and other "building blocks" - ammonia, styrene, methanol, soda ash, chlor alkali, potash, etc. The impact on soil and water pollution can vary considerably based on which of these or other chemicals are involved. Legal liability includes product tort cases and remediation of chemical waste disposal sites. Chemical companies are also exposed to water shortages as large volumes of highly purified water are required to cool process equipment.

Our analysis of companies in this sector typically considers, among other factors, how environmental regulations may increase costs through tighter emission standards, soil and water remediation requirements, or the phasing out of products and their replacement by more expensive products. We also consider how environmental regulations may benefit companies operating in lower-compliance regions, and we seek to understand the trajectory of future environmental regulations. Another area of regional differentiation is legal liability. Where legal liability risks are higher, e.g. in the US, we typically consider the potential liquidity impact or increasing leverage resulting from site remediation requirements or other liabilities. However, the impact of these factors on credit profiles may be overshadowed by supply/demand and commodity pricing cycles.

We also consider social and corporate governance issues that could have a material effect on the credit profile of chemical companies.

Financial Controls

We rely on the accuracy of audited financial statements to assign and monitor ratings in this sector. The quality of financial statements may be influenced by internal controls, including the proper tone at the top, centralized operations, and consistency in accounting policies and procedures. Auditors' reports on the effectiveness of internal controls, auditors' comments in financial reports and unusual restatements of financial statements or delays in regulatory filings may indicate weaknesses in internal controls.

Management Strategy

The quality of management is an important factor supporting a company's credit strength. Assessing the execution of business plans over time can be helpful in assessing management's business strategies, policies and philosophies and in evaluating management performance relative to performance of competitors and our projections. Management's track record of adhering to stated plans, commitments and guidelines provides insight into management's likely future performance, including in stressed situations.

Excess Cash Balances

Some companies in this sector may maintain cash balances (meaning liquid short-term investments as well as cash) that are far in excess of their operating needs. This excess cash can be an important credit consideration; however, the underlying policy and motivations of the issuer in holding high cash balances are often as or more important in our analysis than the level of cash held. We have observed significant variation in company behavior based on differences in financial philosophy, investment opportunities, availability of committed revolving credit facilities and shareholder pressures.

Most issuers need to retain some level of cash in their business for operational purposes. The level of cash required to run a business can vary based on the region(s) of operation and the specific sub-sectors in which the issuer operates. Some issuers have very predictable cash needs and others have much broader intra-period swings, for instance related to mark-to-market collateral requirements under hedging instruments. Some companies may hold large levels of cash at times because they operate without committed, long-term bank borrowing facilities. Some companies may hold cash on the balance sheet to meet long-term contractual liabilities, whereas other companies with the same types of liabilities have deposited cash into trust accounts that are off balance sheet. The level of cash that issuers are willing to hold can also vary over time based on the cost of borrowing and macroeconomic conditions. The same issuer may place a high value on cash holdings in a major recession or financial crisis but seek to pare cash when inflation is high. As a result, cash on the balance sheet is most often considered qualitatively, by assessing the issuer's track record and financial and liquidity policies rather than by measuring how a point-in-time cash balance would affect a specific metric.

Across all corporate sectors, an important shareholder-focused motivation for cash holdings, sometimes over very long periods, is cash for acquisitions. In these cases, we do not typically consider that netting cash against the issuer's current level of debt is analytically meaningful; however, the cash may be a material mitigant in our scenario analyses of potential acquisitions, share buybacks or special dividends. Tax minimization strategies have at times been another primary motivation for holding large cash balances. Given shareholder pressures to return excess cash holdings, when these motivations for holding excess cash are eliminated, we generally expect that a large portion of excess cash will be used for dividends and share repurchases.

By contrast, some companies maintain large cash holdings for long periods of time in excess of their operating and liquidity needs solely due to conservative financial policies, which provides a stronger indication of an enduring approach that will benefit creditors. For instance, some companies have a policy to routinely pre-fund upcoming required debt payments well in advance of the stated maturity. Such companies may also have clearly stated financial targets based on net debt metrics and a track record of maintaining their financial profile within those targets.

While the scorecard in this methodology uses leverage and coverage ratios with total (or gross) debt rather than net debt, we do consider excess cash holdings in our rating analysis, including in our assessment of the financial and liquidity policy. For issuers where we have clarity into the extent to which cash will remain on the balance sheet and/or be used for creditor-friendly purposes, excess cash may be considered in a more quantitative manner. While we consider excess cash in our credit assessment for ratings, we do not typically adjust the balance sheet debt for any specific amount because this implies greater precision than we think is appropriate for the uncertain future uses of cash. However, when cash holdings are unusually large relative to debt, we may refer to debt net of cash, or net of a portion of cash, in our credit analysis and press releases in order to provide additional insight into our qualitative assessment of the credit benefit. Alternatively, creditor-friendly use of cash may be factored into our forward view of metrics, for instance when the cash is expected to be used for debt-repayment. We may also cite rating threshold levels for certain issuers based on net debt ratios, particularly when these issuers have publicly stated financial targets based on net debt metrics.

Even when the eventual use for excess cash is likely to be for purposes that do not benefit debtholders, large holdings provide some beneficial cushion against credit deterioration, and cash balances are often considered in our analysis of near-term liquidity sources and uses. Such downside protection is usually more important for low rated companies than for highly rated companies due to differences in credit stability and the typically shorter distance from potential default for issuers at the lower end of the ratings spectrum.

Liquidity

Liquidity is an important rating consideration for all chemical companies, although it may not have a substantial impact in discriminating between two issuers with a similar credit profile. Liquidity can be particularly important for companies in highly seasonal operating environments where working capital needs must be considered, and ratings can be heavily affected by extremely weak liquidity. We form an opinion on likely near-term liquidity requirements from the perspective of both sources and uses of cash. For more details on our approach, please see our liquidity cross-sector methodology.[5]

Additional Metrics

The metrics included in the scorecard are those that are generally most important in assigning ratings to companies in this industry; however, we may use additional metrics to inform our analysis of specific companies. These additional metrics may be important to our forward view of metrics that are in the scorecard or other rating factors.

For example, free cash flow is not always an important differentiator of credit profiles. Strong companies with excellent investment opportunities may demonstrate multiyear periods of negative free cash flow while retaining solid access to capital and credit, because these investments will yield stable cash flows in future years. Weaker companies with limited access to credit may have positive free cash flow for a period of time because they have curtailed the investments necessary to maintain their assets and future cash-generating prospects. However, in some cases, free cash flow can be an important driver of the future liquidity profile of an issuer, which, as noted above, can have a meaningful impact on ratings.

Non-wholly owned subsidiaries

Some companies in the chemical sector have policies that choose to dilute their equity stake in certain material subsidiaries, for example through an initial public offering, which may in some cases negatively impact future financial flexibility. While improving cash holdings on a one-off basis, selling minority interests in subsidiaries may have a negative impact on cash flows available to the parent company that may not be fully reflected in consolidated financial statements.[6] The parent's share of dividend flows from a non-wholly owned subsidiary are reduced, and minority stakes can increase structural subordination, since dividend flows to minority interest holders are made before the cash flows are available to service debt at the parent company. While less frequent, the sale of a minority stake may be accompanied by policies protective of the subsidiary that further limit the parent's financial flexibility, for instance restrictions on cash pooling with other members of the corporate family, limitations on dividends and distributions, or arms-length business requirements. Minority stakeholders may have seats on the board of the subsidiary. In many cases, we consider the impact of non-wholly owned subsidiaries qualitatively. However, in some cases we may find that an additional view of financial results, such as analyzing cash flows on a proportional consolidation basis, may be very useful to augment our analysis based on consolidated financial statements. When equity dilution or structural subordination arising from non-wholly owned subsidiaries is material and negative, the credit impact is captured in ratings but may not be fully reflected in scorecard-indicated outcomes.

For companies that hold material minority interest stakes, consolidated funds from operations typically includes the dividends received from the minority subsidiary, while none of its debt is consolidated. When such dividends are material to the company's cash flows, these cash flows may be subject to interruption if they are required for the minority subsidiary's debt service, capital expenditures or other cash needs. When minority interest dividends are material, we may also find that proportional consolidation or another additional view of financial results is useful to augment our analysis of consolidated financials. We would generally also consider structural subordination in these cases.[7] When these credit considerations are material, their impact is captured in ratings but may not be fully reflected in scorecard-indicated outcomes.

Event Risk
We also recognize the possibility that an unexpected event could cause a sudden and sharp decline in an issuer's fundamental creditworthiness, which may cause actual ratings to be lower than the scorecard-indicated outcome. Event risks — which are varied and can range from leveraged recapitalizations to sudden regulatory changes or liabilities from an accident — can overwhelm even a stable, well-capitalized firm. Some other types of event risks include M&A, asset sales, spin-offs, litigation, pandemics, significant cyber-crime events and shareholder distributions.

Parental Support
Ownership can provide ratings lift for a particular company in the chemical sector if it is owned by a highly rated owner(s) and is viewed to be of strategic importance to those owners. In our analysis of parental support, we consider whether the parent has the financial capacity and strategic incentives to provide support to the issuer in times of stress or financial need (e.g., a major capital investment or advantaged operating agreement), or has already done so in the past. Conversely, if the parent puts a high dividend burden on the issuer, which in turn reduces its flexibility, the ratings would reflect this risk.

Government-related issuers may receive ratings uplift due to expected government support. However, for certain issuers, government ownership can have a negative impact on the underlying Baseline Credit Assessment.[8] For example, price controls, onerous taxation and high distributions can have a negative effect on an issuer's underlying credit profile.

Other Institutional Support
In some countries, large corporate issuers have received government or banking support in the event of financial difficulties because of their overall importance to the functioning of the economy. In Japan, our corporate ratings consider the support that has operated there for large and systemically important organizations. Over the years, this has resulted in lower levels of default than might otherwise have occurred. Our approach considers whether the presence of group and banking relationships may provide support when systemically important companies encounter significant financial stress.

Seasonality
Seasonality can be an important driver of customer demand and can cause swings in revenue, profits, cash usage, cash balances and working capital positions from month-to-month or quarter-to-quarter for some issuers. Seasonality may be prevalent in the chemical sub-industry specialized in supplying products for the agricultural industry as farmers generally buy what they need in one part of the year, and buying activity can fall significantly in other parts of the year, affecting revenue and profits, which results in short-term increases in debt to finance a buildup in working capital. Generally, seasonality creates less room for errors in meeting customer demand or operational execution.

Cyclical Sectors
Scorecard-indicated outcomes in cyclical sectors may be higher than the rating at the top of the economic cycle and lower than the rating at the bottom of the cycle. While using annual financials in the scorecard typically provides very useful insights into recent or near-term results, ratings may reflect our expectations for the progression of yearly results over a longer period that may include a full economic cycle. However, cyclicality itself poses many different types of risks to companies, and cycles do not reverse themselves with predictable regularity. A cyclical sector may also be affected by a secular decline or expansions. These considerations may be incorporated qualitatively in ratings.

Using the scorecard to arrive at a scorecard-indicated outcome

1. Measurement or estimation of factors in the scorecard

In the "Discussion of the scorecard factors" section, we explain our analytical approach for scoring each scorecard factor or sub-factor,[9] and we describe why they are meaningful as credit indicators.

The information used in assessing the sub-factors is generally found in or calculated from information in the company's financial statements or regulatory filings, derived from other observations or estimated by Moody's analysts. We may also incorporate non-public information.

Our ratings are forward-looking and reflect our expectations for future financial and operating performance. However, historical results are helpful in understanding patterns and trends of a company's performance as well as for peer comparisons. Financial ratios,[10] unless otherwise indicated, are typically calculated based on an annual or 12-month period. However, the factors in the scorecard can be assessed using various time periods. For example, rating committees may find it analytically useful to examine both historical and expected future performance for periods of several years or more.

All of the quantitative credit metrics incorporate our standard adjustments[11] to income statement, cash flow statement and balance sheet amounts for items such as underfunded pension obligations and operating leases. We may also make other analytical adjustments that are specific to a particular company.

2. Mapping scorecard factors to a numeric score

After estimating or calculating each factor or sub-factor, each outcome is mapped to a broad Moody's rating category (Aaa, Aa, A, Baa, Ba, B, Caa or Ca, also called alpha categories) and to a numeric score.

Qualitative factors are scored based on the description by broad rating category in the scorecard. The numeric value of each alpha score is based on the scale below.

Exhibit 3

Aaa	Aa	A	Baa	Ba	B	Caa	Ca
1	3	6	9	12	15	18	20

Source: Moody's Investors Service

Quantitative factors are scored on a linear continuum. For each metric, the scorecard shows the range by alpha category. We use the scale below and linear interpolation to convert the metric, based on its placement within the scorecard range, to a numeric score, which may be a fraction. As a purely theoretical example, if there were a ratio of revenue to interest for which the Baa range was 50x to 100x, then the numeric score for an issuer with revenue/interest of 99x, relatively strong within this range, would score closer to 7.5, and an issuer with revenue/interest of 51x, relatively weak within this range, would score closer to 10.5. In the text or table footnotes, we define the endpoints of the line (i.e., the value of the metric that constitutes the lowest possible numeric score, and the value that constitutes the highest possible numeric score).

Exhibit 4

Aaa	Aa	A	Baa	Ba	B	Caa	Ca
0.5-1.5	1.5-4.5	4.5-7.5	7.5-10.5	10.5-13.5	13.5-16.5	16.5-19.5	19.5-20.5

Source: Moody's Investors Service

3. Determining the overall scorecard-indicated outcome

The numeric score for each sub-factor (or each factor, when the factor has no sub-factors) is multiplied by the weight for that sub-factor (or factor), with the results then summed to produce an aggregate numeric score. The aggregate numeric score is then mapped back to a scorecard-indicated outcome based on the ranges in the table below.

Exhibit 5

Scorecard-indicated outcome

Scorecard-indicated outcome	Aggregate numeric score
Aaa	x ≤ 1.5
Aa1	1.5 < x ≤ 2.5
Aa2	2.5 < x ≤ 3.5
Aa3	3.5 < x ≤ 4.5
A1	4.5 < x ≤ 5.5
A2	5.5 < x ≤ 6.5
A3	6.5 < x ≤ 7.5
Baa1	7.5 < x ≤ 8.5
Baa2	8.5 < x ≤ 9.5
Baa3	9.5 < x ≤ 10.5
Ba1	10.5 < x ≤ 11.5
Ba2	11.5 < x ≤ 12.5
Ba3	12.5 < x ≤ 13.5
B1	13.5 < x ≤ 14.5
B2	14.5 < x ≤ 15.5
B3	15.5 < x ≤ 16.5
Caa1	16.5 < x ≤ 17.5
Caa2	17.5 < x ≤ 18.5
Caa3	18.5 < x ≤ 19.5
Ca	19.5 < x ≤ 20.5
C	x > 20.5

Source: Moody's Investors Service

For example, an issuer with an aggregate numeric score of 11.7 would have a Ba2 scorecard-indicated outcome.

In general, the scorecard-indicated outcome is oriented to the corporate family rating (CFR) for speculative-grade issuers and to the senior unsecured rating for investment-grade issuers. For issuers that benefit from rating uplift from parental support, government ownership or other institutional support, we consider the underlying credit strength or Baseline Credit Assessment for comparison to the scorecard-indicated outcome. For an explanation of the Baseline Credit Assessment, please refer to *Rating Symbols and Definitions* and to our cross-sector methodology for government-related issuers.[12]

Assigning issuer-level and instrument-level ratings

After considering the scorecard-indicated outcome, other considerations and relevant cross-sector methodologies, we typically assign a CFR to speculative-grade issuers or a senior unsecured rating for investment-grade issuers. For issuers that benefit from rating uplift from government ownership, we may assign a Baseline Credit Assessment.[13]

Individual debt instrument ratings may be notched up or down from the CFR or the senior unsecured rating to reflect our assessment of differences in expected loss related to an instrument's seniority level and collateral. The documents that provide broad guidance for such notching decisions are the rating methodology on loss given default for speculative-grade non-financial companies, the methodology for notching corporate instrument ratings based on differences in security and priority of claim, and the methodology for assigning short-term ratings.[14]

Key rating assumptions

For information about key rating assumptions that apply to methodologies generally, please see *Rating Symbols and Definitions*.[15]

Limitations

In the preceding sections, we have discussed the scorecard factors and many of the other considerations that may be important in assigning ratings. In this section, we discuss limitations that pertain to the scorecard and to the overall rating methodology.

Limitations of the scorecard

There are various reasons why scorecard-indicated outcomes may not map closely to actual ratings.

The scorecard in this rating methodology is a relatively simple reference tool that can be used in most cases to approximate credit profiles of companies in this sector and to explain, in summary form, many of the factors that are generally most important in assigning ratings to these companies. Credit loss and recovery considerations, which are typically more important as an issuer gets closer to default, may not be fully captured in the scorecard. The scorecard is also limited by its upper and lower bounds, causing scorecard-indicated outcomes to be less likely to align with ratings for issuers at the upper and lower ends of the rating scale.

The weights for each factor and sub-factor in the scorecard represent an approximation of their importance for rating decisions across the sector, but the actual importance of a particular factor may vary substantially based on an individual company's circumstances.

Factors that are outside the scorecard, including those discussed above in the "Other considerations" section, may be important for ratings, and their relative importance may also vary from company to company. In addition, certain broad methodological considerations described in one or more cross-sector rating methodologies may be relevant to ratings in this sector.[16] Examples of such considerations include the following: how sovereign credit quality affects non-sovereign issuers, the assessment of credit support from other entities, the relative ranking of different classes of debt and hybrid securities, and the assignment of short-term ratings.

We may use the scorecard over various historical or forward-looking time periods. Furthermore, in our ratings we often incorporate directional views of risks and mitigants in a qualitative way.

General limitations of the methodology

This methodology document does not include an exhaustive description of all factors that we may consider in assigning ratings in this sector. Companies in the sector may face new risks or new combinations of risks, and they may develop new strategies to mitigate risk. We seek to incorporate all material credit considerations in ratings and to take the most forward-looking perspective that visibility into these risks and mitigants permits.

Ratings reflect our expectations for an issuer's future performance; however, as the forward horizon lengthens, uncertainty increases and the utility of precise estimates, as scorecard inputs or in other considerations, typically diminishes. Our forward-looking opinions are based on assumptions that may prove, in hindsight, to have been incorrect. Reasons for this could include unanticipated changes in any of the following: the macroeconomic environment, general financial market conditions, industry competition, disruptive technology, or regulatory and legal actions. In any case, predicting the future is subject to substantial uncertainty.

Moody's related publications

Credit ratings are primarily determined through the application of sector credit rating methodologies. Certain broad methodological considerations (described in one or more cross-sector rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments. A list of sector and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings, please click here.

For further information, please refer to *Rating Symbols and Definitions*, which is available here.

Moody's Basic Definitions for Credit Statistics (User's Guide) can be found here.

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Endnotes

1 A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

2 In our methodologies and research, the terms "scorecard" and "grid" are used interchangeably.

3 Liquidity management is distinct from the level of liquidity, which is discussed in the "Other considerations" section.

4 A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

5 A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

6 For example, in the case of an equity stake reduction in a subsidiary down to 75%, in the parent's financial statements, all revenue and EBITDA of the subsidiary would typically still be consolidated at the group level.

7 Proportional consolidation brings a portion of the minority subsidiary's debt onto the balance sheet, but this debt is structurally senior to debt at the parent company, because it is closer to the assets and cash flows of the minority subsidiary.

8 For an explanation of the Baseline Credit Assessment, please refer to *Rating Symbols and Definitions* and to our cross-sector methodology for government-related issuers. A link to a list of our sector and cross-sector methodologies and a link to *Rating Symbols and Definitions* can be found in the "Moody's related publications" section.

9 When a factor comprises sub-factors, we score at the sub-factor level. Some factors do not have sub-factors, in which case we score at the factor level.

10 For definitions of our most common ratio terms, see *Moody's Basic Definitions for Credit Statistics (User's Guide)*. A link can be found in the "Moody's related publications" section.

11 For an explanation of our standard adjustments, see the cross-sector methodology that describes our financial statement adjustments in the analysis of non-financial corporations in the "Moody's related publications" section.

12 A link to a list of our sector and cross-sector methodologies and a link to *Rating Symbols and Definitions* can be found in the "Moody's related publications" section.

13 For an explanation of the Baseline Credit Assessment, refer to *Rating Symbols and Definitions* and to our cross-sector methodology for government-related issuers. A link to a list of our sector and cross-sector methodologies and a link to *Rating Symbols and Definitions* can be found in the "Moody's related publications" section.

14 A link to a list of our sector and cross-sector rating methodologies can be found in the "Moody's related publications" section.

15 A link to *Rating Symbols and Definitions* can be found in the "Moody's related publications" section.

16 A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

This publication does not announce a credit rating action. For any credit ratings referenced in this publication, please see the issuer/deal page on https://ratings.moodys.com for the most updated credit rating action information and rating history.

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