

SECTOR IN-DEPTH

4 February 2022



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ESG – Global

Environmental heat map: Updates to risk assessments for certain sectors

This report updates our [environmental heat map](#) to reflect changes in our assessment of the credit materiality of environmental risks for the sectors listed below following periodic reviews.

- » **Overall environmental risk moves to high from moderate for airlines.** Future carbon emission regulations will increase airlines' costs, particularly on international routes. The extent of competition across an airline's international network will influence its ability to pass higher costs on to passengers. The sector's waste and pollution risk (which does not capture carbon emissions) moves to moderate from high; airlines are moderate producers of waste and non-greenhouse gases.
- » **Overall risk moves to moderate from high for automotive suppliers.** Suppliers have less exposure to carbon transition risk than their automaker customers. Their customer diversity mitigates risk exposure to any one automaker. And many auto parts are used in both traditional combustion engines and alternative fuel vehicles.
- » **Overall risk moves to moderate from low for beverages.** Natural capital risk, a growing risk across sectors, also moves to moderate from low. Companies, particularly alcoholic-beverage producers, rely on specific ingredients, some of which are difficult to obtain or substitute.
- » **Natural capital risk moves to moderate from low for tobacco and restaurants.** Change in natural capital risk for tobacco and restaurants matches those of other sectors reliant on agriculture-based inputs. For restaurants, growing meat consumption in many countries has implications for natural capital.
- » **Consumer goods' waste and pollution risk moves to moderate from low.** Products' heavy packaging ends up in landfills, there is also a growing focus on a circular economy.
- » **Shippers' physical climate, natural capital risks move to moderate from high.** Extreme weather events may affect ports, but only causes delays to shipping operations.
- » **Water management risk moves to low from moderate for manufacturing, and retail and apparel.** These diverse sectors generally use little water and generate little waste water.

Assessing sector exposure to environmental risks: our approach

Our environmental risk heat map was developed by Moody's analytical teams and reviewed independently by our Credit Strategy and Standards and Environmental, Social and Governance groups. Our heat map provides a qualitative assessment of the overall credit materiality of environmental risks for each sector globally. We regard environmental risks as material if they result in visible pressure on the credit profiles of a broad set of issuers, either today or in the foreseeable future. In assigning an overall score, we considered a sector's exposure to environmental risks in their totality, as well as industrywide mitigants to these risks. Sector classifications are based on our rating methodologies and reflect only Moody's rated entities within a given sector.

To assess a sector's environmental credit risk, we first considered each sector's inherent (unmitigated) exposure to different categories of environmental risk and assigned a category score of very high, high, moderate or low to describe the sector's exposure to each risk category. We then took these category scores and any applicable sectorwide mitigating factors into consideration to assign an overall environmental risk credit score to each sector: very high risk, high risk, moderate risk or low risk (see Exhibit 1).

Exhibit 1

Our environmental risk scoring definitions

Overall Sector Environmental Risk Scoring

Our overall scores provide a qualitative assessment of the credit materiality of environmental risks for 89 sectors globally. In this context, we regard environmental risks as material if they result in visible pressure on the credit profiles of a broad set of issuers, either today or in the foreseeable future. In assigning a score, we consider a sector's exposure to environmental risks in their totality, as well as sector-wide mitigants to these risks.

VERY HIGH RISK

For sectors scored red overall, the credit materiality of environmental risks is considered "very high risk". As such, material pressures from environmental risks are visible for issuers' credit profiles currently, or there is a very high likelihood that these will crystallise in the future. There is also limited scope for most issuers to adjust to or manage these risks in the near term without major structural, financial and/or policy realignment.

HIGH RISK

For sectors scored orange overall, the credit materiality of environmental risks is considered "high risk". As such, credit pressures from environmental risks are present, or are likely to crystallise in the future, but are less influential for issuers' credit profiles compared to sectors scored red. There is also typically greater scope for issuers to adjust to or manage environmental risks; for example, by adapting business models, changing policies (in the case of governments), or by passing on expected cost increases to customers or taxpayers.

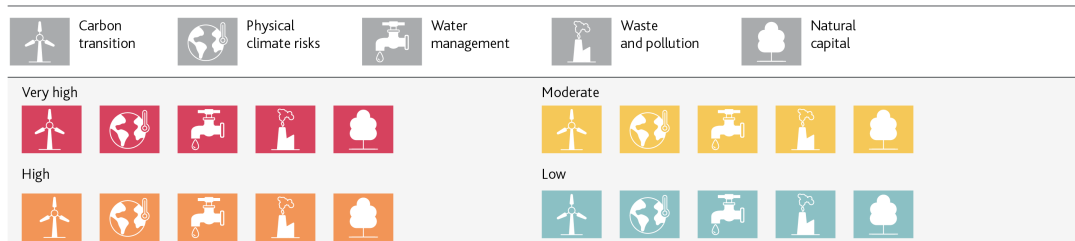
MODERATE RISK

For sectors scored yellow overall, the credit materiality of environmental risks is considered "moderate risk". As such, credit pressures from environmental risks are less pronounced, or are less likely to develop in a way that is influential in the future compared with sectors scored orange. Sectors have inherent exposure to one or more environmental risks, but there is a reasonable expectation that most issuers can adapt to or manage these risks over the medium term in a way that substantially mitigates the overall impact on credit quality.

LOW RISK

For sectors scored blue overall, the credit materiality of environmental risks is considered "low risk". As such, there is little pressure on issuers' credit profiles currently, and a low likelihood that they will manifest in the future. Low risk sectors may have some exposure to one or more environmental risks, but there is significant scope to adjust or manage these risks. Remediation is generally routine, costs can easily be passed along to customers or taxpayers, and/or regulations are unlikely to become meaningfully stricter over the foreseeable future.

ENVIRONMENTAL RISKS



Source: Moody's Investors Service

The debt amounts referred to in this report represent the total face amount of debt publicly rated by Moody's in each sector as of June 2020. They include both long-term obligations and commercial paper. We allocate debt instruments to sectors on the basis of the primary methodology/methodologies used in the rating process. For debt rated under multiple methodologies that fall within different sectors, we evenly distribute the face amount to each sector accordingly.

This publication does not announce a credit rating action. For any credit ratings referenced in this publication, please see the ratings tab on the issuer/entity page on www.moody's.com for the most updated credit rating action information and rating history.

Our environmental risk classification

Exhibit 2

Environmental considerations most relevant to credit quality



Source: Moody's Investors Service

Heat map sector index

Exhibit 3

Sectors listed alphabetically with overall environmental risk score and commentary page number

KEY: ● Very High Risk ● High Risk ● Moderate Risk ● Low Risk

Sectors	Overall Environmental Risk Score	Page	Sectors	Overall Environmental Risk Score	Page
Airlines	●	9	Mining - Metals and Other Materials, excluding Coal	●	7
Airports	●	14	Mortgage Insurance	●	31
Asset Backed Securities – Aircraft	●	15	Multilateral Development Banks	●	31
Asset Backed Securities - Auto Loans, Auto Leases, Floorplan, Car & Truck Rental	●	22	Not for Profit Hospitals	●	31
Asset Backed Securities - Credit Cards	●	22	Oil & Gas - Independent Exploration & Production	●	8
Asset Backed Securities - Equipment Leases and Loans	●	23	Oil & Gas - Integrated Oil Companies	●	8
Asset Backed Securities - Other (Solar)	●	23	Oil & Gas - Midstream Energy	●	11
Asset Backed Securities - Personal Loans	●	23	Oil & Gas - Oilfield Services	●	11
Asset Backed Securities - Railcar Leasing	●	23	Oil & Gas - Refining & Marketing	●	9
Asset Backed Securities - Small and Medium Enterprises	●	24	Packaging Manufacturers: Metal, Glass, and Plastics	●	17
Asset Backed Securities - Student Loans	●	24	Paper and Forest Products	●	18
Asset Backed Securities - Tobacco Settlement	●	15	Passenger Railways	●	32
Asset Backed Securities - Utility Cost Recovery Charges	●	24	Pension Funds	●	32
Asset Backed Securities - Wireless Towers	●	24	Pharmaceuticals	●	32
Asset Managers	●	25	Ports	●	18
Automobile Manufacturers	●	10	Power Generation Projects	●	19
Automotive Suppliers	●	14	Private Hospitals - Acute Care and Specialty	●	33
Banks	●	25	Privately Financed Public Infrastructure Projects (PPPs)	●	33
Beverage Industry	●	22	Property, Casualty and Reinsurance	●	19
Building Materials	●	10	Protein and Agriculture	●	20
Business Services	●	26	Public Sector Housing	●	33
Chemicals	●	6	Publishing	●	34
Coal Mining and Coal Terminals	●	7	Real Estate Trusts & Other Commercial Property Firms	●	34
Collateralised Debt and Loan Obligations - Project Finance and Infrastructure Assets	●	15	Regional and Local Governments - Advanced Economies	●	34
Collateralised Loan and Bond Obligations	●	26	Regional and Local Governments - Emerging Markets	●	20
Commercial Mortgage-Backed Securities	●	26	Regulated Electric and Gas Networks/Utilities with no Generation	●	35
Construction	●	26	Regulated Electric and Gas Utilities with Generation	●	20
Consumer Goods	●	27	Residential Mortgage-Backed Securities	●	35
Consumer Services	●	27	Restaurants	●	35
Covered Bonds	●	27	Retail and Apparel	●	21
Distribution and Supply Chain Services	●	27	Securities Firms and Market Infrastructure Providers	●	36
Education and Not-for-Profits	●	28	Semiconductors & Technology Hardware	●	21
Environmental Services and Waste Management	●	16	Shipping	●	11
Equipment and Transportation Rentals	●	16	Sovereigns - Advanced Economies	●	36
Finance Companies	●	28	Sovereigns - Emerging Markets	●	21
Financial Guarantors	●	28	Steel	●	12
Gaming and Gambling Industry	●	29	Surface Transportation and Logistics	●	12
Health Insurance Companies	●	29	Telecommunications	●	36
Homebuilding and Property Development	●	29	Title and Trade Credit Insurance	●	37
Insurance Brokers and Service Companies	●	29	Tobacco	●	22
Life Insurance	●	30	Toll Roads	●	37
Manufacturing	●	17	Trading Companies	●	38
Mass Transit	●	30	Unregulated Utilities and Power Companies	●	13
Media & Entertainment	●	30	Water and Wastewater, US Municipal Utilities, and State Revolving Funds	●	38
Medical Products and Devices	●	31			

Source: Moody's Investors Service

Detailed heat map by sector

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Very High Risk

Chemicals



Key Issue:
Overall environmental risk is very high because many of the companies in this industry utilize or create toxic or hazardous feedstocks, intermediates or by-products during the production process.

Total Debt:
\$536 billion

Overall environmental risk is very high because many of the companies in this industry utilize or create toxic or hazardous feedstocks, intermediates or by-products during the production process. However, the industry is extremely diverse with a minority of companies having no exposure to toxic or hazardous products. More stringent regulation of waste and pollution, water management and natural capital will continue to increase costs, but regional variations are potentially meaningful, with the most stringent requirements currently in Europe and North America and a recent step-up in environmental enforcement in China. There are additional liability risks, for example in the US, when a company has been designated as a "Potentially Responsible Party" at one or more superfund sites that have not entered into consent decrees with the state or federal Environmental Protection Agencies (EPA).

Chemicals can range from toxic or hazardous chemicals such as formaldehyde to relatively benign products such as salt. However, this industry sector has very high environmental risks because of the high proportion of companies that use or produce hazardous or toxic materials, the large consumption of energy and water, elevated greenhouse gas emissions and the volume of hazardous or carcinogenic waste generated. Chemical companies can be exposed to changes in environmental regulations or government policies. Producers of chemicals face litigation risk and remediation cost for natural capital if accidents, leaks and exposures occur during manufacturing, storage and distribution, or if new science identifies adverse impacts from chemical products on the environment. Regulations may ban the use of certain products that are found to be harmful to the environment or human health, or favour others either deemed or perceived to be more environmentally friendly. Increasing soil, air and water pollution regulations have been and are likely to remain the main environmental risk to the sector, but regulations and legal liability vary considerably from country to country. Exposure to water management is more universal because large volumes of water are required to cool process equipment and are lost to evaporation. Process water must be fairly clean to be used but may become contaminated by the chemicals being produced. Companies occasionally face unplanned production downtime linked to operational problems or adverse weather effects, such as hurricanes or floods, which can also affect the supply of chemicals intermediates.

Companies in the chemical industry are also significant producers of greenhouse gases. Many companies, in particular highly energy-intensive petrochemical companies, will be affected by current and evolving carbon emission regulations. The largest emissions come from the direct or indirect production of energy and steam to run chemical processes that creates a large amount of carbon dioxide. Also some chemical production processes like ammonia create roughly 2.5 tonnes of carbon dioxide for every tonne of ammonia. The production process for carbon black produces even more carbon dioxide per tonne of carbon black. The EPA also cites carbon black as a solid particle or aerosol, not a gas, that contributes to warming of the atmosphere. The chemical industry also produces other greenhouse gases like nitrous oxide and fluorinated gases that are emitted by downstream industries or applications.

Many chemical companies have a very large scale and diversity of products and markets, which mitigate their exposure to environmental risks. Specialty producers, which use chemical commodities/intermediates as raw materials, are indirectly exposed to waste and pollution and carbon emissions regulations that commodity producers face.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Very High Risk**Coal Mining and Coal Terminals**

Key Issue:
Reduced global demand as the use of renewables expands and waste and pollution rules tighten; pressure on contractual counterparties of coal terminals

Total Debt:
\$10 billion

Environmental risks limit and contribute to downward pressure on the ratings of coal companies. While thermal and metallurgical coal prices held up well in 2017 and 2018, thermal coal prices began to weaken meaningfully in 2019 and both grades weakened substantially in 2020. The pressures are incorporated into our forward view of coal producers' revenues and margins. However, the specifics vary by region and type of coal, particularly with respect to intensifying issues related to access to capital. Global demand and policy support for clean energy is detrimental to the carbon-intensive coal industry. Challenges are global, but demand in North America and Western Europe is contracting rapidly. The US coal industry remains particularly pressured. Natural gas pricing remains low compared with historical levels, resulting in most new electrical generation being gas-fired. According to the US energy information administration, coal-fired electrical generation fell from around 50% of electrical generation in the late 2000s to 24% in 2019. Coal took the brunt of the hit during the early months of the coronavirus crisis, with its share falling below 20%. We expect a modest uptick in 2021 followed by a continued decline toward around 10% by 2030. Extensive regulations are aimed at curbing air and water pollution by coal-burning plants. Political efforts could significantly accelerate the pace of decline in demand for thermal coal. Coal terminal projects obtain their revenue under ship-or-pay contracts with coal producers that typically pay for the service irrespective of volumes shipped. A gradual reduction in the growth in demand for thermal coal in particular would ultimately be reflected in lower prices and reduce coal mines' capacity to meet their take-or-pay obligations to the terminals. At the same time, increasingly onerous environmental restrictions will affect the operating regime of coal mines or terminals, or both; and expansion of mined areas may not necessarily be pursued or could be subject to judicial challenges. These issues could materially affect the profitability of coal producers over the long term, though the quality of Australian thermal coal and export of metallurgical coal through these terminals could mitigate that trend.

Very High Risk**Mining - Metals and Other Materials, excluding Coal**

Key Issue:
Main environmental risks include impacts on soil and water (including the availability of water for mining activities), waste and pollution management and physical climate risks.

Total Debt:
\$253 billion

Environmental risk is "Very High" for the global metals and mining industry. The most significant risk category is natural capital, for which the risk is "Very High", because of the physical degradation related to mining operations and risks relating to successful reclamation following the completion of mining-related activities. Waste and pollution risk is "High" because mining disasters can significantly damage the environment and increase regulatory scrutiny in a way that cascades across the entire industry. The industry continues to develop recycling capabilities and invest in strategies to reduce non-CO2 emissions. Leaks, spills and tailings dam incidents are company-specific, but international organisations and regulatory bodies have increased standards and reporting frameworks that have forced companies to adhere to stricter environmental regulations. Physical climate risk is "High" because mining operations have varying exposure to climate change, heat stress, water stress, flooding and other concerns, based on location, that can lead to disruptions such as tailings dam collapses. Water management risk is "High" because mining companies compete for limited water resources with local communities or other industries such as agriculture for mining operations that often use significant amounts of water. The industry continues to focus on increasing recycled water use and invest in processes that reduce the use of water or allow for the use of sea water through desalination. Carbon transition risk is "Moderate" because certain mined products (such as iron ore) will be challenged by decarbonisation trends, while others could see benefits, particularly metals such as lithium, copper, cobalt and nickel, which are used in batteries in growing areas such as electric vehicles and energy storage. However, investment in new capacity could bring new environmental challenges, particularly if mine development is accelerated to meet a rapid expansion in demand.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Very High Risk**Oil & Gas - Independent Exploration & Production**

Key Issue:
Environmental regulations increase costs and place limits on where companies can explore for new resources.

Total Debt:
\$365 billion

Exploration and production companies contend with the effects of increasing environmental regulations on their operations, as well as limitations on where they can explore for new resources. Oil, their primary product, is an energy-intensive, high-carbon emitter, but natural gas consumption produces lower CO2 emissions than other hydrocarbons. Regulations have gradually increased operational and investment costs in recent years. While we do not foresee meaningful product substitution in the near-to-medium term, carbon transition risk will reduce demand over the longer term through the increasing availability and adoption of alternative energy products. This creates medium-term risks for the valuation of reserves and – particularly for smaller companies with high leverage – the availability of credit. However, carbon regulations could also favour natural gas over coal and, to a lesser extent, oil. The sector's operations are exposed to industrial accidents, spills and disasters, particularly offshore. Such events can have a high-severity impact on an issuer's credit profile, but are very rare. Hydraulic fracturing has raised general environmental and water use concerns, and certain countries, states and municipalities have banned the practice. However, in the US and other countries where it has generally been allowed, the upstream industry has been able to navigate these risks to date. Given that exploration and production companies have to continuously deal with high volumes of produced, flowback and polluted water, good policies and processes need to be in place to safely dispose of, recycle and manage water. In addition, producers are often required by law to restore natural landscape to its original state and remove infrastructure where applicable. We consider environmental compliance costs and related capital investment requirements in our forward view of issuers' margins, returns and cash flow.

Very High Risk**Oil & Gas - Integrated Oil Companies**

Key Issue:
Increased regulation of operations and the quality/content of fuels produced; spills and other disasters; restrictions on access to new resources; transition to low-carbon energy.

Total Debt:
\$799 billion

Integrated oil and gas companies (IOCs) face a combination of upstream (exploration and production) and downstream (refining and marketing) operational and regulatory risks. Such companies are most likely to have complex offshore drilling operations and are the most visible and scrutinised industry participants. IOCs are better able to manage complex operating risks, support/absorb regulatory spending and withstand disasters than most issuers in other oil and gas subsectors because of their greater scale, diversification and integration benefits. However, ever increasing investor, capital markets and societal pressure to decarbonise the global economy poses a material and gathering threat. Substantial investment is needed over a number of years to adapt business models and successfully transition to the low-carbon economy. In upstream, IOCs face increasing environmental regulation of their operations and restrictions on access to new resources. Downstream faces stricter regulation of fuel quality/content, refining facility air/water emissions and safety oversight. As primary products, both oil and natural gas are energy-intensive, high carbon emitters. While uptake of renewable fuel sources for power generation has grown rapidly, meaningful product substitution remains a longer-term risk. Upstream operations are very exposed to industrial accidents, spills and disasters, particularly offshore. Downstream is exposed to plant accidents, disruptions and pipeline ruptures. IOCs are the industry participants that are best equipped to manage large upstream projects, alter refined product slates and upgrade facilities to meet evolving regulations and fuel specifications. Some IOCs have also started to invest in low carbon energy businesses. Adjusting business models to a low-carbon energy future will require material investments, mitigated by the long time horizon of the expected energy transition.

Carbon
TransitionPhysical
Climate RisksWater
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Capital

Icon color key:

Very high

High

Moderate

Low

Very High Risk**Oil & Gas - Refining & Marketing**

Key Issue:
High environment-related regulatory spending requirements. Key risks are waste and pollution and the carbon transition, both at a very high score. Water management and physical climate risks persist.

Total Debt:
\$68 billion

The global refining and marketing industry has been subject to increasing environmental regulations and mandates that require companies to make substantial investments in their assets, often without compensation in the form of higher product prices. The trend toward stricter requirements for air, water and carbon emissions, as well as product specifications such as lower sulfur content, is likely to continue, and pressure to decarbonise the global economy is likely to dampen demand for refined products in the longer term. Carbon transition could pose existential risks to some refiners based on long-term demand declines. Demand has peaked in Western Europe and could do so in the US in the next few years, which would accelerate consolidation and capacity reductions in these regions. Refiners will face the choice of incurring mandatory expenditure or closing a refinery that does not meet the more stringent requirements, and we therefore expect further differentiation of winners and losers. Refiners with better geographic asset diversification, larger crude distillation capacity, high chemical feedstock production capacity, product slate flexibility and better EBIT/total throughput margins are better placed to cope with changing requirements and environmental and disaster risks in the sector which, while infrequent, can be severe and have historically resulted in rapid rating downgrades for some issuers. Single-site – particularly inland – refiners with lower margins are most vulnerable to environmental risks. Although the US and Europe currently have the strictest environmental standards, standards in Asia are evolving toward global standards. We incorporate expectations of higher operating costs, continuing mandatory capital expenditure and competitive pressures into our assessment of an issuer's business profile and our forward view of cash flow.

High Risk**Airlines**

Key Issue:
Future carbon and air emission regulations will increase airlines' costs, particularly on international routes

Total Debt:
\$86 billion

Forecast annual improvements in the fuel efficiency of the global commercial aircraft fleet of around 1%-2% will not offset expected post-coronavirus annual traffic growth of about 4%. The industry's fuel consumption will grow. Carbon emissions will rise, particularly because production capacity for sustainable aviation fuel (SAF) will remain grossly insufficient, creating a growing cost burden from carbon and emissions regulations. The International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and the European Union's Emissions Trading System (ETS) are the main carbon emissions regulatory schemes with which airlines will need to comply. CORSIA covers emissions from flights between participating countries, of which 85 or more have agreed to adopt CORSIA in 2021. ETS will cover flights by airlines within EU airspace. Domestic emissions regulations in non-EU countries may be governed by the Paris Agreement, though few countries have implemented such schemes to date. CORSIA will use airlines and the industry's 2019 emission levels as the baseline for determining future excess emissions. Pursuant to CORSIA, carbon offset costs would have been incurred from 2021 while purchases of offsets were due to start by 2024, if not sooner, on an elective basis by airlines. However, we expect few airlines will be required to purchase offsets pursuant to CORSIA until their flight and passenger volumes recover to pre-COVID-19 pandemic levels. Passenger airlines, particularly larger carriers, remain well-positioned to meet challenges for at least the next five years. Many carriers will increase investing to modernize their fleets, starting in 2022, supporting the expected modest annual improvement in the global fleet's fuel efficiency. However, the recovery in global demand for air travel will make it difficult for the industry to meet CORSIA's target without the purchase of growing volumes of offsets each year, starting in 2023 for some, and spreading across global airlines thereafter. The extent of competition across an airline's international network will influence its ability to pass higher costs on to passengers. Market prices for offsets will become more transparent with growing demand, potentially lowering the current wide range of carbon offset costs across the globe. Voluntary purchases of carbon offsets and or SAF credits by customers (business and leisure) will help offset some of the increased costs. Because countries' implementation of the Paris Agreement is unclear, it is not possible to estimate the extent of exposure for purely domestic airlines outside the EU.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

High Risk**Automobile Manufacturers**

Key Issue:
Stricter CO2 emission requirements and fuel economy standards are the sector's main sources of environmental risk

Total Debt:
\$555 billion

Meeting emissions requirements, particularly those relating to CO2, is one of the most pressing and challenging objectives that the auto industry is facing. Although specific standards are regional, virtually all major automotive markets are tightening standards, making this a global issue for the industry. Automotive ratings incorporate the sizeable level of capital investment and R&D expenditure that the industry must maintain irrespective of cyclical upturns and downturns. These expenditure levels have to be maintained in part because of the dictated timetables for meeting regulatory thresholds, but also to meet consumer demand for performance, safety, reliability and innovation. As countries and large cities come under pressure to address climate and air pollution issues, we expect environmental regulations on newly produced vehicles to continue to tighten and drive the shift toward electrification. Over the past two years, automotive manufacturers have taken mitigating action in terms of developing and successfully launching new, more carbon friendly models, especially battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEV). This has already substantially improved carbon emissions and resulted in a good level of compliance with stricter regulatory standards (such as the EU, since 2020). Some countries have additionally offered sales incentives for the purchase of low-carbon vehicles, such as BEVs or PHEVs. These programmes are typically limited but will help automakers to increase volumes of new BEVs and PHEVs in the early phase after the product launch.

Following two years of rapid growth, BEVs and PHEVs on the road are relatively new and are not expected to be retired in size in the next few years. With the fleet gradual ageing, however, waste management will become more important. The recycling of old electrified vehicles, especially the batteries, becomes more relevant, and related regulation could lead to additional challenges for automakers. Dedicated recycling and reusing strategies of automakers are, however, mitigating these risks.

High Risk**Building Materials**

Key Issue:
Environmental risk largely stems from the potential for damage to the ecosystem from the creation of building materials as well as the costs of complying with air and carbon regulations.

Total Debt:
\$90 billion

Natural capital risk and waste and pollution risk are high because the production of building materials often requires quarries and pits, which may alter the natural landscape, and stricter air pollution standards could increase costs. Carbon transition risk is moderate, mainly because cement producers make up a small proportion of the building materials companies that we rate; for most such issuers, cement production is one of many business units. Cement producers are by far the most exposed to the risk of carbon emissions legislation. Profitability and cash flow generation for these companies could be at significant risk if compliance costs cannot be passed on to customers, though disparities in regulations and associated costs are likely to favour some producers and create competitive challenges for others. For now, the lack of alternative materials mitigates the potential increase in cost associated with future environmental regulations. While changes in the cement production process (lower clinker-to-cement ratio, lower thermal energy intensity and a higher share of bioenergy and renewable waste) could help reduce carbon emissions, a real break-through requires large-scale deployments of innovative technologies, primarily carbon capture, utilisation and storage (CCUS). Although a number of efforts and pilot projects have been implemented in recent years, we do not expect a large-scale commercial deployment of CCUS before 2025. Several policy and private-sector efforts around the globe, such as China's 13th Five-Year Plan (2016-20) and India's Perform, Achieve and Trade (PAT) scheme, are promoting reductions in energy use and carbon emissions in the cement sector. In Europe, the cement sector, which is covered by the EU emissions trading system, will see a quicker reduction in free CO2 allowances in Phase IV (2021-30) of the ETS, incentivising producers to speed up decarbonisation. At the same time, many of the product categories used in the construction of residential and commercial buildings are significantly less energy-intensive and emit less CO2 in their production than cement. Certain building materials companies have developed product portfolios that reduce the energy intensity and energy consumption of buildings. These companies would benefit from increasingly stringent regulations targeting a reduction in greenhouse gas emissions.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

High Risk

Oil & Gas - Midstream Energy



Key Issue:
High carbon transition risk is likely to reduce demand for oil and gas and gradually reduce traditional midstream volumes and growth opportunities. High exposure to waste and pollution relates to oil spills and pipeline incidents.

Midstream energy is mainly an oil and gas transportation and processing business whose activity level is essentially a derivative of upstream exploration and production (E&P) development and production. The sector has significant carbon transition exposure as economies pivot away from oil and natural gas in the coming decades, but the pace of the transition is likely to vary among the commodities the sector transports. Oil is an energy-intensive, high-carbon emitter, even though natural gas causes lower, but still meaningful, CO2 emissions than other hydrocarbons. Very high carbon transition risk for the E&P sector directly influences that of the midstream sector because it will reduce oil and gas demand in the long term by favouring alternative energy products, which most midstream companies are currently not favourably exposed to in a material way. Regulations to preserve natural capital can change the competitive dynamics of specific basins and the midstream companies that serve them. As a result, scale and diversity are important factors in considering individual issuers' exposure to environmental risk. Oil pipeline spills are infrequent, but potentially expensive and reputationally damaging. Regulatory scrutiny of methane emissions across the production (E&P) and processing chain has increased. However, physical climate risks for midstream companies are moderate because they generally have assets that are either spread out over large areas (such as hundreds of miles of pipelines) or individually do not constitute a large portion of revenue by themselves.

Total Debt:
\$401 billion

High Risk

Oil & Gas - Oilfield Services



Key Issue:
Potential costs associated with carbon regulation laws, legal liabilities and reputational damage as a result of catastrophic spills and other disasters.

Oilfield services companies generally face environmental risks similar to those of the exploration and production (E&P) companies that are their customers. E&P companies hire the services companies to find, develop and produce oil and natural gas resources. A dampening of demand for oil because of environmental concerns would reduce demand for services and weaken the pricing power of the services companies. As a result, services companies are price takers and usually worse-hit when their producer customers' cash flow weakens. However, we expect some of the large services companies with technology know-how to transition at least a portion of their service offering toward renewable energy development. In addition, the potential increase in the service intensity of hydrocarbon production as unconventional drilling to some extent replaces drilling for conventional resources could help to offset the effect of weakening demand for hydrocarbons. Service companies generally obtain indemnification from their E&P customers for most drilling and other services-related activity, and particularly for high-risk endeavours, thereby minimising their exposure to potential legal claims or regulatory scrutiny. Nevertheless, a catastrophic spill or other event (such as the Macondo blowout) could carry substantial financial liability. At the very least, such events can temporarily impair a service company's ability to do business as usual, tarnish its reputation and pressure its credit metrics. Service companies have historically been able to pass on incremental environmental and/or regulatory costs to their customers.

Total Debt:
\$141 billion

High Risk

Shipping



Key Issue:
Carbon transition risk is rising as the industry and regulators seek to reduce emissions

Shipping is exposed to carbon transition risk as the industry and regulators seek to reduce the carbon footprint of the sector, for example through installing equipment that reduces fuel consumption and emissions or the use of alternative fuels such as methanol or liquified natural gas. However, the industry is at an early stage of transitioning with very limited use of alternative fuels, a risk of tightening regulation and uncertainty regarding future dominant propulsion and fuel technologies. Exhaust regulations (for traditional pollutants such as SOx and NOx, as well as CO2) are the biggest drivers of regulatory tightening for the sector, but recycling of old vessels is also an environmental concern. The risk of spillage, especially for liquids carriers such as crude tankers, as well as marine ecology protection (ballast water) add to environmental risks. Rated companies focused on inland transportation also face additional climate-related risks such as low river water levels, for example driven by lower rainfall, causing lower transportation volumes or higher cost.

Total Debt:
\$15 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

High Risk

Steel



Key Issue:
Steel makers in countries with increasingly stringent requirements are likely to face heightened costs

Total Debt:
\$90 billion

The global steel sector is viewed as having high environmental risk, particularly with respect to carbon transition risk and waste and pollution (though in many areas of operation this risk is highly regulated). Steel companies that operate blast furnaces are more exposed to carbon transition risk from a Scope 1 perspective than Electric Arc Furnace (EAF) producers, though they have Scope 2 exposure because of high electricity requirements. While the industry has been able to reduce carbon emissions through better energy efficiency, new technologies such as Carbon Capture and Storage will be needed to make further material advances. In addition, the move to lighter-weight materials, such as aluminium in the automotive industry, will have a market impact and could lead to less intensity in steel usage. However, the development of high-strength steels provides some mitigant to the degree of market erosion. Environmental risks in the industry vary widely around the world, with regulatory requirements in the US and Europe being further advanced. Chinese steel producers, with over 50% of global steel production, most of which is blast furnace production, remain more exposed to environmental credit risk because of rapidly increasing regulatory requirements, particularly for carbon and air quality emissions. The growth of EAFs to replace blast furnace production is expected to continue, with a more significant transition outside the US, where it already accounts for around 70% of steel production. However, the transition will be slow and require new capital investment, as well as sufficiency of scrap supply.

High Risk

Surface Transportation and Logistics



Key Issue:
Stricter emission standards, lower demand for freight exposed to environmental risks, notably coal

Total Debt:
\$271 billion

The sector primarily consists of trucking, railroad and parcel delivery companies, which are heavy users of diesel fuel. Trucking is a highly competitive business with low barriers to entry, and is therefore sensitive to increases in costs, particularly fuel costs and the cost of upgrading fleets to trucks with new emission technologies. Road freight transport is responsible for an estimated 5% of global CO2 emissions, elevating the risk of more stringent regulatory standards and other government policies that aim to convert freight from road to rail. Concerns over the impact on air quality of nitrogen oxide and particulate matter in diesel engine emissions have also prompted a number of European local governments to ban diesel vehicles that do not meet certain emission standards. Rail transport is more energy fuel-efficient and much less fragmented. However, its infrastructure is more exposed to physical climate risks such as flooding, severe winter weather and bushfires, and rail accidents (such as derailments of rail tank cars with oil or other hazardous materials). Rail transport is also affected by lower demand for bulk freight exposed to carbon transition risk, particularly coal, but also crude oil and frac sand. Coal exposure can vary notably by region, however. Similar to trucking, new emissions standards have increased the cost of new locomotive purchases.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

High Risk**Unregulated Utilities and Power Companies****Key Issue:**

Policy pressure to cut emissions continues to disrupt business models and pressure margins of unregulated utilities and power companies in mature economies. The composition of the sector's output and profitability has shifted favourably towards renewables in recent years

Total Debt:
\$542 billion

Unregulated power and utility companies are exposed to the effects of the carbon transition on electricity prices, fuel and environmental costs, and investment requirements across generation networks and customer-facing activities. Offsetting these pressures, utilities are likely to benefit from increased demand from the electrification of heating, transportation and industry to support decarbonisation of the broader economy. The net effect of decarbonisation depends on the share of generation in the business mix, generation technology and geographic location. The pressure to decarbonize and timeline for doing so will be affected by regulation, policies and physical potential for renewables in each market. In general, however, coal plants are most vulnerable, followed by gas-fired plants, while renewables and other low-carbon generation energy sources are likely to grow. Electricity transmission and distribution networks, which in Europe are often among the largest sources of earnings for these companies, face lower carbon transition risk as their services will be required regardless of the type of generation being used. The composition of the sector's output and profitability has shifted favourably in recent years. In Europe, the output share of coal has fallen sharply, while that of wind and solar has grown. In some cases, compensation mechanisms may mitigate the credit impact of coal retirements. Earnings from selling electricity at market prices now represent a small share of these companies' profits, while earnings from subsidised renewables and regulated networks have grown. Unregulated power companies in Asia are also rapidly shifting from coal-fired to renewable generation; renewables account for the majority of capital expenditure among the Chinese companies that we rate. The growth of the "yieldco" sector in the US, with its focus on renewables, and widespread coal plant closures among traditional unregulated power companies have increased the number of US companies in the sector with low- or zero-carbon emissions. Restrictions on non-carbon air pollutants can impose significant compliance costs on thermal generators, while nuclear generators in some regions have full or partial responsibility for long-term storage of nuclear waste. These utilities also face physical risks associated with climate change. For example, hydro generators and water-cooled thermal plants may suffer from lower output during periods of low rainfall. Conversely, all generators in hydro-dominated markets may be affected by lower electricity prices during unusually wet periods. These utilities are also subject to weather-related disasters and other catastrophic events, including nuclear accidents and natural gas pipeline explosions, as well as an escalation of environmental remediation and nuclear storage costs.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Automotive Suppliers**

Key Issue:
The risk to automotive parts suppliers is related to their automotive manufacturer customers' ability to meet increasing emissions regulations. Although this effect will be mitigated for those parts suppliers with products that are agnostic to the type of propulsion used in a car.

Given Moody's view that the parts supplier sector less is negatively impacted by CT than the OEMs as our rated parts suppliers benefit from a very diversified customer structure among the OEMs and are able to mitigate any challenge from one single OEM regarding its compliance to emission regulation we revise our risk score to Moderate from High. The change also considers that many products are agnostic to the propulsion technology.

Total Debt:
\$119 billion

Moderate Risk**Airports**

Key Issue:
Air Pollution, carbon and disaster risks offset by cost pass-through ability and steady demand

A reduction in passenger numbers if more stringent air emissions and carbon regulations for airlines significantly increase airfares is the primary risk to airports. Such a development would have the greatest impact on airports where increased travel costs make other alternatives more competitive, particularly where these increased costs are faced by smaller and less efficient airlines. Regulation can help mitigate this risk. Airports may face more regulation in respect of air quality, including noise pollution, in and around airports. They also face risks in the form of exposure to soil pollution from fuel leaks, de-icing fluids and by-products from fire-fighting activities. Natural disasters can temporarily reduce volumes. New airports and airport expansions face increasing environmental hurdles and compliance requirements, particularly those situated in more environmentally sensitive locations. The sector is generally able to pass on added costs from these exposures to airline counterparties, depending on the jurisdiction and the airport's competitive position. Growth in demand for air travel, particularly on long-haul routes, which are most exposed to the costs of carbon legislation, is likely to remain steady, resulting in increased carbon costs with growing passenger volumes.

Total Debt:
\$172 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Asset Backed Securities - Aircraft**

Key Issue:
Future carbon and other air emission regulations could decrease collateral values over time

Pooled aircraft financings are long-lived deals. Future carbon and fuel-efficiency standards for airplanes could make older and fuel-inefficient aircraft more expensive to operate or require retro-fits that may still make them less attractive to airlines. This could relegate older aircraft to airlines with lower credit quality, or those operating where regulations have not been implemented.

Total Debt:
\$4 billion

Moderate Risk**Asset Backed Securities - Tobacco Settlement**

Key Issue:
Further regulation and weather events pose moderate risks for tobacco settlement ABS

Future regulation regarding second-hand smoke could reduce cigarette consumption, thereby reducing the revenue available to repay tobacco bonds. Severe weather events may also pose supply chain issues that can potentially reduce revenues.

Total Debt:
\$7 billion

Moderate Risk**Collateralised Debt and Loan Obligations - Project Finance and Infrastructure Assets**

Key Issue:
Increased exposure to power-generation projects and the oil and gas sectors in new CDOs elevates environmental risks for the overall sector

We have raised the sector's overall score to moderate because of increased exposure to power-generation projects and oil and gas exposures in new CDOs. However, the environmental risk still largely depends on the portfolio composition of each individual transaction. Risk remains low for portfolios with significant exposure to public-private partnerships, regulated water utilities and regulated electric and gas networks sectors (please see commentary under Privately Financed Public Infrastructure Projects (PPPs), Regulated Water Utilities and Regulated Electric and Gas Networks). Portfolios with higher exposure to project finance and infrastructure linked to higher-risk sectors (power-generation projects and oil and gas) will have a higher risk in respect of carbon transition, waste and pollution, natural capital, water management and physical climate risks (please see commentary under Power Generation Projects and Oil and Gas). Furthermore, because of the somewhat concentrated nature of PF CDOs, these deals have a higher exposure to environmental risks than other types of CDOs.

Total Debt:
\$6 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Environmental Services and Waste Management**

Key Issue:
Regulations increase costs and demand for services; human errors or accidents involving hazardous materials or waste

Total Debt:
\$84 billion

The environmental services and solid waste management sectors are both subject to stringent regulation and monitoring. Regulation is led by the Environmental Protection Agency (EPA) and carried out through the Resource Conservation and Recovery Act (RCRA), which establishes a framework for legally enforceable requirements for landfill management. Subtitle D of the RCRA governs non-hazardous solid waste management with state and local governments as the primary regulatory authorities. Subtitle C of the Act oversees hazardous solid waste and is monitored by the EPA. Accordingly, landfills face siting restrictions as well as regulations on design, emissions, content of waste deposited, maximum capping, closure and post-closure procedures, in addition to requirements in certain jurisdictions to set aside provisions for post closure maintenance liabilities. For the environmental services sector, however, there are the additional aspects of collection, transportation, treatment and disposal of hazardous materials or waste, which inherently create much higher potential for remediation and headline risk – mostly related to disasters caused by human error. The industry uses surety bonds, letters of credit and insurance policies to help protect itself from potential environmental damages. Partially offsetting these risks to waste management and environmental services issuers are the industry's high barriers to entry, including the high cost and complexity of obtaining regulatory permits, required in-house expertise on hazardous and radioactive waste laws and regulations, and high initial capital spending, as well as the likelihood of public opposition to new landfills. Landfill regulations vary from state to state as the EPA sets minimum national compliance standards. Also, while there have not been any significant changes in regulations in recent years, cell construction costs continue to rise. Increased regulation will increase compliance costs, but demand for services will increase with more industrial waste streams being regulated into landfills, with expectations that benefits should outweigh the costs.

Moderate Risk**Equipment and Transportation Rentals**

Key Issue:
Equipment rental companies change portfolios every three-to-four years, allowing them to adjust to new environmental standards

Total Debt:
\$48 billion

The large capital programmes, along with only three-to-four year equipment holding periods, help ensure that rented equipment meets recent pollution standards. As a result, this shared equipment model helps lower overall pollution versus ownership. When regulation causes changes, companies are forced to buy the new equipment and adjust to the new standards. On the negative side, rental equipment has to be transferred to new locations. Moreover, even though the equipment often burns fuel, it is more efficient than using smaller more polluting equipment.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Manufacturing**

Key Issue:
Diverse sector with some risks from waste and pollution and carbon transition risk, particularly when offshored to countries with less-developed environmental regulations.

Total Debt:
\$1,201 billion

Manufacturing is a broad sector with generally moderate environmental risk, although certain sub-sectors and issuers may have greater exposures to waste and pollution, natural capital, and water management – and the resulting costs of cleanup. However, well understood regulation and active compliance in most developed nations reduce the risk of unexpected cleanup costs. When manufacturing/assembly is offshored to countries that have less rigorous standards, regulatory costs are reduced but cleanup risks and exposure to carbon taxes that increase transportation costs are potentially higher. The impact of these risks to high-value manufacturing, including aerospace and defence, communications equipment, medical devices and consumer durables, is lower because cost increases from increased regulations can generally be passed along to consumers. Manufacturers can typically absorb disruptions from physical climate risk, at least for short-term events, and the industry has shown flexibility in restoring just-in-time supply chains, as demonstrated after the heavy hurricane season of 2017. Certain specific sub-sectors may face other environmental challenges – for instance lower demand at Brazilian manufacturers of hydro-electric equipment during drought conditions in recent years.

Moderate Risk**Packaging Manufacturers: Metal, Glass, and Plastics**

Key Issue:
Primary risk is the use of plastic resin; increasingly trend toward recyclability

Total Debt:
\$121 billion

The use of plastic resin is the primary risk in the sector. Risks of plastic resin include Bisphenol A (BPA, which has been cited for safety concerns and has been banned for use in baby bottles in Canada and the European Union), recyclability and lack of decomposition. Manufacturing of metal, glass and plastic containers is energy-intensive and thus exposed to increased cost from carbon regulations. Recycling requirements vary widely by jurisdiction, and some products, such as plastic bags and Styrofoam cups, have been banned in certain jurisdictions. There is an increasing trend toward recyclability, using biodegradable substrates and regulation around marine and landfill pollution. Additionally, some companies in the sector have legacy environmental liabilities for the operation of non-packaging operations they previously owned. Although the use of plastic resin entails the risks outlined above, these risks are moderate overall and can be remediated, but changing products, regulations and consumer preferences could create winners and losers over the longer term. Manufacturers have already identified biodegradable substitutes for resin, but these have not yet been adopted because there has not been a regulatory requirement to do so and there is an added cost. Overall, we believe increased costs will be passed on to consumers, since they are generally small in relation to the products that are stored in/protected by packaging.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk

Paper and Forest Products



Key Issue:
Moderate physical climate, natural capital, water management and pollution risks are partially offset by the industry's established sustainability practices and low carbon transition risks.

Total Debt:
\$76 billion

While the paper and forest products industry is exposed to environmental risks, we do not expect a material impact on the overall credit quality of most companies over the next five to ten years. Most rated companies in the industry have established expertise and a strong track record of obtaining fiber from sustainable sources and in maintaining compliance with environmental regulations. Increased consumer commitment to sustainability, including a focus on the circular economy, carbon sequestering and repurposing waste to extend product lifespans, is likely to further benefit most firms in this industry. For example, most paper and packaging producers offer recyclable fiber-based alternatives to single-use plastic products, such as plastic bags and cups. The main environmental risks that could disrupt operations and/or the supply of fiber include wildfires, floods, hurricanes and insect infestations. While most producers have invested heavily in technologies and capital upgrades to reduce environmental impacts, human error or defective operations could lead to toxic air emissions, waste water or chemical spills, which could result in fines or clean-up costs. Rules and regulations in regions where most rated companies obtain their fiber ensure that working forests are harvested on a sustainable basis and that the habitat is protected. While the industry is relatively energy-intensive, it is also the biggest industrial user of self-generated renewable energy. The primary inputs, fiber and the bio-energy derived from residual wood fiber, are renewable and infinitely available. In addition, the end products (i.e. paper boxes, lumber) are reusable and/or recyclable after their initial use. Scale and geographical diversity are additional considerations in analyzing the impact of environmental risks on issuers.

Moderate Risk

Ports



Key Issue:
Emissions of machinery and vessels lowered by regulations; coastal location risks, but port infrastructure is resilient to severe weather

Total Debt:
\$40 billion

Areas encompassing ports experience emissions generated by truck carriers, terminal equipment operators and ocean carriers burning diesel or bunker fuel. Certain ports have been required to upgrade truck carrier engines to reduce emissions, electrify terminal areas to support electric-powered handling and ship-to-shore crane equipment, and request waterborne vessels be powered by electricity when at berth. Many ports engage in dredging to maintain authorised depth and width, or to accommodate larger vessels. Dredging can often entail efforts to protect wildlife and river flows or mitigate other environmental effects, increasing costs. Ports face shoaling and disruption to navigational channels, flooding of marine terminals, damage to customer goods (for which they are indemnified) and damage to assets by severe weather. Sea level rise may require ports to increase their elevation and invest in asset hardening, which may require existing facilities to be redesigned. Ports have displayed resilience to severe weather as their infrastructure is intended to interact with or be resilient to water.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk

Power Generation Projects



Key Issue:
Portfolio increasingly moving toward renewables (US, LATAM) or is already there (EMEA, APAC) with modest, elevated exposure for thermal generation assets

Total Debt:
\$47 billion

The sector's overall moderate exposure to environmental risks reflects a portfolio composition that is becoming more heavily concentrated in renewable power generation, the assets best suited to a low-carbon economy. However, exposure to carbon transition risk varies widely for projects, with asset profile and contractual structure and local and national environmental policies the key drivers of credit impact. Fully contracted renewable projects have low transition risk, while older, inefficient merchant coal projects are more likely to suffer because of lower wholesale prices and lower capacity factors. Between these endpoints lie mostly non-renewable projects with contractual arrangements with varying degrees of carbon risk. Technological advancements allowing newer thermal plants to meaningfully reduce water intake and water cooling requirements, or increase operating efficiency, are also taking hold and contributing to better positioning in an increasingly challenging physical and regulatory operating environment. As countries implement more stringent carbon policies to achieve their Nationally Determined Contributions under the Paris climate agreement, policy changes are likely to be more credit negative for conventional thermal power generation projects than for renewable projects. Although there will be a greater emphasis on carbon emissions reduction under the new US administration, economic advantages and state policies have driven fossil fuel generation shutdowns and plant dispatch decisions to a greater extent than federal policies. Physical risks including natural and man-made disasters are increasing as the frequency and intensity of named tropical storms and wildfires affect plants (including renewables), either directly or indirectly, by damaging transmission lines and preventing electricity transmission or affecting their ability to generate solar power. This is particularly relevant for power generation projects given the concentrated nature of the assets. The effect of more extreme temperature changes (hotter summers or milder winters) could have either a positive or negative effect on merchant generators that typically benefit from either peaking winter or summer loads, potentially increasing cash flow volatility.

Moderate Risk

Property, Casualty and Reinsurance



Key Issue:
Physical climate risk, including the rising frequency and severity of destructive weather events, and growing risks related to chronic, slow-moving trends linked to climate change, create additional underwriting and risk management complexity

Total Debt:
\$225 billion

Property and casualty insurers and reinsurers are in the business of assessing, pricing and managing risks stemming from physical climate risks. As such, they closely monitor the potential impact of climate change on the frequency and severity of natural catastrophes. Historical catastrophes have demonstrated that actual losses may differ materially from anticipated (modelled) losses because of the limitations of risk models and the assumption parameters used, with the difficulty in modelling the expected effect of climate change adding to model risk and uncertainty. While the ability of (re)insurers to generally re-price insurance policies on an annual basis mitigates this risk, the increasing incidence of catastrophe losses linked to climate change and the build-up of physical climate risk as a result of chronic, slow-moving trends such as rising sea levels creates additional underwriting and risk management complexity. Risks related to water management, such as water shortages and droughts, can result in losses in agricultural insurance and reinsurance, but this is typically just one of many lines in a (re)insurer's product set. P&C (re)insurers are also exposed to potential losses on liability insurance policies provided to clients facing litigation alleging damages resulting from climate change, as well as a growing but still modest risk of asset stranding as a result of transition to low-carbon economies. In contrast to life insurers, for which we consider carbon transition risk to be moderate, P&C insurers have lower asset leverage and shorter-duration investment portfolios, limiting the potential risk of asset stranding.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Protein and Agriculture**

Key Issue:
Inelastic demand for food ingredients mitigates the risk of cost increases due to environmental risks and regulation

Climate events, the need to exploit natural resources, including land and water, and potential changes in greenhouse emissions regulation expose the protein and agricultural sector to moderate environmental risks. However, companies in the sector actively manage these risks through measures such as diversification, production technology and financial derivatives. In addition, given the essential nature of food ingredients, companies are typically able to pass through resulting higher costs to customers. Water intensity is high but varies. A number of food production companies, including palm oil, fruit grower and aquaculture businesses, remain dependent on water availability to maintain constant production levels. However, food production is likely to receive priority in water usage. Some companies, mainly ethanol producers, are benefitting from carbon transition policies because renewable fuels will help countries curb carbon emissions from fossil fuels in the transport sector.

Total Debt:
\$52 billion

Moderate Risk**Regional and Local Governments - Emerging Markets**

Key Issue:
Water scarcity is the main risk and physical climate risks are common, though many regional and local governments receive central government assistance

Vulnerability to environmental risks for regional and local governments (RLGs) in developing countries can vary significantly depending on the region's geography, population growth, the maturity of institutions, and the availability and strength of central government assistance programmes. Generally, emerging market RLGs have higher exposure and lower capacity than advanced economy RLGs to respond to physical climate risks. Physical climate risks such as hurricanes and flooding have always represented significant risks for some RLGs. However, to the extent that central government assistance programmes exist in these countries, costs are often shared with the central government. Water scarcity has become one of the main challenges for RLGs in the developing world. Serious droughts in recent years in Argentina and Brazil have put pressure on local economies that depend on agriculture, while Cape Town in South Africa has faced severe water shortages. Changing weather patterns and rapid urbanisation are the main causes of water problems, and addressing the challenges requires RLGs to make significant infrastructure investments. However, these will come with help from central governments in many cases.

Total Debt:
\$31 billion

Moderate Risk**Regulated Electric and Gas Utilities with Generation**

Key Issue:
Direct air polluter but able to recover costs related to carbon and other air pollution regulations; sector emissions on a downward trajectory

Regulated utilities with generation are exposed to the effects of the carbon transition on electricity prices, fuel and environmental costs, and investment requirements. Offsetting these pressures, utilities are likely to benefit from increased demand from the electrification of heating, transportation and industry to support decarbonisation of the broader economy. The net effect of decarbonisation depends on a utility's generation mix and geographic location. In general, coal plants are most vulnerable, followed by gas-fired plants, while renewables and other low-carbon generation energy sources are likely to grow. Environmental regulations and the mix of generation sources vary between jurisdictions and geographies. Regulated utilities generally have long experience of handling progressively more stringent environmental regulations, and a strong ability to recover related costs under well-defined regulatory frameworks. However, increasing utility rates to mitigate environmental risks or meet air pollutant standards could be politically sensitive in some cases. Rate increases could encourage distributed generation or lower sales volumes over time due to energy efficiency and conservation. All this could lead to a shift in market fundamentals or the regulatory paradigm, creating additional risks for the regulated utilities, particularly those that depend on volumetric charges to cover fixed expenses. Regulated electric and gas utilities are also subject to weather-related disasters and other catastrophic events, including nuclear accidents, natural gas pipeline explosions and damage to electricity networks caused by storms or wildfires. The cost of disasters caused by the utilities' own failings are less likely to be recovered from ratepayers. For public power issuers, amortising debt structures provide a strong mitigant to stranded costs from carbon transition or increased leverage where new, cleaner generation is built to achieve utilities' carbon transition plans. Although there will be a greater emphasis on carbon emissions reduction under the new US administration, economic advantages and state policies have driven fossil fuel generation shutdowns and plant dispatch decisions to a greater extent than federal policies.

Total Debt:
\$865 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Retail and Apparel**

Key Issue:
Overall moderate environmental exposure reflecting carbon transition, natural capital and physical climate risks

Total Debt:
\$619 billion

Overall environmental risk is moderate given retailers moderate exposure to carbon transition, natural capital and physical climate risks. Retailers with a large concentration of stores, distribution centers or suppliers in geographies prone to extreme weather events face potential store closures or supply disruptions due to extreme weather. The entire industry faces the risk of carbon taxes and the pressure to convert their trucking fleets to electric vehicles increasing transportation costs. Certain sub-sectors, such as food and apparel issuers, have greater exposure to natural capital risks because of their reliance on agriculture such as crops and the raising of animals for the goods that they sell. Apparel retailers face increased scrutiny over sustainability issues related to natural resources from customers and governments while food retailers continue to face a consumer migrations towards organic. These trends can result in rising input costs, a credit negative. However, these costs represent only a portion of overall costs. Over time, we believe that companies could adapt by passing on higher costs to consumers, finding alternative manufacturers and suppliers, and changing product offerings/mixes. Generally, we view the risks related to water management and waste and pollution as low across the retail sector, as most store operations do not rely on significant water usage, and most apparel companies outsource their manufacturing. Retailers do not generate much hazardous waste and risks related to stranded assets or remediation are low.

Moderate Risk**Semiconductors & Technology Hardware**

Key Issue:
Overall moderate risk; exposure to carbon transition, water management, waste and pollution risks and physical climate risk in certain regions

Total Debt:
\$589 billion

Overall, environmental risk for the semiconductor and technology hardware sector is moderate. Most firms face the same moderate environmental exposures as either a manufacturer or a customer of the limited supply chain of specialized manufacturers, such as foundries, that support the sector. These include moderate risk exposure to the physical climate risk inherent in large manufacturing operations, to carbon transition and water management risks due to the water and energy intensive production process of semiconductor chip manufacturing and assembly and test process, and to waste and pollution risks due to the by-product hazardous waste of the manufacturing process and the long term disposal of electronics waste.

Moderate Risk**Sovereigns - Emerging Markets**

Key Issue:
Exposure to environmental risk varies and is broad-based. Small, agriculture-reliant sovereigns are vulnerable to climate change. Water risks often amplify and are amplified by climate change. Hydrocarbon-exporting sovereigns will face the credit impact of carbon transition

Total Debt:
\$3,108 billion

Emerging market (EM) sovereigns' exposure to environmental risk varies greatly, with a significant share of sovereigns materially exposed to some of these risks. The burden of responding to environmental risks, including physical climate risks, often falls on central governments. A sovereign's susceptibility to environmental risks depends on a combination of exposure and environmental-specific mitigants, as well as broader resiliency features. Small, less diversified economies and agriculture-reliant sovereigns, including small island economies, are most exposed to physical climate risks such as extreme weather events and sea level rise. Countries with low per capita income and weak institutions and government finances are less resilient, though access to multilateral financial support, whether in the form of loans or aid, can bolster credit resilience to physical climate risks. Often, though not always, exposure to physical climate change combines with exposure to water risks, challenging EM sovereigns to preserve scarce water resources. Hydrocarbon-exporting sovereigns face the credit impact of carbon transition on their fiscal and external accounts. A baseline carbon transition consistent with Paris Agreement country commitments will be manageable for most sovereigns. However, the challenge of adjusting to lower demand and prices for hydrocarbons will be particularly high for sovereigns with already relatively weak fiscal and external positions, some of which are developing countries. EMS may face pressure in the long term to improve quality of life and strengthen environmental regulations that are typically less stringent than those of developed countries to preserve natural capital. Where natural capital is a significant source of income, including foreign-currency income, policymakers will be challenged to adjust regulation while maintaining economic growth priorities.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Moderate Risk**Tobacco**

Key Issue:
Moderate Natural capital, Waste & Pollution, Physical Climate and Water management risks

Environmental risks are moderate for the tobacco sector. This mainly reflects the industry's exposure to physical climate, natural capital and water management risks related to tobacco products manufacturing activities as well as waste and pollution risks stemming from littering. Despite efforts to reduce waste by integrating eco-design and circularity considerations at the early stages of product development have yet to produce tangible results. Most companies have in place plans to reduce CO2 emissions, thus somewhat mitigating physical climate risk.

Total Debt:
\$184 billion

Moderate Risk**Beverage Industry**

Key Issue:
Ability to diversify water sources limits risk amid increased focus on sustainability and reducing water use

In both the soft beverage and alcoholic beverage sectors, lack of clean water would be an issue, and severe droughts could limit production of grapes and grains, from which most alcoholic beverages are made. However, these are high value-added products for which ingredients represent a relatively small percentage of the total costs, which are more heavily oriented toward marketing and distribution. In addition, some ingredients, like sweeteners for soft beverages, can be easily substituted or are produced on a large scale globally. Beverage makers, especially larger concerns, can diversify their sourcing of water and agricultural inputs, and are typically intensely focused on water stewardship and sustainability.

Total Debt:
\$400 billion

Low Risk**Asset Backed Securities - Auto Loans, Auto Leases, Floorplan, Car & Truck Rental**

Key Issue:
Short deal tenors mitigate risks to vehicles' residual value from carbon emissions regulations

Vehicles backing auto loan, lease, floorplan, fleet leasing and rental car asset-backed securities (ABS) are subject to carbon/air pollution regulations. Any changes in emissions regulations can affect the value of the vehicle and therefore the residual value of vehicles (on lease, floorplan, fleet lease and rental car transactions) or the recovery value of the vehicles on defaulted contracts (on loan transactions). These risks are largely mitigated by the short tenor of assets and liabilities for most of the transactions, which would require revolutionary policy shifts in a short period of time to have a material negative impact on ABS. Changes in emission regulations typically take years to develop and implement. These transactions typically have low exposures to severe weather events or other environmental factors because of the geographical diversification of underlying collateral pools and the physical mobility of vehicles backing the pools. In addition, vehicle insurance can reduce the collateral losses due to physical damage, if any.

Total Debt:
\$317 billion

Low Risk**Asset Backed Securities - Credit Cards**

Key Issue:
Overall low exposure; collateral diversification and short asset tenor limit environmental risk

Environmental risks are not a primary credit driver for most credit card ABS transactions. The credit card sector has low exposure to meaningful environmental risks. Potential consequences are unlikely to be material to credit quality given collateral pool diversification and the short tenor of receivables.

Total Debt:
\$76 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Asset Backed Securities - Equipment Leases and Loans



Key Issue:
Regulation of waste and pollution, natural capital, and carbon emissions for certain loan/lease pools

The overall risk is low but varies based on deal tenor and loan collateral, which vary by region and deal. Some pools have greater concentration in leases and loans related to vehicles, construction and agricultural equipment, which have greater exposure to air emissions and carbon regulations. However, a majority of the collateral pools contain new vehicles/equipment, which helps mitigate the environmental risks. Additionally, portfolios backed by office equipment have lower exposure to these environmental risks. Pools backed mostly by loans and leases for agricultural equipment have some exposure to natural capital, which can be caused by agricultural waste. The obligors in these pools are also reliant on a constant water source to operate their business and as a result may be affected by future droughts. Government regulations and geographic diversification help mitigate these risks.

Total Debt:
\$48 billion

Low Risk

Asset Backed Securities - Other (Solar)



Key Issue:
Growth in solar power generation is partly driven by renewable portfolio standard requirements to reduce carbon emissions

Solar photovoltaic systems convert sunlight into electric power and are typically installed on rooftops or on the ground (ground-mounted). Solar is a renewable source of energy and therefore environmentally friendly. The systems have long useful lives and are often used to satisfy renewable portfolio standard (RPS) requirements at the state level to reduce carbon emissions. In certain US states, system owners can sell solar renewable energy certificates to utility companies to satisfy their RPS requirements. Solar is, however, exposed to regulatory risks as a result of changes to net energy metering rules. Also, most system components, such as solar panels or modules, are manufactured in Asia (mostly China) and therefore the supply chain is subject to trade tariffs.

Total Debt:
\$0 billion

Low Risk

Asset Backed Securities - Personal Loans



Key Issue:
Overall low exposure; collateral diversification and short asset tenor limit environmental risk

Environmental risks are not a primary credit driver for most personal loan ABS transactions. The personal loan sector has low exposure to meaningful environmental risks. Potential consequences are unlikely to be material to credit quality given collateral pool diversification and the short tenor of loans.

Total Debt:
\$59 billion

Low Risk

Asset Backed Securities - Railcar Leasing



Key Issue:
Well diversified fleets, but some car types exposed to obsolescence due to changing safety regulations

These are long-lived deals, but railcar lease portfolios are generally well diversified, leading to overall low risk for the sector. Although there is indirect exposure to carbon emission through coal, coal typically consists of about 10% of the freight volume. Collateral is exposed to disasters, including railcar accidents, and to the regulations that seek to prevent them. The portions of fleets that carry flammable and hazardous materials are most at risk of obsolescence from safety regulations. Although accidents can cause significant environmental damage, liability generally rests with the rail operators.

Total Debt:
\$0 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Asset Backed Securities - Small and Medium Enterprises



Key Issue:

Diversification mitigates most risk

ABS-SME transactions, although diversified across asset sectors, have risks that reflect the sum of their parts.

Construction and building is a top three industry exposure in more than 90% of European SME transactions and concerns around land use could affect this sub-sector. Interruptions to the supply chain process could have a negative impact on SME sub-sectors such as construction and building, beverage, food and tobacco, and retail. In the US, physical climate risks could have a negative effect on businesses in regions that are prone to severe weather events.

Total Debt:

\$92 billion

Low Risk

Asset Backed Securities - Student Loans



Key Issue:

Overall low exposure. Collateral diversification limits environmental risk involving physical climate risk

Environmental risks are not a primary credit driver for most student loan ABS transactions. Student loan transactions have low exposure to waste and pollution and carbon transition risks. In addition, the granularity and geographic diversification of student loan collateral pools largely mitigate exposure to physical climate risks such as hurricanes. In the event of a significant physical climate risk, servicers typically provide payment plan assistance, such as natural disaster forbearance, which allows borrowers to pause payments for a period of time to reduce default risk.

Total Debt:

\$222 billion

Low Risk

Asset Backed Securities - Utility Cost Recovery Charges



Key Issue:

Deal structures, true-up mechanisms and medium tenors limit risk

Bonds are serviced by charges on the bills of utility customers and are typically insulated from regulatory and operational risks. Although extreme weather fluctuations could cause actual electricity usage to deviate from what was forecast and there may be some exposure to carbon transition risk that could lead to lower volumes sold, deal structures typically include true-up mechanisms to adjust the charges rapidly so the bonds fully amortise within the established maturity.

Total Debt:

\$23 billion

Low Risk

Asset Backed Securities - Wireless Towers



Key Issue:

Low environmental risk

The wireless tower ABS sector is negligibly affected by environmental risk because of the granularity of the underlying pools, geographic diversification and towers that are designed to withstand physical climate risks.

Total Debt:

\$11 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Asset Managers



Key Issue:
Generally low direct exposure but some moderate investment risks, depending on manager

Total Debt:
\$75 billion

Asset management companies have low exposure to environmental risks. Unlike banks and insurance companies, asset managers do not warehouse risks on their balance sheets and instead earn fees for managing assets on behalf of third-party clients. However, while not directly affected by environmental risk, asset managers increasingly face reputational risk associated with clients, regulators and other market participants' perceptions of their response to environmental risk and overall ESG stewardship, which could be both positive and negative. Asset managers are increasingly attempting to promote ESG stewardship, as well as capitalise on investors' growing interest in ESG globally by creating suites of new ESG-focused products and services. Closed-end funds also have below average exposure to environmental risks, with the exception of Master Limited Partnership (MLP) closed-end funds and municipal bond funds which have high geographical exposures to states and cities with elevated environmental risks, mostly physical climate risk. MLPs tend to have very high exposure to fossil fuel infrastructure and energy transportation, and are therefore exposed to carbon transition risks. Municipal bond closed-end funds, which invest in the obligations of states and cities that are sensitive to environmental risks, including physical climate risks and carbon transition risk, will be exposed to similar risks.

Low Risk

Banks



Key Issue:
Carbon transition is the most prevalent environmental risk for banks, posing credit risks on loan portfolios but also growing challenges to banks' business models as governments transition towards low-carbon economic models.

Total Debt:
\$14,031 billion

Banks face below-average risks from environmental issues, given the indirect nature of their primary exposures through investment and lending decisions. However, the transition to a low-carbon economy poses increasing business risks for banks because they face mounting pressure from customers, investors and regulators to meet broader carbon transition goals, given their role as capital providers.

Although environmental risks may be significant for some of the banks' exposures, the impact on their overall credit profile is typically tempered by portfolio diversification. Their retail and corporate lending and investment activities principally mirror the full spectrum of economic activities and the varying degrees of environmental-related risks. In addition, active portfolio and risk management capabilities allow banks to alter the composition of their portfolios and adjust loan pricing in response to emerging risks, mitigating the credit exposure. Banks with concentrated lending exposures to sectors highly exposed to environmental risks face a greater risk, particularly if they are unable or have limited capacity to adjust their loan exposures.

Carbon transition is forcing banks to adjust their business models and strategies as governments pursue low-carbon economic models, a global challenge which, although at different paces, will virtually affect all banks, requiring them to incorporate climate criteria into their lending and investment decisions. Credit risks will be higher under a more rapid and disorderly transition than anticipated by current energy policies or climate targets, or for those banks which are slow to adapt or pursue an unsuccessful business plan.

Bank-focused environmental regulation aimed to implement climate policies is also likely to increase, although we expect regulators to ensure that environmentally-motivated changes to bank regulation do not have a detrimental impact on financial stability, letting banks adapt gradually.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Business Services



Key Issue:
The provision of services is mostly low-risk, but with some exceptions

This sector comprises companies providing a number of types of services to a wide range of customers. Direct exposures to environmental risks are generally low. Certain companies or industry sub-sectors may be indirectly exposed where their customers' environmental exposures are high (e.g., services to mining companies), while certain sub-segments that handle hazardous or sensitive materials are exposed to pollution and regulatory pressures in the medium term (e.g., passenger cruise ship operators). By contrast, the software services sector has low environmental impact, while increasing needs for environmental controls and energy efficiency can drive demand for sophisticated software.

Total Debt:
\$1,392 billion

Low Risk

Collateralised Loan and Bond Obligations



Key Issue:
Diversified portfolio limits environmental risk

The diversified nature of CLOs and CBOs backed by corporate assets limits exposure to environmental risk. The overall sector risk is low and such risk is not material to our credit ratings.

Total Debt:
\$741 billion

Low Risk

Commercial Mortgage Backed Securities



Key Issue:
Collateral diversification limits environmental risks for most CMBS

Conduit transactions, backed by multiple commercial property loans, have greater diversity than single-asset transactions, and are therefore less sensitive to idiosyncratic environmental risks. For both the diversified and single-asset deals, natural disasters such as hurricanes, and wildfires can damage individual properties, but a requirement to maintain comprehensive insurance is the norm. Rising property insurance premiums triggered by increasing physical climate risks will increase expenses and could marginally affect property values. Rigorous upfront environmental due diligence by lenders limits exposure to natural capital and liability risk. Local water management could lead to higher water costs, but also limit the supply of new properties and potentially increase the values of existing properties. Mandated improvements in buildings' energy efficiency could increase short-term property operating costs. Ultimately, however, long-term expense reductions benefit cash flow, enhancing property value. In Europe, landlords will have to increase capital spending to comply with stringent energy efficiency regulations. Noncompliant properties face higher cash flow and value volatility, and the risk of leasing prohibition.

Total Debt:
\$399 billion

Low Risk

Construction



Key Issue:
Environmental regulations and risks create more benefits than threats for the construction sector

The construction sector has low exposure to environmental risks and is not a material direct source of pollution or carbon emissions given its customer and end-market diversity. The sector has some indirect exposure to natural capital risk and carbon-emitting industries like the oil and gas sector, and environmental regulations could increase the cost of construction projects, but the additional costs are typically borne by the customer. In fact, the sector often benefits from increased regulation, because it tends to drive increased demand for the services that construction companies provide, such as more efficient buildings and less-polluting industrial and power generating facilities. Physical climate risk can also create demand for clean-up and restoration services and new infrastructure. Additionally, water shortages can create opportunities for additional infrastructure to improve the water supply.

Total Debt:
\$43 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Consumer Goods



Key Issue:
High value of packaged goods limits exposure to rising costs from environmental regulation

Packaged goods providers typically benefit from high margins and an ability to pass along rising costs over time, so the overall environmental risk exposure is low. Regulations and consumer preferences for greener products will drive changes in product offerings. For instance, companies making disposable diapers and hygienic products, which largely consist of plastic and oil-based absorbing materials, are exposed to changes in regulation of natural capital and waste and pollution from products and packaging that could affect product production and disposal. Increases in costs would likely be passed on to consumers, however, and companies in this sector have been adept at meeting changing consumer needs.

Total Debt:
\$704 billion

Low Risk

Consumer Services



Key Issue:
The provision of services is mostly low-risk, but with some exceptions

This sector consists of companies providing a number of types of services to a wide range of customers. New regulations, as well as evolving consumer preferences for greener services, can pose environmental risks to consumer services issuers. Where present, issuers' capacity to mitigate these risks will depend on their ability to pass incremental costs on to the consumer and adapt their services to meet consumer demand.

Total Debt:
\$364 billion

Low Risk

Covered Bonds



Key Issue:
Financial institution issuers have low environmental risk

Issuer credit quality is the primary ratings driver for covered bonds, which are direct obligations of financial institutions that also benefit from collateral in the form of a cover pool of loans, primarily residential mortgages. As long as the issuer does not default on the covered bonds, any environmental risk impact on the cover pool would not have any negative credit impact on the covered bonds. The cover pool typically benefits from diversification geographically and in the number of individual loans that are pledged, as well as asset turnover as new loans replace older ones. Covered bonds can be used as a funding tool for assets with a positive impact on the environment, such as green mortgages for buildings with enhanced energy efficiency or loans that fund renewable energy projects.

Total Debt:
\$2,399 billion

Low Risk

Distribution and Supply Chain Services



Key Issue:
Essentiality of these companies to modern methods of distribution and manufacturing across many industries offsets environmental exposures

Although air and sea freight are material costs for distribution companies, under their service contracts, increasing costs for almost any reason (including any carbon taxes) can be passed along to customers. Electronic manufacturing services have similar contract provisions, but their processes include hazardous substances that must be disposed of correctly. Some of these manufacturing facilities may be subject to increased environmental regulation (especially in China), while most of the issuers already have to comply with the Conflict Minerals laws. We do not expect changes in costs from increasing environmental regulation to materially change the sector's strengths, which primarily derive from using scale and inventory management to reduce unit costs of production/distribution, and the value to customers of a "one-stop shop" for thousands of components and ancillary services. Electronic manufacturing services companies operate globally and, in many cases, are prepared to shift manufacturing responsibilities from a facility in one region to a facility located in another region in the event of physical climate risks, war, or changes in the regulatory environment.

Total Debt:
\$120 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Education and Not-for-Profits



Key Issue:
Low risks as a sector, though individual issuers have geographic concentration

Environmental risks will not be a primary credit driver for most education and not-for-profit issuers. Education and social services generally have limited adaptation needs to reduce pollution. Issuers in this sector are somewhat exposed to physical climate risks such as hurricanes, extreme rainfall and heat stress because many have geographically concentrated facilities. However, most would benefit from government (and/or private philanthropic) assistance to help finance required capital spending or with recovery following a disaster. In other cases, ESG concerns create opportunities for research universities, environmental nonprofits and others.

Total Debt:
\$320 billion

Low Risk

Finance Companies



Key Issue:
Most finance companies face below-average environmental risks given the indirect nature of their business models.

Most finance companies face below-average environmental risks given the indirect nature of their business models. However, certain finance companies have higher exposure to sectors that face higher environmental risks, primarily through carbon transition risks. These sectors include, but are not limited to, airlines, shipping, automotive, energy and power industries.

Finance companies' low exposure to environment risks is aided by the relatively short duration of their lending portfolios (generally lower than 5 years), which allow firms the flexibility to shift focus, if needed. However, certain firms face higher risks, such as those with more concentrated portfolios and portfolios with high exposure to sectors facing high environmental risks, as well as those firms owning assets exposing them to long-term infrastructure and energy projects that entail lower flexibility.

Total Debt:
\$640 billion

We expect environmental risks, particularly those arising from climate change, to become more significant for finance companies over time. The impact on firms' credit strength will depend on how quickly these changes develop, and the relative amount of time available to and actions taken by the companies to adapt to the changing circumstances.

Low Risk

Financial Guarantors



Key Issue:
Exposure to physical climate risk via guarantees on municipal issuers' debt mitigated by diversification

Financial guarantors have exposure to US municipal sectors that could be affected by environmental risks (waste and pollution, water management, carbon transition risk, and so on). The credit impact on guarantors is mitigated, however, by manageable overall concentration and significant single-name and geographic diversification among these sectors, as well as the expected amortisation of their insured portfolios over time.

Total Debt:
\$4 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Gaming and Gambling Industry



Key Issue:
Low environmental risks overall; some exposure to carbon transition risk and physical climate risk

Demand for gaming can be affected by cycles in disposable income but has been resilient over long periods. Gaming itself has low impact on the environment, but has some exposure to carbon taxes (consumers often fly to cities such as Las Vegas and Macau, and drive fairly long distances to regional gaming centres) and to physical climate risk, since companies' real estate may be concentrated in specific locations. For instance, Atlantic City and New Orleans are subject to flooding and hurricane risks. These impacts are unlikely to be a material driver of credit profiles over the next seven or more years.

Total Debt:
\$98 billion

Low Risk

Health Insurance Companies



Key Issue:
Ability to reprice policies annually mitigates environmental risks

Physical climate risks and waste and pollution are environmental risks that could lead to increasing healthcare claims and costs over a number of years. However, the short-term nature of health insurance policies and health insurers' ability to re-price annually mitigates most of the risk. The risk of large-scale natural catastrophes, an acute manifestation of physical climate risks, leading to significant healthcare claims is mitigated by the finite number of care providers, which limits the number of possible claims, as well as expected government assistance.

Total Debt:
\$152 billion

Low Risk

Homebuilding and Property Development



Key Issue:
Regulations are stable and well understood, though water management and natural capital could limit property development

Homebuilding and property development technology and regulations have primarily been stable, and increases in costs can be largely passed to consumers. Pre-purchase environmental diligence is standard practice. The greatest risks are in land inventory and water management that can lead to development restrictions, diminishing the value of inventoried land but increasing the value of finished housing and permitted properties. In drought-plagued areas, severe water shortages and rationing can limit or eliminate the granting of building permits. Physical climate risk and more stringent regulation will also raise construction costs. Cement production is increasingly exposed to carbon regulation, indirectly affecting costs and margins of homebuilders and property developers.

Total Debt:
\$186 billion

Low Risk

Insurance Brokers and Service Companies



Key Issue:
Mostly fee-based businesses with essentially no exposure to environmental risks

Insurance brokers are almost purely fee-based businesses providing risk management, data analytics and advisory services, in addition to brokerage. As a result, environmental risks, including rising physical climate risks, present more opportunity than risk for these firms. The growing complexity and potential severity of environmental risk help drive steady demand for brokerage services, which is somewhat offset by potential liabilities stemming from errors and omissions in the advice and solutions they provide.

Total Debt:
\$93 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Life Insurance



Key Issue:
High asset leverage and regulatory scrutiny increase exposure to carbon transition risk; overall environmental risk is mitigated by investment portfolio diversification and active credit risk management

Total Debt:
\$407 billion

Life insurers typically invest in long-term bonds to match their long-term liabilities, and have broadly diversified portfolios that include exposure to sectors affected by environmental risks. These risks include carbon transition risk, which we consider moderate given life insurers' long-duration investments. In addition, the high asset leverage inherent in the business model could amplify the impact of potential impairments as a result of asset stranding. However, life insurers' active credit risk and portfolio management, including a growing focus on managing environmental risks within their highly diversified investment portfolios, is a core strength of the industry that helps to moderate the risk of stranded assets associated with a transition to a lower-carbon or carbon-neutral economy. In addition to the potential balance sheet impact of carbon transition risk, increased regulatory focus on life insurers' investment portfolios and growing customer and investor interest in their environmental stewardship gives rise to greater reputational and strategic risk as societies transition towards lower carbon dependence. A range of environmental risks, including physical climate risks, waste and pollution, water management and the depletion of natural capital – specifically loss of biodiversity – could have some effect on mortality rates in the long run. However, we currently expect these considerations to present only a limited risk to mortality experience for diversified life insurers, particularly because life insurers are in many cases able to reprice policies to reflect changes in mortality experience. Insurers that underwrite policies in only a limited geographical area (a small country or region) could be more affected by the aforementioned risks, particularly physical climate risks.

Low Risk

Mass Transit



Key Issue:
Ridership is likely to increase for energy-efficient transport, but the sector is susceptible to damage from physical climate risks

Total Debt:
\$95 billion

Overall environmental credit risk for the sector is low. Mass transit is a relatively energy-efficient mode of transportation that will see increased ridership as government policies and public preference transition away from carbon-intensive travel. Exposure to physical climate risks depends on the geographic location of the transit system and how prone it is to hurricanes, flooding, sea level rise and wildfires. Transit systems in areas with rising water levels and more frequent severe storms will face service disruptions and higher capital reconstruction costs. In addition, changes to regional construction and zoning regulations could require rail-based mass transit systems to invest in significant infrastructure hardening. However, compared with other enterprises, transit systems benefit from above-average financial and political support from national, regional and local governments that will increase their flexibility to manage rising costs.

Low Risk

Media & Entertainment



Key Issue:
Overall light environmental footprint; limited exposure to physical climate risk

Total Debt:
\$514 billion

Media and broadcasting companies have very low emissions of pollutants and carbon, though broadcasting towers do have some exposure to physical climate risk. We capture such risks in our ratings indirectly, by considering volatility of input costs such as energy that can arise from environmental factors.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Medical Products and Devices



Key Issue:
Environmental risks are low overall, but companies in locations exposed to physical climate risks face a moderate risk of manufacturing disruption

The medical device sector has low exposure to environmental risks. Because a number of medical device companies have manufacturing facilities in areas that are subject to physical climate risks, such as Puerto Rico, there is a moderate risk of manufacturing disruptions should hurricanes or other natural disasters lead to extended power outages or damage facilities. Most companies in this sector operate manufacturing and distribution centres where there may be a low risk of soil or water pollution, though these costs historically have been immaterial.

Total Debt:
\$300 billion

Low Risk

Mortgage Insurance



Key Issue:
Policies generally do not cover physical damage or environmental risks, limiting insurers' exposure to physical climate risks

US mortgage insurers provide policies that cover payment default risks, mostly for residential mortgages, and are not responsible for physical damage to properties arising from catastrophes. They do not underwrite damage arising from natural disasters or other direct manifestations of physical climate risks, or pre-existing environmental conditions. In parallel with US mortgage insurers, and to increase the amount of private capital available to assume mortgage risk, Fannie Mae and Freddie Mac transfer a portion of their mortgage credit risk to investors in the capital markets in the form of bonds, and to (re)insurers, including affiliates of certain mortgage insurers. In these transactions, mortgage loan defaults resulting from physical climate risks are typically covered losses, albeit that they are a smaller portion of the insurers' overall business.

Total Debt:
\$8 billion

Low Risk

Multilateral Development Banks



Key Issue:
Environmental risks are indirect and unlikely to have a meaningful credit impact on MDBs

Multilateral development banks' exposure to environmental risks is indirect because they pertain to the operations of their borrowers and the credit profiles of their sovereign sponsors. For the sector as a whole, environmental risks are unlikely to translate into a meaningful credit impact because of portfolio diversification, though such risks may vary with the primary operating environment and the policy mandate of the specific institution. However, on the whole, multilateral development banks face low risks in all five of our environmental risk categories.

Total Debt:
\$1,765 billion

Low Risk

Not for Profit Hospitals



Key Issue:
Low risks as a sector, though individual issuers have geographic concentration

Environmental risks will not be a primary credit driver for most not-for-profit hospital issuers. Hospitals generally have limited adaptation needs to reduce pollution. Issuers in this category are somewhat exposed to physical climate risks such as hurricanes, extreme rainfall and heat stress, because many have geographically concentrated facilities. However, most would benefit from government (and/or private philanthropic) assistance to help finance required capital spending or to help with recovery following a disaster.

Total Debt:
\$270 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Passenger Railways



Key Issue:
Primarily energy-efficient; risk from physical climate risk in certain regions

Passenger railways tend to be environmentally clean and highly energy-efficient. An ongoing shift toward the use of electricity as a power source will reduce emissions. Legacy railway networks that still use diesel or even coal as locomotive fuel will have higher exposure to waste and pollution and carbon transition risk. In certain regions however, passenger railways suffer from the risk of large-scale environmental disasters. To a lesser extent, passenger railways also remain vulnerable to flooding, storms and tsunamis in certain parts of the world. Typically, temporary support from various stakeholders (government, banks and railway passengers) mitigate this type of risk, especially because railways are critical infrastructure in most parts of the world with limited alternatives.

Total Debt:
\$191 billion

Low Risk

Pension Funds



Key Issue:
Low direct risk overall; some investment exposure to carbon, land-use and water-intensive industries

Similar to other financial institutions, pension funds have a low direct environmental exposure because of their limited physical footprint. However, funds have exposure to environmental risks through their investment portfolios, where they hold some investments in carbon, land-use, and/or water-intensive industries as part of diversified asset portfolios. Pension funds typically invest over a longer time horizon and are not subject to the same regulatory capital constraints as insurers, for example, leading to moderate exposure to carbon transition risk. Through their investment holdings, funds are also exposed to other environmental risks, including physical climate risks and waste and pollution risk. However, we consider these risks to be low at present. Pension funds' ability to move between asset sectors as risks develop, and their ability to diversify risk exposures within the portfolio, limit their overall exposure to environmental risk despite their moderate exposure to carbon transition risk.

Total Debt:
\$148 billion

Low Risk

Pharmaceuticals



Key Issue:
High value-added products; generally low environmental exposure, but some exposure to severe weather-related disruption of manufacturing facilities in storm-prone areas.

The pharmaceuticals sector has low exposure to environmental risks. Because a number of companies have manufacturing facilities in locations subject to physical climate risks, such as Puerto Rico and Japan, there is a moderate risk of disruption to manufacturing if tropical storms or other physical climate risks result in extended power outages or damage facilities. While there is some waste and pollution risk as a result of inappropriate or accidental disposal of chemical waste by-products, clean-up costs have been small relative to these companies' financial positions.

Total Debt:
\$782 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Private Hospitals - Acute Care and Specialty



Key Issue:

Overall environmental risk is low, though high geographic concentration increases operators' exposure to environmental regulations and conditions

The for-profit hospital sector faces low environmental risk. However, high geographic concentration in a given state increases a hospital operator's sensitivity to environmental regulations and conditions in those states. Material changes in environmental regulations and conditions in states where a hospital derives a significant portion of its revenue could adversely affect its operating performance. Additionally, several hospital operators have large geographic concentrations in Florida, Texas and other coastal states that routinely experience elevated physical climate risk given their exposure to hurricanes and tropical storms. These events can cause material levels of operating disruption and, depending on their severity, related damages may not be fully covered by property insurance.

Total Debt:

\$103 billion

Low Risk

Privately Financed Public Infrastructure Projects (PPPs)



Key Issue:

Overall exposure is low given upfront risk allocation in the project agreement

Public-private partnerships (PPPs) have low exposure to environmental risks because: (1) many facilities relate to lower-risk asset classes such as hospitals and schools; and (2) project agreements have a track record of identifying most key risks – including those relating to existing and future environmental requirements and costs – and allocating them in a transaction's project agreement to either the public or private party should they arise. Typically, the public sector is a government entity that can bear unknown force majeure and other similar risks, whereas the private party will pass through its risks to a constructor and/or an operator under a contract. However, if a new project in a new jurisdiction does not have the standard contractual risk allocation or approach to project development, the risk profile for that project may be higher. Similarly, individual projects may have higher exposure to potential force majeure risk because of their location (e.g., a coastal location could be exposed to rising sea levels or an asset could be located near a flood or fire-prone area). In these cases, the risk allocation in the transaction's project agreement should have identified these risks upfront and allocated them to one or both parties to manage should they arise.

Total Debt:

\$44 billion

Low Risk

Public Sector Housing



Key Issue:

Sector risks are low, but individual projects are subject to disaster risk

Environmental risks for existing housing projects are low overall, but individual projects may be exposed. Exposure to physical climate risks depends on the geographic concentration of housing projects and how vulnerable they are to hurricanes, flooding and other hazards. Many but not all of these are insurable risks. For example, there has been credit impact in cases where extreme rainfall damaged the property and resulted in tenant displacement. However, we do not expect disasters to have a meaningful impact on a significant number of issuers, and the sectorwide impact is therefore relatively low. Housing associations are capital-intensive businesses with material physical assets, so have some exposure to environmental risk. However, the sector to date has not experienced significant pressure or regulation around environmental risks.

Total Debt:

\$185 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Publishing



Key Issue:
The publishing sector faces low environmental risk overall

Publishing companies have very low emissions of pollutants and carbon. We capture such risks in our ratings indirectly by considering the volatility of input costs such as energy that can arise from environmental factors. Major publishing and printing companies have increasingly transitioned to digital offerings, reducing their exposure to environmental risks related to paper products. Issuers that have converted most of their revenue into digital sales would be better competitively positioned in a scenario of high environmental risk related to paper products.

Total Debt:
\$15 billion

Low Risk

Real Estate Trusts & Other Commercial Property Firms



Key Issue:
Generally low exposure to environmental risks due to portfolio diversification and asset enhancements; green credentials are becoming an important leasing factor in certain asset classes and jurisdictions

Rated REITs' exposure to environmental risks is low because the landlords tend to own diversified portfolios of assets and continually invest in the assets to mitigate event and operational risks. Building approvals are subject to strict regulations in most countries, and environmental site diligence is typically required. Nevertheless, the REITs' exposure to physical risk is material given our expectations of more frequent and severe climate events in certain regions and a steady increase in surface temperatures, and their physical asset-intensive business models. Exposure to carbon regulation is growing as more jurisdictions establish emission and energy-efficiency guidelines. A property's environmental footprint (parameters such as energy efficiency, water usage, waste management and indoor environment quality) could influence leasing outcomes because tenants are becoming more sensitive to the green attributes of their leased spaces. In a similar vein, the environmental attributes of real estate assets also have a bearing on investor interest in the REIT and the property. REITs with less diversified portfolios in regions that are more exposed to climate change and regulation would be most challenged. Landlords would have to invest in their assets to improve resiliency parameters and operational efficiency.

Total Debt:
\$483 billion

Low Risk

Regional and Local Governments - Advanced Economies



Key Issue:
Vulnerability to environmental risks varies significantly across countries and within regional and local governments in the same country, but remains low for the sector overall

Regional and local governments (RLGs) in developed economies are very diverse in terms of geography and ecosystems, responsibilities assumed, tax base concentration, and policies and regulations designed to reduce carbon emissions or mitigate air pollution and other environmental risk factors. RLGs overall face a relatively low level of environment-related credit risk and are generally resilient to climate shocks and negative climate trends. RLGs' resilience to climate shocks reflects: (1) their relatively wealthy and diverse economies, which allow for fiscal flexibility to mitigate the negative effects of specific events; (2) that they often develop contingencies, manage reserves and sometimes have private insurance to offset climate-related impacts; and (3) the burden of responding to natural disasters most often falls on central governments, which effectively act as public insurers. RLGs' resilience to negative climate trends reflects their inherent, relative wealth, long-term planning capability and inherent operational flexibility. Moreover, the RLGs we rate are, on average, larger than their unrated peers. This allows for greater shock-absorption capacity than the sector average when considering both rated and unrated RLGs. Although overall environmental risk is low, some RLGs in developed economies have a clear exposure to physical climate risks, including flooding, drought, forest fires, hurricanes, and in a few cases sea level rise. Pollution and carbon-related issues generally do not pose material risks to their credit quality.

Total Debt:
\$4,288 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Regulated Electric and Gas Networks/Utilities with no Generation



Key Issue:
Direct air polluter but able to recover costs related to carbon and other air pollution regulations; sector emissions on a downward trajectory

Total Debt:
\$518 billion

Networks and utilities that do not own generation have lower carbon transition risks than generation utilities and will play a key role in facilitating the transition. However, they face changing operating paradigms to accommodate the growing share of renewables and to create “smart grids”, and associated investment needs. While improving the resilience and entrenching the essential nature of the grid, a credit positive, this investment brings execution risk and could weigh on credit metrics, depending on the funding plan and the timing and structure of regulatory cost recovery provisions. In addition, small-scale generation, self-supply and energy efficiency may reduce electricity volumes and challenge the large-scale network model in the long term. More immediately, decarbonisation is raising questions over the future of gas transmission and distribution utilities in some developed countries. In several European countries and US cities, new residential gas connections will not be allowed from as early as 2023, and the Netherlands intends to end the use of gas by households entirely by 2050. The US state of Washington has adopted a rule under which natural gas distributors will be required to reduce carbon emissions from the gas they supply by 1.7% annually until 2035. Gas networks in some countries are running pilot projects to adapt their networks for hydrogen and renewable gas, which may extend operating lives but will also create new technical risks. Regulated electric and gas utilities are also subject to weather-related disasters and other catastrophic events, including natural gas pipeline explosions and damage to electricity networks by storms or wildfires. Utilities may face increasing challenges in recovering the cost of disasters through increased tariffs and/or insurers, particularly when caused by utilities' own failings.

Low Risk

Residential Mortgage Backed Securities



Key Issue:
Diversification of pool collateral mitigates environmental risks, but some deals have regional concentrations

Total Debt:
\$2,645 billion

Diversification mitigates many environmental risks, but regional concentrations can occur. Most homeowners maintain property insurance and, in some cases, casualty insurance. With some exceptions, it is rare that the insurance fully covers the costs of “Acts of God” or physical climate risks. Deals with concentrations in drought, flood or hurricane-prone regions may see more impact, but those transactions are generally outliers. In some countries, pools are more concentrated, and could therefore be more prone to local risks. In Europe, energy-efficiency classifications exist for residential properties and buildings. However, rules restricting or prohibiting the use of properties that fail to adhere to minimum energy-efficiency levels of residential properties are not typical. Where such rules exist, their impact is credit neutral on the pools we rate, but point toward greener homes.

Low Risk

Restaurants



Key Issue:
The restaurant industry does not have material exposure to environmental risk

Total Debt:
\$117 billion

Despite its low exposure to environmental risk, the industry does have asset exposure (physical restaurants) to physical climate risk such as flooding or hurricanes that could cause certain locations to close temporarily. Other environmental issues of concern to the industry include the use of non-biodegradable materials (primarily plastics and Styrofoam) in straws and packaging materials. However, we also recognize the industry's reliance on the origins of its core products and ingredients (farmers, ranchers) which would be a concern if availability from these sources were interrupted.

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Securities Firms and Market Infrastructure Providers



Key Issue:
Primarily fee-based
businesses with low
exposure to
environmental risks

This sector includes securities industry service providers, securities industry market-makers and central counterparty clearing houses. Securities industry service providers are mostly fee-based businesses with low exposure to environmental risks. The positions held by securities industry market-makers (including investment banks, other brokers and trading firms) are mostly short-term. Any long-term positions (such as derivatives) typically require collateral support arrangements when mark-to-market exposures exceed certain thresholds. These factors substantially mitigate risks pertaining to these firms' exposure to counterparties that may have elevated environmental risks.

Total Debt:
\$275 billion

Low Risk

Sovereigns - Advanced Economies



Key Issue:
Susceptibility to
environmental risks is
not material given the
high resilience of
developed economies

Environmental risks do not represent a material credit burden for advanced economies, though they may pose quality of life and other concerns that some sovereign policies will aim to address. Advanced economies have the financial resources and governance capacity to reduce exposure to and mitigate the impact of physical climate risks, and to address transition to a low-carbon future. For example, a large share of the Netherlands' population is exposed to rising sea levels, but the country has a long-standing history of adaption. Physical climate risks have social, economic and fiscal costs, but they have not had material rating implications for these sovereigns. Advanced Economy sovereigns are not generally reliant on natural capital as a source of revenue.

Total Debt:
\$29,706 billion

Low Risk

Telecommunications



Key Issue:
Low environmental
impact, with some risk
from severe weather or
physical climate risk

Telecommunications companies have low environmental impact compared with other sectors. An increase in the severity or frequency of physical climate risks could result in more prolonged outages and higher network costs. An issuer's scale and operational effectiveness in quickly responding to network outages are important credit considerations. Well-run, diversified network operators can reallocate resources and restore service following outages. Customers generally tolerate network outages related to physical climate risks. Carbon regulation could result in higher input costs for utility power, but this would likely be passed along to customers over time.

Total Debt:
\$1,187 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Title and Trade Credit Insurance



Key Issue:
Title insurance policies exclude most environmental risks; extensive risk portfolio diversification and very short-term exposures moderate trade credit insurers' indirect exposure to environmental risks

Title insurers cover mortgagee losses when the mortgagor does not have clear ownership rights to the mortgaged property. They have limited exposure to environmental risks, including physical climate risks and waste and pollution. This is because title insurance policies do not cover damages related to decreases in property value, physical climate risks or pre-existing environmental conditions including pollution or water shortages. Trade credit insurance protects suppliers against the risk of non-payment for goods and services by their customers, typically for periods of one year or less. Credit insurers are exposed to a wide array of industries, including some that are more exposed to environmental risks. Such industries include automotive suppliers exposed to carbon transition risk, and manufacturers and retailers with large physical footprints that are meaningfully exposed to physical climate risks. Theoretically, credit insurers' profitability could be affected if a natural catastrophe led to a sharp deterioration in a specific economy and a sudden increase in corporate insolvencies. However, credit insurers are well-diversified by geography and sector. In addition, trade credit exposures are very short-term, allowing insurers to quickly manage down their exposures to sectors facing carbon transition risk or economic challenges.

Total Debt:
\$4 billion

Low Risk

Toll Roads



Key Issue:
Potentially higher fuel costs from carbon regulation mitigated by population growth, personal mobility requirements and rising use of low-emission vehicles

The sector faces a limited impact from environmental risks overall. However, the effect of car use on air pollution is gaining increasing attention, and could result in restrictions on traffic and car purchases in some areas through air quality and traffic control measures. Nonetheless, traffic volumes are fundamentally linked to macroeconomic trends, business sentiment, population growth and personal mobility requirements. The increasing use of electric or hybrid cars is a further mitigant, with new revenue streams likely to support any investment by toll road operators in additional facilities such as charging stations. Some governments view toll roads as playing an important role in diverting traffic from and improving the amenity of suburban arterial roads, a factor underpinning our low risk assessment. Some jurisdictions also have mechanisms that allow for the recovery of a detrimental financial impact as a result of differences between projected and lower actual traffic volumes. Environmental policies, particularly related to carbon reduction, are more advanced in Europe and accelerating in Asia and Latin America, but are likely to be phased. Toll road traffic can also be affected by physical climate risks. Mitigating factors include insurance policies, regulations in some jurisdictions that allow for the recovery of unforeseen costs or losses, and state intervention.

Total Debt:
\$242 billion

Carbon
TransitionPhysical
Climate RisksWater
ManagementWaste and
PollutionNatural
Capital

Icon color key:

Very high

High

Moderate

Low

Low Risk

Trading Companies



Key Issue:

Minimal direct exposure
to environmental risks

There is minimal exposure to environmental risks. These companies are largely intermediaries, transporting commodities or other products from point A to point B. We believe that any exogenous event (export/import restrictions, land-use restrictions, droughts, water shortages, etc.) will continue to be regional in nature and not affect all producers globally at the same time. Carbon taxes could increase transportation expenses, but historically the industry has adapted quickly to change.

Total Debt:

\$90 billion

Low Risk

Water and Wastewater, US Municipal Utilities, and State
Revolving Funds

Key Issue:

Strong ability to raise
rates in response to
cost increases limits
risk; some exposure to
droughts and disasters

Water and sewer utilities dominate the sector, which in the US also includes municipal electric utilities with no material generation exposure. Revenue from pools of water and sewer utilities also secure a portion of the debt for state revolving funds. Water shortages and restrictions can reduce these utilities' revenue in the short term. However, they can typically adjust rates for volume fluctuations and recover costs through tariffs, in some cases subject to efficiency tests. The fixed nature of their assets mean that they are exposed to physical climate risks, particularly in regions that are prone to hurricanes, flooding and sea level rise. In some regions, climate change is also adding to pressure on water resources, increasing the size and complexity of investment programmes. Despite these risks, strong national and regional regulatory frameworks are designed to keep utilities functioning to protect public health and achieve environmental goals. Sudden events, such as floods or illegal discharges, have only rarely resulted in significant financial losses.

Total Debt:

\$388 billion

Moody's related publications

ESG methodology, heat map and classification

- » [General Principles for Assessing Environmental, Social and Governance Risks Methodology](#), 19 October 2021
- » [ESG – Global: Heat map: Sectors with \\$3.4 trillion in debt face heightened environmental credit risk](#), 14 December 2020
- » [ESG — Global: Revised classification of environmental considerations reflects evolving standards](#), 14 December 2020

Outlook

- » [ESG Global: 2022 Outlook - Amid new pledges, action on carbon, social issues rise to the fore](#), 11 January 2022

Sector In-Depth

- » [Credit Conditions - Global: FAQ on 10 key issues that will shape global credit in 2022](#), 26 January 2022
- » [Sovereigns - Hydrocarbon exporters: Strengthening global commitment to carbon transition increases longer-term credit risks](#), 11 January 2022
- » [Carbon Transition - Asia-Pacific: Slow adoption of carbon pricing leaves region vulnerable to cross-border taxes](#), 8 December 2021
- » [Regulated Networks and Unregulated Utilities - Global: ESG issues have an overall credit-negative impact; more severe for some subsectors](#), 7 December 2021
- » [Corporates - Latin America & Caribbean: Deforestation intensifies reputational risk for companies operating in Brazil](#), 2 December 2021
- » [ESG - Emerging Markets: Environmental and social risk will curb growth potential from rise in urbanization](#), 30 November 2021
- » [Power - China: Government support key for coal power sector amid China's net-zero targets](#), 9 November 2021
- » [Carbon Transition - Global: As Paris Agreement goals challenge large emitters, some sectors are making progress](#), 4 November 2021
- » [Banking - Cross Region: Financial impact disclosure of banks' climate risks is progressing slowly](#), 2 November 2021
- » [Financial institutions - Decarbonizing finance: Financial firms need to rise to the challenges of supporting carbon transition](#), 12 October 2021
- » [Carbon Transition - Europe: Airlines, shipping and non-EU producers will shoulder high costs of EU carbon legislation](#), 27 September 2021
- » [Integrated Oil and Gas: Carbon transition assessments show material exposure for all companies](#), 21 September 2021
- » [Sovereigns - Global: Water management risks curb economic strength in South Asia, Middle East, Africa, may cause wider long-term pressures](#), 4 August 2021
- » [Metals & Mining and Coal - Global: ESG issues have negative credit impact on metals and mining, more severe for coal](#), 8 June 2021

Assessment Frameworks

- » [Steel and Specialty Metals - Global: Carbon transition assessment framework for steel producers](#), 3 February 2022
- » [Exploration and Production - Global: Carbon transition assessment framework for exploration and production companies](#), 1 July 2021

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