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CREDIT OPINION
27 October 2022

Update

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RATINGS

Vale S.A.

Domicile	Rio de Janeiro, Brazil
Long Term Rating	Baa3
Type	LT Issuer Rating - Dom Curr
Outlook	Stable

Please see the ratings section at the end of this report for more information. The ratings and outlook shown reflect information as of the publication date.

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Vale S.A.

Update following affirmation of Baa3 rating; stable outlook

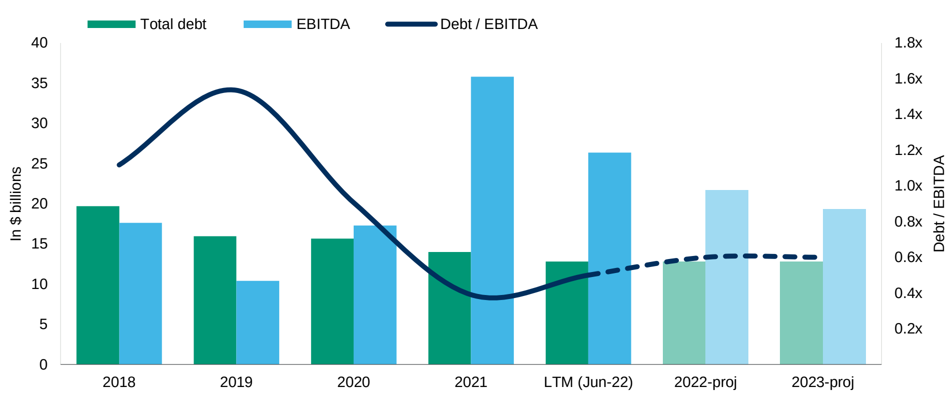
Summary

On October 26, Moody's affirmed Vale S.A.'s (Vale) Baa3 rating, reflecting its strong business profile as one of the largest iron ore producers and one of the largest nickel producers globally. It also reflects the company's ability to resume operations under stricter risk and safety controls after the dam incident in Brumadinho, with greater production flexibility, which will lead to cost reduction and allow the company to continue to generate positive FCF, even in an environment of weaker commodity prices.

The Baa3 rating is supported by Vale's strong production profile, its portfolio of long lived assets (in iron ore, nickel and copper), low cost position and strong balance sheet, with leverage below 1x (total debt/EBITDA) since 2020.

The rating is constrained by the sovereign rating of the of the Government of Brazil (Ba2 stable) because it is unlikely that Moody's would further widen the rating differential, as a result of Vale's asset concentration in Brazil (65% of total assets). To be rated more than two notches above the sovereign rating, a company would need to have a substantial majority of its operating assets located outside the country and a substantial majority of its cash flows generated outside of the country.

Exhibit 1
Conservative debt levels will keep gross leverage below 1x, despite weaker EBITDA



*Iron ore price assumption of $100/ton for 2022-2023.
Source: Moody's Investors Service

Credit strengths

» Strong position in the iron ore markets, complemented by a relevant position in nickel and copper

» Competitive cost position and focus on profitability in iron ore and base metals

» Low leverage, which makes it better prepared to manage commodity price volatility

» Strong cash flow from operations (CFO), while free cash flow (FCF) has weakened because of high dividend distribution

» Reduction in ESG risks with an improvement in corporate governance, risk management and safety of operations

Credit challenges

» Cash outflow related to the tailings dam accidents — in Brumadinho and in Mariana (Samarco) — and uncertainty around the amount of support Samarco will require from Vale

» Concentration in iron ore, which makes the company's performance dependent on steel industry fundamentals, in particular steel production levels in China

» ESG considerations, in particular related to the safety of tailings dams

Rating outlook

The stable outlook reflects Moody's expectation of a gradual recovery of production levels, as well as advancements in the decommissioning of upstream tailings according to the company's schedule. Moody's expects to continue to see evidence of stricter risk management and oversight of all operations and higher scrutiny in the company's corporate governance practices, with a strong strategic focus on safety and operational excellence. The stable outlook also incorporates the expectation of no material increase in provisions and cash disbursements related to Brumadinho or Samarco that could impact the company's liquidity or leverage.

Factors that could lead to an upgrade

An upward rating movement would be subject to the relative position to Brazil's sovereign rating (Government of Brazil, Ba2 stable). Moreover, an upgrade of Vale's rating would require continued evidence of enhanced risk control and governance oversight, with production gradually normalizing and no material additional provisions or cash disbursements related to the incidents in Brumadinho or Samarco. An upgrade would also depend on the maintenance of a solid liquidity and positive free cash flow generation, supported by leading market positioning in its main segments and low-cost operations. Quantitatively, an upgrade would also require the following factors on a sustained basis (Moody's-adjusted metrics):

» Total debt/EBITDA below 2x

» EBIT/interest expense above 5.5x

» (Cash flow from operations [CFO]-dividends)/debt consistently above 40%

Factors that could lead to a downgrade

Vale's ratings could be downgraded should the ultimate costs related to the disasters in Brumadinho or disbursements related to Samarco be materially above the amounts already provisioned due to higher fines and settlements, litigations and class actions, or if operations do not fully recover within the expected timeframe, affecting cash costs and free cash flow generation. Evidence that ESG initiatives are not on track to further de-risk the company could also lead to a negative rating action. The rating or outlook could face downward pressure should the conditions for iron ore and base metals deteriorate, leading to lower profitability. A marked deterioration in the company's liquidity would also lead to a downgrade. In addition, a downgrade of Brazil's sovereign rating could strain Vale's rating. Quantitatively, there could be downward pressure on Vale's rating or outlook if its:

» leverage (total debt/EBITDA) rises toward 2.75x or above

» EBIT/interest expense falls below 4.5x

» (CFO-dividends)/debt remains sustained below 35%

Key indicators

Exhibit 2

Vale S.A.

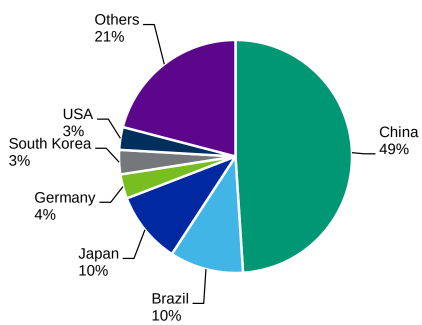
US Millions	Dec-18	Dec-19	Dec-20	Dec-21	LTM (Jun-22)	2022-proj	2023-proj
Revenue	36,575	37,570	39,545	54,502	47,404	47,760	42,983
EBIT Margin %	36.8%	18.5%	36.1%	60.4%	49.8%	41.0%	39.6%
EBIT / Interest Expense	8.5x	5.6x	16.0x	41.0x	28.6x	23.6x	20.5x
Debt / EBITDA	1.1x	1.5x	0.9x	0.4x	0.5x	0.6x	0.6x
Debt / Book Capitalization	29.9%	28.2%	30.0%	27.4%	24.9%	26.5%	23.7%
(CFO - Dividends) / Debt	52.5%	76.1%	70.6%	86.6%	48.7%	66.3%	57.9%

All figures and ratios are calculated using Moody's estimates and standard adjustments. Moody's forecasts (f) or projections (proj.) are Moody's opinion and do not represent the views of the issuer. Periods are financial year end unless indicated.
Source: Moody's Financial Metrics™

Profile

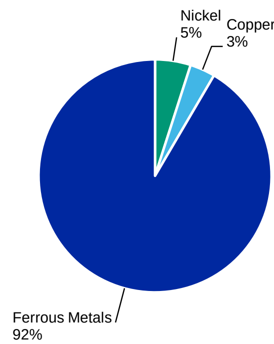
Headquartered in Rio de Janeiro, Vale S.A. (Vale) is one of the world's largest mining companies. The company has substantive positions in iron ore and nickel, and relevant operations in copper. The company's principal mining operations are in Brazil, Canada and Indonesia. Despite Vale's geographic and commodity diversification, its Brazilian iron ore operations and major position in the seaborne iron ore markets remain the main drivers of revenue, earnings and cash flow. As of June 2022, ferrous minerals (primarily iron ore and pellets) accounted for around 90% of the company's net revenue. In the 12 months that ended in June 2022, Vale reported net revenue of $47.4 billion.

Exhibit 3
Diversified revenue base with a predominance in China, the largest steel producer globally
For the 12 months that ended in June 2022



Source: Company filings

Exhibit 4
EBITDA is highly concentrated in ferrous minerals
For the 12 months that ended in June 2022



Source: Company filings

Detailed credit considerations

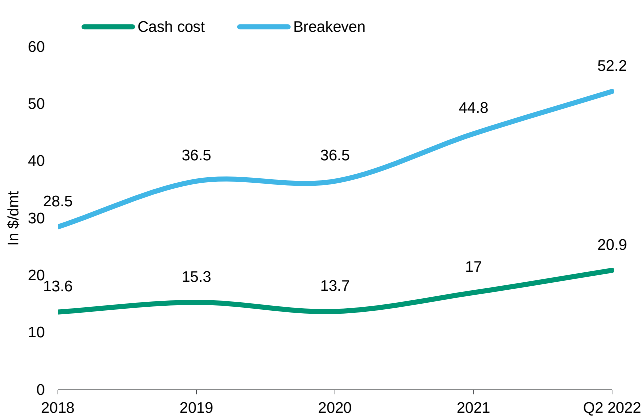
Solid business model and low-cost asset base support credit quality

Vale benefits from its global business platform and significant strength in iron ore and base metals, in particular nickel. The company is one of the world's largest diversified mining companies (along with Rio Tinto Limited [Rio Tinto, A2 stable], BHP Group Limited [BHP, A2 stable] and Anglo American [Baa2 stable]).

Given its large scale and position as one of the largest iron ore producers worldwide, Vale is a low-cost producer, which, together with the high quality of ore produced, supports high margins. In the 12 months that ended in June 2022, premium iron ore represented about 81% of total iron ore sold. C1 cash costs increased to $20.9 per ton (excluding third-party purchases) in 2Q22, because of higher fuel costs, the effects of foreign exchange, higher demurrage costs, higher maintenance costs and higher ocean freight costs, a trend observed across the global mining industry. The gradual increase in capacity will allow for higher cost dilution, and Vale expects C1 cash costs to decrease to $14-$15 per ton as the company moves toward 400 million tons of iron ore production.

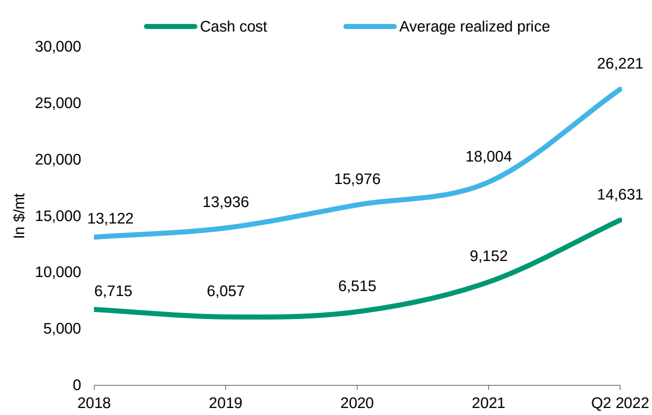
Cash costs for base metals (copper and nickel) remain well below market prices. The overall cost profile of Vale's nickel production has strengthened with the divestment of Vale Nouvelle-Calédonie S.A.S. (VNC) in 2021, which had a higher cost base. Overtime, with the growth in base metal volumes, we expect higher EBITDA contribution from nickel and copper to the company's consolidated cash flow.

Exhibit 5
Iron ore C1 cash costs (excluding third-party purchases) and cash breakeven in China
$/dry metric ton (dmt)



Source: Company's filings

Exhibit 6
Nickel cash cost and average realized prices excluding VNC (New Caledonia)
$/metric ton (mt)

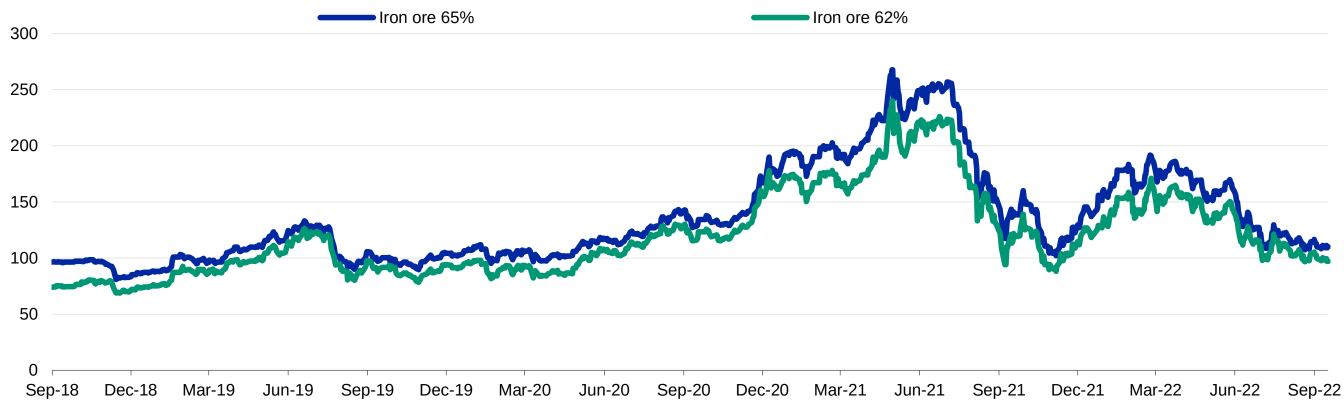


Source: Company's filings

Gradual recovery in iron ore production and planned expansion for base metals will support cash flow even in a weaker price environment

Vale's credit metrics have improved significantly over the past couple of years, with stronger cash flow from operations supported by the favorable price environment, while Vale pursued a divestment program to sell assets with low profitability, with a focus on higher-quality iron ore and expansion of the contribution of base metals to the business.

Exhibit 7
Iron ore prices retreated from record highs in 2021, but remain in the $90-$100/ton range



Source: Fastmarket MB

Iron ore production volumes in 2022 will be between 310 million tons and 320 million tons. Vale will reach a nominal iron ore annual production capacity of 450 million tons in the long run, but the estimated medium term annual production capacity once all operational constraints are addressed will be around 400 million tons, supported by expansion projects in the Northern System to 240 million tons (about 189 million tons produced in the twelve months ended September 2022) and the continued resumption of operations in the Southern and Southeast systems, with a strong focus on high-quality iron ore, dry processing (70% of total iron ore production) and filtration plants. Vale expects to increase the share of premium products (Carajas ore, Brazilian Blend Fines, pellet feeds) to 90% overtime, which compares with 53% in 2015.

Vale has a relevant pipeline of projects to expand the production of nickel and increase the contribution of base metals in consolidated results. In nickel, Vale plans to reach annual production of 230,000-245,000 tons in 2024-26 supported by projects currently underway in Canada, Brazil and Indonesia. The company plans to expand further in Indonesia, reaching annual production of more than 300,000 tons in 2028. In addition to the stabilization of production at the North Atlantic mines, Vale plans to add capacity in South Atlantic (Onça Puma) and in Indonesia, with projects in Bahodopi and Pomalaa, which, if approved, will be carried out through joint ventures (JVs) and together can add more than 100,000 tons of nickel production per year.

In copper, growth will come from projects in Brazil and Indonesia, with annual production estimated at 390,000-420,000 tons in 2024-26, reaching around 900,000 tons in/after 2028. Vale continued to advance with Salobo III, with a startup planned for year-end 2022, which will increase copper production by 30,000-40,000 tons per year. Furthermore, projects in Brazil and Canada will increase annual copper production to 390,000-420,000 tons in 2024-26, reaching around 900,000 tons in/after 2028, supported by growth in Indonesia. Vale is working on a pre-feasibility study for the Hu'ú project in Indonesia, which has estimated resources of 17.6 million tons of copper and 31 million ounces of gold, and an estimated copper production of 300,000-350,000 tons per year in peak, which would double Vale's copper production capacity.

The increase in base metal production volumes will bring diversification to Vale's business profile, reducing cash flow reliance on iron ore and increasing geographic diversification with a higher share of assets outside Brazil.

Significant improvements in safety of tailing dams and legal settlement on tailings dam incident in Brumadinho

Since the incident in Brumadinho in January 2019, Vale has been working toward the plan to make safety improvements on critical emergency level structures by 2025 and to de-characterize all upstream structures in Brazil by 2035. Out of 30 upstream dams, Vale has fully de-characterized 12. For structures at emergency levels 2 or 3, emergency protocols are applied, with no workers or civil population allowed in such self-rescue zones. For these structures, Vale adopts measures to strengthen stability and safety conditions, such as keeping the reservoirs dry and reducing water supply, and has built containment structures for these dams.

To further increase the safety of operations, Vale built backup dams for certain dams, and has preemptively removed civil population and workers out of risk areas and uses remotely operated equipment to remove tailings in critical areas.

An important way the risk of tailings dams has been reduced is by continuously increasing the share of dry processing production to 70% of total iron ore production now from 40% in 2014, while 15% of total production relies on dry stacking and only 15% relies on tailings dams (not upstream dams).

In February 2021, Vale announced it has reached an $7 billion agreement with Brazilian authorities for the reparation of environmental and social damage resulting from the tailings dam accident in Brumadinho, which has largely resolved the uncertainty regarding the collective damage. The agreement comprises projects for the affected communities, including a program of income transfer to the population, and resources to the state of Minas Gerais for certain programs. The settlement also addresses the reparation plan for environmental damages and water cleanup in the affected area. The amount settled included initiatives already implemented and provisioned by Vale.

Although the agreement does not include individual claims, we estimate those to have a lower impact on Vale's disbursements, as the company has already signed a significant number of individual agreements with more than 13,000 people. We do not expect any significant disbursements related to individual agreements in addition to the amounts already provisioned.

Exhibit 8
Provisions and expenses since 2019 related to the Brumadinho accident

In USD million	2019	2020	2021	H1 2022
Balance at the beginning of period		**5,472**	**6,864**	**7,060**
Provisions	6,550	4,747	1,926	163
Disbursements	(989)	(2,122)	(1,726)	(535)
Other adjustments	(89)	(1,233)	(4)	536
Balance at the end of period	**5,472**	**6,864**	**7,060**	**7,224**

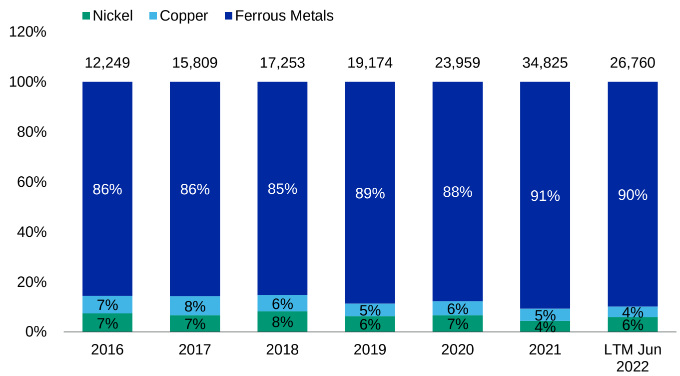
Source: Company's fillings

Iron ore asset concentration in Brazil constrains the rating

Vale is rated two notches above the rating of the Government of Brazil, which is supported by the company's position as one of the largest mining companies globally, with cash flow and profitability showing minimal correlation with domestic economic conditions. Vale is highly unlikely to default as a consequence of sovereign credit stress or default, since its large reliance on China and large developed countries provides reasonable insulation from Brazil's macroeconomic and political environment and make Vale less vulnerable to a decline in sovereign credit quality, which supports the higher rating relative to the sovereign.

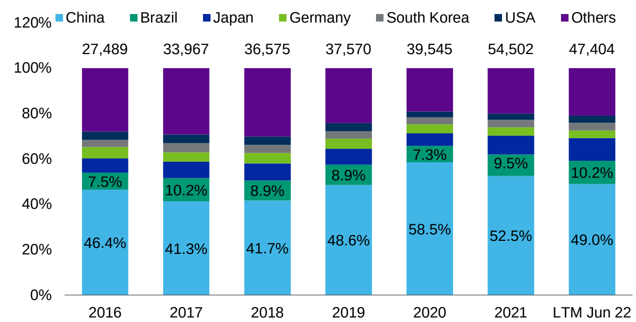
However, the company has about 65% of total assets located in Brazil, most of which are iron ore, followed by Canada (Vale Canada) with about 25%. To be rated more than two notches above the sovereign rating, a company would need to have a substantial majority of its operating assets located outside the country and a substantial majority of its cash flows generated outside of the country. Given the large share of assets in Brazil and cash flow reliance on assets located in the country, the sovereign of Brazil rating remains a constraint.

Exhibit 9
EBITDA by commodity
In $ million



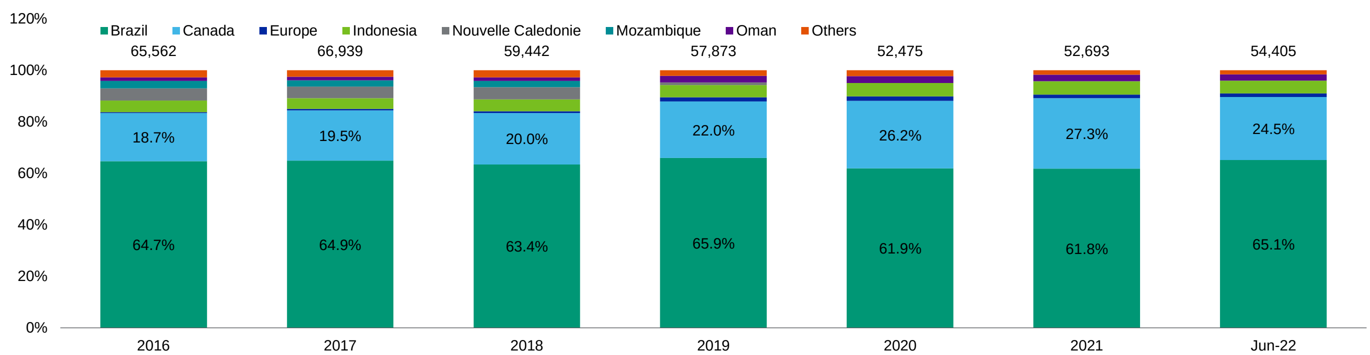
Source: Company's fillings

Exhibit 10
Revenue by geography
In $ million



Source: Company's fillings

Exhibit 11
Assets by geography
In $ million



Source: Company's fillings

ESG considerations

Vale S.A.'s ESG Credit Impact Score is Neutral-to-Low CIS-2

Exhibit 12
ESG Credit Impact Score

CIS-2

Neutral-to-Low

For an issuer scored CIS-2 (Neutral-to-Low), its ESG attributes are overall considered as having a neutral-to-low impact on the current rating; i.e., the overall influence of these attributes on the rating is non-material.

Source: Moody's Investors Service

Vale's ESG Credit Impact score is neutral-to-low (**CIS-2**). This reflects our assessment that ESG attributes are overall considered as having a neutral-to-low impact on the current rating, because the rating is constrained by the sovereign rating of the government of Brazil. Vale has a very highly negative environmental risk exposure and highly negative social risk exposure. The company has a moderately negative governance risk exposure because of limited track record after the tailings dam accident in 2019.

Exhibit 13
ESG Issuer Profile Scores

Source: Moody's Investors Service

Environmental

E-5 (very highly negative). Vale has a very highly negative exposure to environmental risks mainly related to natural capital and waste and pollution. The tailing dam incident in Brumadinho in 2019, which resulted in a large number of fatalities, extensive environmental damage and loss of production, and resulted in fines ($7 billion settlement) and litigations is an important consideration, as tailings dam management is the primary waste and pollution risk for this sector. Vale's operations are located in areas of abundant water availability with only moderately negative exposure to weather and climate related hazards, which gives Vale moderately negative exposure to water management and physical climate risks. However, the company's operations in Southeast Brazil are particularly exposed to floods risks.

Social

S-4 (highly negative). Exposure to social risks is highly negative. Improvements in safety of operations through initiatives taken to enhance the risk management control, particularly as the company progresses with the de-characterization of upstream dams, jointly with the construction of backup dams (containment structures) and preventive removal of workers and civil population of riskier areas, have reduced the exposure to social risks, in particular health and safety. However, the tailings dam incident and its implications related to safety of operations, employee well-being and community stakeholder engagement and reputation remains an important credit consideration. Vale's exposure to other social risks such as human capital is not as high as most mining companies, given the absence of union disputes and strikes, while demographic and societal trends are moderately negative, since Vale's exposure to iron ore is somewhat mitigated by the company's exposure to commodities (copper, nickel) that are linked to battery production and the green economy.

Governance

G-3 (moderately negative). Governance poses moderately negative risks. Vale's financial strategy, strong balance sheet, solid liquidity and enhanced risk management is balanced by limited track record following the dam collapse in 2019.

ESG Issuer Profile Scores and Credit Impact Scores for the rated entity/transaction are available on Moodys.com. In order to view the latest scores, please click here to go to the landing page for the entity/transaction on MDC and view the ESG Scores section.

Evolution in ESG initiatives are positive credit considerations

Significant reduction in operational risk linked to tailings dams

Enhanced risk management after the tailings dam accident in 2019 seeks to significantly reduce the risk of accidents. The dam collapse in Brumadinho in January 2019 raised a series of ESG concerns and tarnished Vale's reputation, operations, and government and employee relationships. After the accident, the company established a new tailings management system, aligned with best international practices, which included new roles and responsibilities, and three lines of defense to enhance the safety of operations. In line with the Global Industry Standard for Tailings Management (GISTM), Vale has also assigned an Independent Tailings Review Board (ITRB) to monitor each business unit related to the iron ore segment in Brazil. The ITRB provides an independent technical review of the construction, operation and management of tailings facilities. As of December 2021, Vale reached 60% adherence to those global standards and is committed to reach 90% by year-end 2022.

As part of this new management system, Vale announced the decommissioning (or the reintegration of a dam and its content to the local environment) of all tailings dams built under the upstream method. This process, when completed, will significantly reduce the risk of accidents. Since the announcement in 2019, Vale has been working toward the plan to make safety improvements on critical emergency-level structures by 2025 and to de-characterize all upstream dams and structures by 2035. For structures at emergency level 2 or 3, Vale adopted measures to strengthen stability and safety conditions, such as keeping the reservoirs dry and reducing water supply, and has built containment structures for these dams. Out of 30 upstream dams, Vale has fully de-characterized 12 as of October 2022.

Finally, an important way the risk of tailings dams has been reduced is by continuously increasing the share of dry processing production, which reduces the reliance on dams.

We acknowledge the company's initiatives to meet these objectives and, since the accident, we have seen an enhancement in risk management controls and increased scrutiny in the company's corporate governance practices and oversight. However, continued evidence of progress in these initiatives will remain critical for its rating.

Advances in 2030 commitments

Moreover, Vale has revised its sustainability goals established in 2018, in line with the sustainable development goals of the United Nations 2030 Agenda to adopt more ambitious targets. Vale's 2030 commitments include the following:

» **Energy self-sufficiency, energy efficiency and energy matrix transformation**: Around 99% of the electricity contracted and consumed by Vale's operations in Brazil is generated from renewable sources. Vale intends to reach 100% of self-generation from renewable sources in Brazil by 2025 and 100% of renewable electricity consumption globally by 2030. Vale will further invest in renewable energy projects, such as the Sol do Cerrado project and wind farms in the northeast region of Brazil.

» **Climate change**: Vale has a commitment to reduce greenhouse gas (GHG) emissions by 33% (Scope 1 and Scope 2) by 2030, in line with the Paris Agreement, and become carbon neutral by 2050. Vale has a commitment to reduce Scope 3 emissions by 15% by 2035.

» **Water use**: Vale is committed to promoting water recycling by developing programs and implementing actions that go beyond compliance with the legal requirements to optimize water use and consumption. Water reuse represents at least 80% of Vale's total production. The company established a target, already achieved in 2021, to reduce the new water captured and used in processes per ton produced by 2030 by 10% compared to 2017, which means a smaller volume of fresh water captured for the same volume of production.

» **Forest protection**: Vale is committed to the rehabilitation of areas to restore previously existing native habitats and recover important ecosystems. The company is also committed to recovering and protecting 500,000 hectares of degraded land beyond its boundaries by 2030. Vale also has 1.1 million hectares of protected forests, of which 80% is in the Amazon.

Apart from this, Vale is committed to improving the health and safety of its workers, reflected in its long-term goals of achieving zero recordable high-potential injuries by 2025; and eliminating the most significant risk scenarios by 2025. The company plans to double the number of women in its workforce by 2025 to 26% from 13% and to increase their presence in leadership roles to 20% from 12%. In 2021, Vale's workforce was composed 18.7% of women and their share in leadership roles ended the year at 20.9%.

Since the accident, Vale's board and senior management have been focusing on improving the company's governance and creating mechanisms to reinforce accident prevention and safety in the company's operations. Moreover, there have been relevant changes in Vale's compensation policy with the introduction of ESG as an important performance factor. For short-term compensation, between 40% and 75% of performance goals will be ESG driven and directly related to safety, risk management and sustainability targets. Meanwhile, for long-term compensation, 25% of the performance goals of Vale's virtual share plan are based on ESG metrics (evenly split between health and safety, and sustainability targets, supporting 2030 commitments). The company also adopted a malus clause and a clawback policy, according to which the board of directors may reduce the variable compensation of executives if events of exceptional severity occur.

Under the performance share units, executive directors receive compensation tied to Vale's performance, unlike at a select group of mining companies, where the payment is based on the total shareholder return of the common shares of those companies. The peer group includes Anglo American plc (Baa2 stable), BHP, Freeport-McMoRan Inc. (Baa3 stable), Glencore plc (Baa1 positive), Rio Tinto, Alcoa Nederland Holding B.V. (Baa3 stable) and South32 Limited (Baa1 stable). If Vale ranks lower than fifth, there will be no payment of shares.

Development of products with low carbon footprint

In September 2021, Vale launched a green briquette, which allows the reduction by up to 10% of GHG emissions during steelmaking production processes. This supports Vale's goal of achieving a reduction of all Scope 3 emissions by 2035.

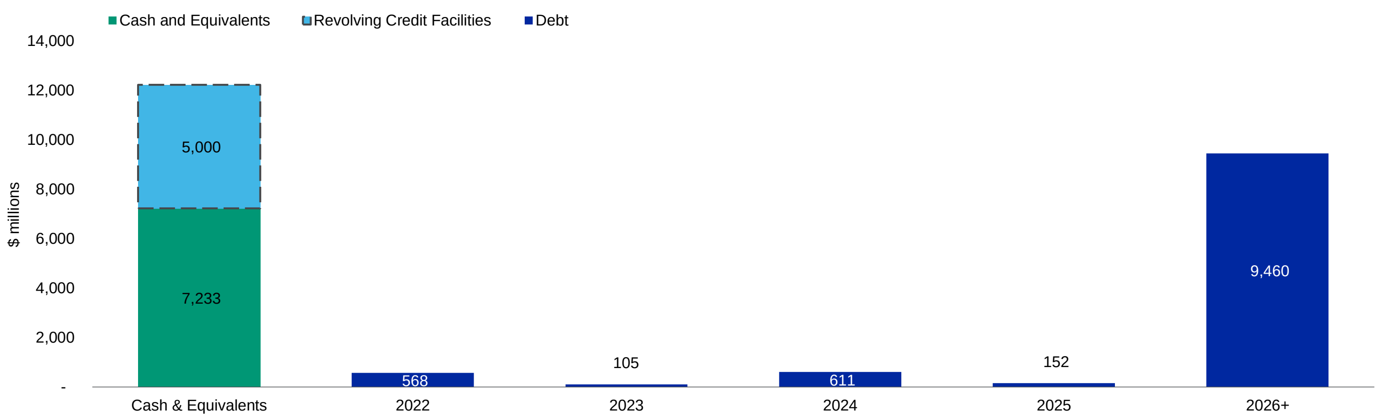
To develop low-carbon ferrous products for the steel industry, Vale has signed a memorandum of understanding with Ternium S.A., Kobe Steel Ltd, Mitsui & Co., Ltd (A3 stable), Midrex Technologies Inc., Hunan Valin Iron and Steel Group Co.Ltd., China Baowu Steel Group Corporation Limited (A2 stable), Jiangsu Shagang Group Co., Ltd and POSCO Holdings Inc. (Baa1 stable) for investments in new solutions to reduce Scope 3 emissions.

In the Base Metals business, the upper class 1 nickel represents about 50% of all nickel produced by Vale. The company's advantageous position of high-quality nickel with a low carbon footprint supports demand from battery producers and EV manufacturers. Recently, Vale has announced it has entered into supply agreements with both Tesla and Northvolt.

Liquidity analysis

Vale has excellent liquidity for the next 12 months. As of June 2022, the company had $7.2 billion in cash and $5.0 billion available under its revolving credit facility agreements ($3 billion due in December 2024 and $2 billion due in June 2026), compared with its total financial debt of $10.9 billion, mostly due after 2026. Vale generated operating cash flow of around $14.1 billion in the 12 months that ended in June 2022, and after dividend distribution of $10.9 billion and capital spending of $5.5 billion, FCF totaled $703 million. Vale disbursed around $7.9 billion in share buyback the 12 months ended in June 2022. The dividend payout is based on the policy established in March 2018, which ties Vale's dividend payments to its CFO and sustaining capital investment (30% of EBITDA - sustaining capital spending), with payments set twice a year — in September for H1 results and in March of the following year for H2 results.

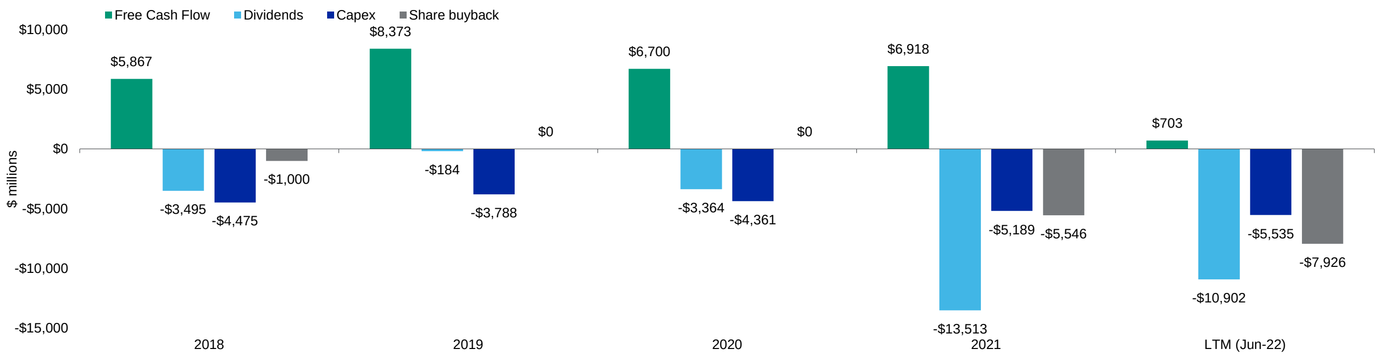
Exhibit 14
Debt amortization schedule as of June 2022; total reported financial debt of $10.9 billion



Does not include accrued interest and leases.
Source: Company filings and Moody's Investors Service

Exhibit 15

High iron ore and base metal prices support positive FCF, despite higher capital spending and dividend distribution



Sources: Company fillings and Moody's Financial Metrics™

Vale's leverage (Moody's-adjusted total gross debt/EBITDA) was 0.5x for the 12 months that ended June 2022, and remained below 1x in the past two years. Some of the company's financing documents contain covenants related to debt/EBITDA and the interest coverage ratio, representing less than 20% of its total debt. The company is in full compliance with these covenants.

Although much of Vale's iron ore and mining operations are under the parent company, it also has subsidiaries, associates and JV interests, both domestically and abroad. Although some of these entities may have debt and creditor obligations, which have the first claim on cash flow before distribution to the parent, they are relatively modest compared with the assets held within and the earnings generated by the parent company. Vale's debt-financing requirements are met with a combination of bonds, bank loans, debentures and other trade finance vehicles. Vale Overseas Limited (Baa3 stable), incorporated as a Cayman Islands-domiciled company, is a wholly owned finance subsidiary of Vale and is used as a vehicle to issue US dollar-denominated notes.

Other considerations

Samarco files for judicial reorganization

Since 2001, Samarco has operated as a 50:50 JV between the mining companies Vale and BHP. On 5 November 2015, there was an accident involving a tailings dam, which led to a suspension of all operations of Samarco, which restarted only in late 2020, with a production capacity of 7-8 million tons per year (about 25% of total capacity).

There are two separate proceedings related to Samarco, both of which can have implications for Vale's credit quality: the review of the framework agreement signed with Brazilian authorities in 2016 and negotiations with bondholders as part of Samarco's judicial reorganization after bankruptcy.

In March 2016, a 15-year agreement was signed by Samarco, Vale and BHP with the federal authorities, with the creation of the Renova Foundation to fund environmental, social and economic remediation and reparation programs as set by the framework agreement. In June 2018, a new agreement was established to improve the governance mechanism of Renova Foundation and establish a process for revision of the remediation programs. Further revisions on the reparation programs are contemplated, which could potentially increase the amounts to fund these programs. To date, Vale's and BHP's provisions are equivalent to the present value of each owner's total estimated responsibility under the BRL20 billion ($5.3 billion) framework agreement they signed in 2016.

We expect shareholders (Vale and BHP) to continue to support Samarco, but limit support to compensation and reparation programs for the affected population and environment. Vale's cash outflow is limited to short-term credit lines for general working capital purposes and to meet obligations under the framework agreement signed in 2016.

Exhibit 16

Provisions and expenses since 2016 related to the Samarco accident

In USD million	2016	2017	2018	2019	2020	2021	H1 2022
Balance at the beginning of period		**1,077**	**996**	**1,121**	**1,700**	**2,074**	**3,112**
Provisions	1,163	38	403	758	1,095	1,700	89
Disbursements	(139)	(294)	(290)	(315)	(394)	(392)	0
Others adjustments	53	175	12	136	(327)	(270)	185
Balance at the end of period	**1,077**	**996**	**1,121**	**1,700**	**2,074**	**3,112**	**3,386**
Working capital contributions to Samarco	**71**	**142**	**84**	**102**	**166**	**21**	**0**

Source: Company fillings

In early April 2021, Samarco filed for judicial reorganization to restructure its liabilities. Bondholders rejected the plan presented in April 2022 and no agreement was reached between the parties during mediation. As of October 2022, Samarco and creditors have not yet reached an agreement on the restructuring. The court extended Samarco's stay period for another 180 days on October 14, 2022. Samarco has around BRL50 billion ($9.5 billion) subject to judicial reorganization (about $4.2 billion owed to bondholders).

Vale Canada

Vale Canada's Ba1 senior unsecured rating, one notch below Vale's rating, reflects the fact that Vale does not guarantee its 2032 notes ($279 million outstanding at the end of June 2022), while continuing to incorporate Vale's ability to support Vale Canada, and the links of Vale Canada and Vale from a legal, operational, financial and strategic perspective. Although the contribution of Vale Canada to Vale's consolidated EBITDA is relatively small (about 5%), the business is an important component of the company's strategy for growth and diversification in base metals.

Methodology and scorecard

Vale's scorecard-indicated outcome under our Mining rating methodology, published in October 2021, maps to A1, based on data for the 12 months that ended in June 2022. On a forward-looking basis for the next 12-18 months, the scorecard-indicated outcome remains A1. The current rating is Baa3, reflecting Brazil's sovereign rating constraints.

Exhibit 17

Rating factors

Vale S.A.

Mining Industry Scorecard [1][2]	Current LTM 6/30/2022		Moody's 12-18 Month Forward View As of 10/21/2022 [3]	
Factor 1: Scale (20%)	**Measure**	**Score**	**Measure**	**Score**
a) Revenues (USD Billion)	$47.4	A	$43 - $47.8	A
Factor 2: Business Profile (25%)				
a) Business Profile	Baa	Baa	Baa	Baa
Factor 3: Profitability and Efficiency (10%)				
a) EBIT Margin (EBIT / Revenue)	49.8%	Aa	39% - 41%	Aa
Factor 4: Leverage and Coverage (30%)				
a) EBIT / Interest Expense	28.6x	Aaa	20x - 24x	Aaa
b) Debt / EBITDA	0.5x	Aaa	0.5x - 0.6x	Aa
c) Debt / Total Capital	24.9%	Aa	24% - 27%	Aa
d) (CFO - Dividends) / Debt	48.7%	A	58% - 66%	Aa
Factor 5: Financial Policy (15%)				
a) Financial Policy	Baa	Baa	Baa	Baa
Rating:				
a) Scorecard-Indicated Outcome		A1		A1
b) Actual Rating Assigned				Baa3

[1] All ratios are based on adjusted financial data and incorporate Moody's Global Standard Adjustments for Non-Financial Corporations. [2] As of 6/30/2022(L). [3] This represents our forward view, not the view of the issuer, and unless noted in the text, does not incorporate significant acquisitions and divestitures.
Source: Moody's Financial Metrics™

Ratings

Exhibit 18

Category	Moody's Rating
VALE S.A.	
Outlook	Stable
Issuer Rating -Dom Curr	Baa3
Senior Unsecured	Baa3
VALE OVERSEAS LIMITED	
Outlook	Stable
Bkd Senior Unsecured	Baa3
VALE CANADA LTD.	
Outlook	Stable
Senior Unsecured	Ba1

Source: Moody's Investors Service

Appendix

Exhibit 19

Peer comparison

Vale S.A.

	Vale S.A. Baa3 Stable			Rio Tinto A2 Stable			Fortescue Metals Group Ltd Ba1 Stable			Anglo American plc Baa2 Stable			BHP Group Limited A2 Stable		
(in US millions)	FYE Dec-20	FYE Dec-21	LTM Jun-22	FYE Dec-20	FYE Dec-21	LTM Jun-22	FYE Jun-20	FYE Jun-21	LTM Jun-22	FYE Dec-20	FYE Dec-21	LTM Jun-22	FYE Jun-20	FYE Jun-21	LTM Jun-22
Revenue	$39,545	$54,502	$47,404	$44,611	$63,495	$60,187	$12,820	$22,284	$17,390	$25,447	$41,547	$38,393	$42,931	$56,921	$65,098
EBITDA	$17,303	$35,811	$26,354	$21,358	$34,179	$29,117	$8,270	$16,231	$10,524	$9,477	$20,886	$17,619	$21,428	$38,794	$39,832
Total Debt	$15,668	$13,986	$12,812	$15,918	$14,815	$14,483	$5,113	$4,252	$6,103	$13,519	$13,054	$13,485	$23,734	$20,210	$17,883
EBIT Margin	36.1%	60.4%	49.8%	38.3%	46.0%	39.9%	53.6%	66.7%	51.7%	26.7%	43.5%	39.1%	35.7%	59.2%	51.7%
EBIT/Avg. Tang. Assets	17.3%	40.4%	29.4%	19.3%	30.4%	24.4%	31.8%	57.4%	31.8%	12.1%	29.6%	23.2%	14.9%	32.1%	33.3%
EBIT / Int. Exp.	16.0x	41.0x	28.6x	26.0x	51.0x	41.7x	32.9x	104.0x	60.0x	10.7x	30.9x	24.0x	16.1x	50.3x	54.5x
Debt / EBITDA	0.9x	0.4x	0.5x	0.7x	0.4x	0.5x	0.6x	0.3x	0.6x	1.4x	0.6x	0.8x	1.1x	0.5x	0.4x
Total Debt/Capital	30.0%	27.4%	24.9%	22.4%	19.7%	19.3%	25.6%	17.9%	24.2%	26.9%	24.9%	25.1%	28.7%	25.5%	25.5%
(CFO - Dividends) / Debt	70.6%	86.6%	48.7%	61.4%	69.2%	40.8%	87.2%	160.2%	-1.3%	34.6%	71.1%	32.7%	31.5%	84.1%	65.3%

All figures and ratios are calculated using Moody's estimates and standard adjustments. FYE = Financial year end. LTM = Last 12 months.
Source: Moody's Financial Metrics™

Exhibit 20

Moody's-adjusted debt breakdown

Vale S.A.

(in US Millions)	FYE Dec-18	FYE Dec-19	FYE Dec-20	FYE Dec-21	LTM Ending Jun-22
As Reported Debt	**15,466.0**	**14,847.0**	**15,027.0**	**13,782.0**	**12,608.0**
Pensions	656.0	695.0	641.0	204.0	204.0
Operating Leases	3,132.0	0.0	0.0	0.0	0.0
Non-Standard Adjustments	432.0	431.0	0.0	0.0	0.0
Moody's-Adjusted Debt	**19,686.0**	**15,973.0**	**15,668.0**	**13,986.0**	**12,812.0**

All figures are calculated using Moody's estimates and standard adjustments.
Source: Moody's Financial Metrics™

Exhibit 21

Moody's-adjusted EBITDA breakdown

Vale S.A.

(in US Millions)	FYE Dec-18	FYE Dec-19	FYE Dec-20	FYE Dec-21	LTM Ending Jun-22
As Reported EBITDA	**11,457.0**	**6,080.0**	**11,434.0**	**33,299.0**	**26,790.0**
Pensions	31.0	30.0	25.0	21.0	21.0
Operating Leases	1,044.0	0.0	0.0	0.0	0.0
Unusual	4,907.0	3,614.0	4,824.0	1,220.0	-1,285.0
Non-Standard Adjustments	182.0	681.0	1,020.0	1,271.0	828.0
Moody's-Adjusted EBITDA	**17,621.0**	**10,405.0**	**17,303.0**	**35,811.0**	**26,354.0**

All figures are calculated using Moody's estimates and standard adjustments.
Source: Moody's Financial Metrics™

Exhibit 22

Key financial metrics

Vale S.A.

	2018	2019	2020	2021	LTM (Jun-22)
INCOME STATEMENT					
Revenue	36,575.00	37,570.00	39,545.00	54,502.00	47,404.00
EBITDA	17,621.00	10,405.00	17,303.00	35,811.00	26,354.00
EBIT	13,467.22	6,950.00	14,293.00	32,912.00	23,592.00
BALANCE SHEET					
Cash & Cash Equivalents	5,784.00	8,176.00	14,258.00	11,721.00	7,185.00
Total Debt	19,686.00	15,973.00	15,668.00	13,986.00	12,812.00
CASH FLOW					
Capex = Capital Expenditures	4,474.78	3,788.00	4,361.00	5,189.00	5,535.00
Dividends	3,495.00	184.00	3,364.00	13,513.00	10,902.00
Retained Cash Flow	12,061.78	14,300.00	13,860.00	12,939.00	8,182.00
RCF / Debt	61.27%	89.53%	88.46%	92.51%	63.86%
Free Cash Flow (FCF)	5,867.00	8,373.00	6,700.00	6,918.00	703.00
FCF / Debt	29.80%	52.42%	42.76%	49.46%	5.49%
PROFITABILITY					
% Change in Sales (YoY)	7.68%	2.72%	5.26%	37.82%	-12.42%
SG&A % of Sales	2.17%	2.32%	2.16%	1.81%	2.17%
EBIT Margin %	36.82%	18.50%	36.14%	60.39%	49.77%
EBITDA Margin %	48.18%	27.69%	43.76%	65.71%	55.59%
INTEREST COVERAGE					
EBIT / Interest Expense	8.55x	5.57x	16.05x	41.04x	28.55x
EBITDA / Interest Expense	11.19x	8.34x	19.43x	44.65x	31.90x
(EBITDA - CAPEX) / Interest Expense	8.35x	5.30x	14.53x	38.18x	25.20x
LEVERAGE					
Debt / EBITDA	1.12x	1.54x	0.91x	0.39x	0.49x
Debt / (EBITDA - CAPEX)	1.50x	2.41x	1.21x	0.46x	0.62x
Avg.Assets / Avg.Equity	2.21x	2.18x	2.43x	2.59x	2.35x

All figures are calculated using our estimates and standard adjustments.

Source: Moody's Financial Metrics™

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