

Risky Business: Companies' Progress On Adapting To Climate Change

April 3, 2024

Physical climate risks are on the rise but progress on adapting to them still varies, leaving some financial and non-financial corporates vulnerable.

This research report explores an evolving topic relating to sustainability. It reflects research conducted by and contributions from S&P Global Ratings' sustainability research and sustainable finance teams as well as our credit rating analysts (where listed).

This report does not constitute a rating action



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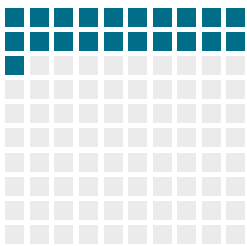
This research aims to understand the progress made by companies on adapting to the physical impacts of climate change. To do this, S&P Global Ratings analyzed 6,871 responses in the 2022 S&P Global Sustainable1 Corporate Sustainability Assessment, as well as 130 companies' adaptation and resilience plans, to evaluate the potential efficacy of companies' adaptation strategies in the face of worsening climate hazards.

Key Findings

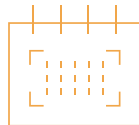
- **Only about one-fifth of companies in the sample disclosed an adaptation plan.** And less than half are planning to implement their adaptation plans within the next decade, implying that companies' progress on adapting to climate change is not keeping pace with worsening climate hazards.
- **Some companies are not prioritizing adaptation planning, which could ultimately increase the cost to adapt, and the amount of change required.** Sectors indirectly exposed to physical climate risks--such as communications services, information technology, and consumer discretionary--could see rising exposure, absent adaptation.
- **Regulation and disclosure requirements could speed up climate adaptation planning.** To this extent, adaptation plans are generally more prevalent and advanced among European companies in our sample than among companies in other regions, although--globally--the implementation of adaptation plans still has some way to go.
- **Large, investment-grade companies are generally more advanced in considering the potential financial impacts of climate change.** In addition, large companies are more likely to have spare resources to support adaptation efforts.
- **The extent of financial impacts from climate hazards, and how this might translate into credit risk, can vary greatly.** Factors like the type and severity of climate events, type of affected assets, or resilience of surrounding infrastructure may lead to different credit implications. Yet, in our view, direct and indirect financial impacts could be mitigated to a greater degree depending on whether there is an adaptation plan and robust corporate risk management to address these potential impacts.

By the numbers: Companies and climate adaptation

21% of companies have an **adaptation plan**



Less than half of adaptation plans will be **implemented within 10 years**



In 48% of the adaptation plans we reviewed, risks could be **underestimated or not assessed**



69% of plans we reviewed do not quantify **adaptation costs**



In Europe, 83% with adaptation plans say climate risks can have a **financial impact**



Based on 6,871 responses in the 2022 S&P Global Sustainable1 Corporate Sustainability Assessment, as well as 130 companies' adaptation and resilience plans. Source: S&P Global Ratings.

Companies Face Rising Physical Climate Risks

Extreme weather events and chronic physical climate risks are worsening in many regions. For example, the period 2011-2020 was the warmest on record, affecting most of Europe, southern Africa, and parts of North America and Asia-Pacific, as reported by the World Meteorological Organization. In the U.S., the number of climate disasters costing a billion dollars or more increased to 13.1 events per year in 2010-2019 from 3.3 per year in 1980-1989, and the average for 2021-2023 is 22 events per year, according to the National Oceanic and Atmospheric Administration.

The rising frequency and severity of physical climate risks can pose a potential threat to companies. By 2030, if mitigation is not stepped up, the number of climate-related disasters could be 40% higher than in 2015. This is according to a 2022 UN Office for Disaster Risk Reduction report, which also estimates there could be about 250 events globally per year in such a scenario.

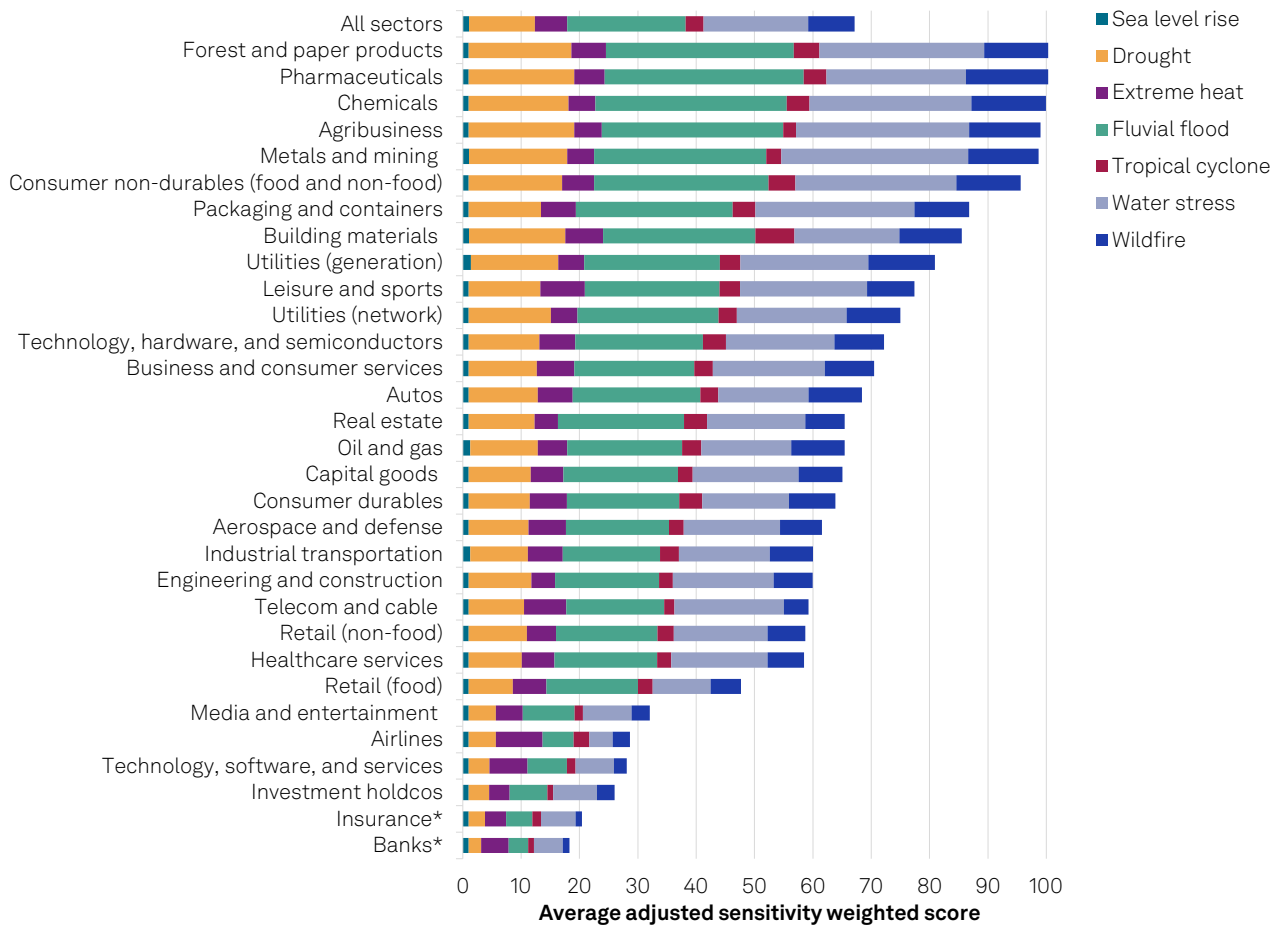
The location of companies' assets drives exposure to physical climate risks, making some sectors more or less sensitive to climate hazards than others. For example, operations that are water intensive are likely to be more sensitive to constrained water supply and/or increased water costs than those that are less water intensive. Likewise, extreme heat events reduce labor productivity more when work is conducted outdoors--such as in agriculture--due to heat stress and its impact on human health, than when activity is indoors, such as in the services sectors. In addition, assets with fixed locations face greater physical climate risk because they cannot be moved away from climate hazards (see "[Corporate Physical Assets Increasingly In Harm's Way As Climate Change Intensifies](#)," Oct. 1, 2021). Our credit rating actions related to physical climate risks in recent years reflect the impact of the location of assets, and show concentration in the utilities and infrastructure sectors (see "[ESG In Credit Ratings Deep Dive: ESG Factors Drove 13% Of Corporate And Infrastructure Rating Actions Since 2020](#)," March 13, 2024).

On average, droughts, extreme heat, as well as flooding and water stress, are projected to be the main climate hazards for about 50% of companies in 2030, absent adaptation. This is according to S&P Global Sustainable1's Physical Risk Sensitivity-Weighted Exposure Scores, which are based on companies' exposure and expected sensitivity to seven climate hazards (see chart 1). The five sectors most exposed, according to the sample, are forest and paper products, pharmaceuticals, chemicals, agribusiness, and metals and mining. Given the lock-in effect of historical greenhouse gas emissions, many of the physical risks of climate change will materialize irrespective of today's policy choices. Consequently, the data is projected to the year 2030 under a slow transition climate scenario (SSP3-7.0), which equates to a rise in temperature from pre-industrial levels of about 2.1 degrees Celsius (C) by 2050, or 3.6 C by the end of the century.

Chart 1

More than one-third of all sectors are highly exposed to physical climate risks

Total average sensitivity-weighted exposure score by climate hazard and sector under a slow transition climate scenario (SSP3-7.0) in 2030 (S&P1200 companies)



*The S&P Global Sustainable1 Physical Climate Risk dataset captures the direct exposure of companies' assets to climate hazards; it therefore excludes any value chain exposures, such as through banks and insurance companies' financed assets. Analysis based on S&P1200 companies. Sectors with total scores exceeding 75 out of 100 may be highly exposed to physical climate risks. Data sorted in descending order by total score--total score may exceed 100 due to rounding. Excludes extreme cold due to reduced impact of this hazard with greater warming. The sensitivity of companies to climate hazards is based on company-level data on water, capital, and labor intensity. Source: S&P Global Sustainable1, S&P Global Ratings.

Data And Approach: Assessing Companies' Progress On Adaptation

In our research, we analyzed two datasets: 1) 6,871 companies' responses for S&P Global Sustainable 1's Corporate Sustainability Assessment (CSA) in 2022, and 2) adaptation plans of 130 publicly listed companies.

- **CSA analysis:** We focused on responses that describe companies' awareness of physical climate risks, steps taken to adapt to those risks, and how companies view the potential financial impacts and/or opportunities that climate change may bring.

- Analysis of adaptation plans:** We primarily focused on companies in geographic regions and sectors that are generally more exposed than others to physical climate risks. Those regions include South Asia, Central Asia, and Sub-Saharan Africa, and sectors include materials, energy generation, utilities, and consumer staples. We also include some European entities in our sample to understand companies' progress on adaptation in countries generally less exposed to climate hazards. To understand the efficacy of companies' adaptation plans, we assess eight components (see table 1). We view adaptation plans that demonstrate a greater number of these components as advanced. We believe companies with such plans are likely to be well placed to adapt to and cope with physical climate risks.

Taken together, the findings from both analyses provide an in-depth view of companies' preparedness to adapt to and cope with the physical impacts of climate change. Limitations of our analysis, and a summary of the companies whose CSA responses or adaptation plans we reviewed, are in the Appendix.

Table 1

Components used to assess the efficacy of 130 companies' adaptation plans

Component	Description
Physical risk scenarios	The number of climate scenarios used to inform the adaptation plan (for example, Shared Socioeconomic Pathways, or Representative Concentration Pathways)
Timelines	Time boundaries used in companies' physical climate risk assessments
Financial planning	Whether the identified risks and/or opportunities are inputs in companies' financial planning processes
Prioritization	How companies determine the relative significance of climate-related risks in relation to other risks (approaches may be more advanced or less advanced)
Costing adaptation and resilience measures	Calculation of the cost of measures required to build resilience to physical climate risks (excludes quantification of potential impacts from climate hazards)
Implementation	Presence of a plan that describes how the identified adaptation and resilience measures will be incorporated into companies' operations
Monitoring and evaluation framework	Definition of a framework that describes how success of the identified adaptation and resilience measures will be monitored
Metrics and targets	Presence of metrics and targets to capture companies' progress (and success) in implementing adaptation and resilience measures

Source: S&P Global Ratings.

Few Companies Seem To Have An Adaptation Plan

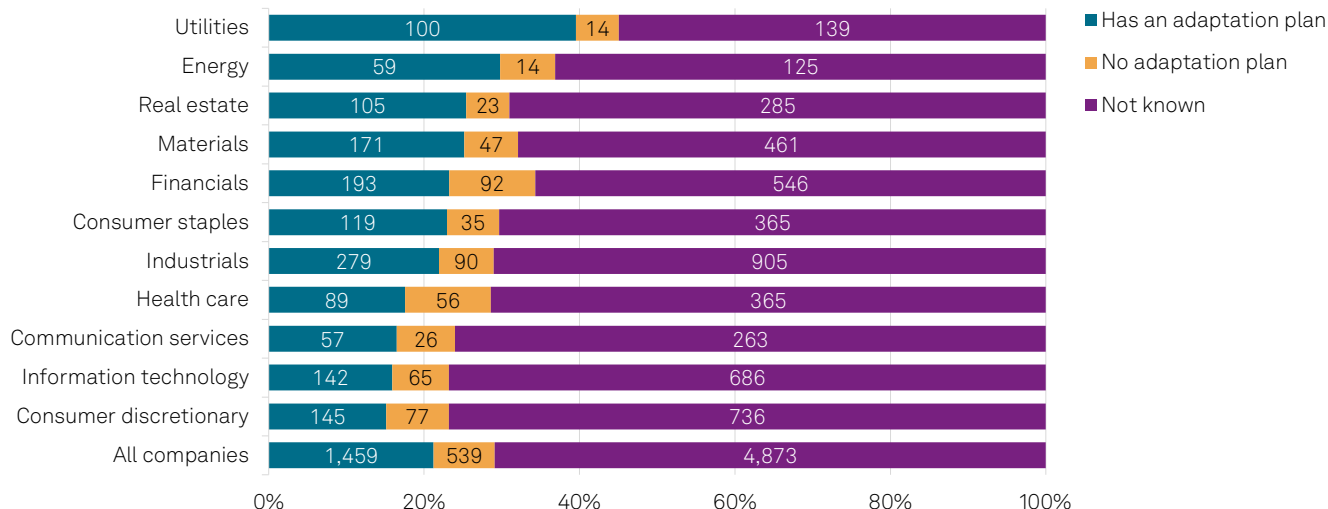
Only 21% (1,459) of the 6,871 companies responding to the 2022 CSA reported they have an adaptation plan (see chart 2 and "[Adaptation Planning Is The Next Step For Companies To Prepare For Climate Risk](#)," Feb. 21, 2023).

An adaptation plan--as defined by the CSA--is a plan to adapt to any climate risks across a company's value chain that the company has identified through a climate risk assessment. This can be a specific climate-related plan included in wider risk assessments, or a separate climate-specific report. A study exploring how companies adapt to climate hazards found the average rate of adaptation to be about 23% across 1,068 publicly listed companies (Li, 2024), which is similar to the finding from our analysis of S&P Global Sustainable 1's 2022 CSA.

Chart 2

Only 1 in 5 companies has an adaptation plan to address physical climate risks

Number and percentage of companies by sector that have adaptation plans, based on CSA 2022 responses



Data as of April 5, 2023. "Not known" includes companies that responded "not known" in the CSA; companies that did not answer the physical risk adaptation plan question or left the question blank; and companies whose adaptation plans could not be verified using publicly available sources. "No adaptation plan" includes companies that responded "no" or "not applicable" in the CSA and companies for which publicly available sources indicated there is no adaptation plan. Results based on responses from 6,871 companies responding to S&P Global Sustainable's CSA (Corporate Sustainability Assessment). Source: S&P Global Sustainable1.

The highest proportion of companies with adaptation plans are in the utilities and energy sectors (40% and 30% respectively, based on the 2022 CSA).

Of the utility companies with adaptation plans, the majority (62%) are electricity companies, followed by water (23%) and gas (15%) companies. The fixed physical locations and long lives of assets of these companies contribute to heightened exposure to climate hazards, including storms, floods, and wildfires. Political and regulatory scrutiny may have also contributed to the higher share of adaptation plans. For instance, the impact of cyclones Lothar and Martin in 1999 in France led the regulator to significantly accelerate the pace of burying above-ground electricity transmission lines. The focus on longer time horizons when conducting climate risk analyses may have also helped speed up action on adaptation as most utility companies look to the future in their efforts to manage the dual risks posed by worsening climate hazards and the energy transition.

Less than one-quarter (23% of 193 entities reporting via the CSA) of financial services companies--including banks and insurance companies--report having an adaptation plan.

Of those, 46% (89 companies) are banks, 29% (56) are insurance companies, and 25% (48) are diversified financial services companies. Physical risks for these companies are typically represented by financed exposure to corporates, households, and countries that experience climate shocks. Exposures may manifest through increased default risk of loans and securities, or lower value of assets. For example, about two-thirds of European banks' exposures to companies with high physical climate risks are secured by collateral that may be subject to damage or loss in value (European Central Bank, 2021). Future initiatives by regulators globally, including potentially through mandatory disclosures, are expected to raise banks' awareness and preparedness for assessing and managing their exposure to physical climate risks. Such disclosures will help reduce information asymmetries, enhance transparency, and improve comparative analysis (see "[Bank Regulation And Disclosure To Foster Climate-Related Risk Analysis](#)," Oct. 3, 2022).

In four sectors, the share of companies with adaptation plans is below the 21% average for the sample--health care (18% of companies), communication services (16%), information technology (16%), and consumer discretionary (15%), based on the 2022 CSA. Many companies in these sectors are likely to be indirectly exposed to physical climate risks, including through their value chains. Yet real assets like hospitals or other patient care facilities, and data centers--which typically use large volumes of water for cooling--could be directly exposed, absent adaptation. We believe these sectors' slower progress in formalizing plans to address exposure to climate hazards may reflect a limited impact from past climate events, as well as companies' lack of awareness of--or uncertainty about--how physical climate risks could affect their operations and value chains. Indeed, greater awareness of climate risks has been shown to drive adaptation efforts in the corporate sector (Arnell and Delaney, 2006; Hoffmann et al. 2009). Delayed adaptation or no adaptation may increase the costs and the amount of change required to adapt to climate change (see European Environment Agency, 2023).

The majority of companies, whose adaptation plans we analyzed, use climate risk scenarios.

About 76% (99 of the 130 companies) report that they are using Shared Socioeconomic Pathways (SSPs) or Representative Concentration Pathways (RCPs) to inform their adaptation plans. This proportion is significantly greater than the 11% of companies that disclosed the resilience of their strategies in 2022 under different climate scenarios, as recommended in the Task Force on Climate-related Financial Disclosures (TCFD, 2023) framework. We believe the disparity likely reflects companies' quicker progress on using climate scenarios in physical risk assessments than on translating those potential impacts into strategic decisions: the focus of the TCFD recommendations. The RCPs provide projections of future greenhouse gas concentrations and the amount of warming that is expected to occur by the end of the century. The SSPs reflect assumed changes in various socioeconomic factors--including population, economic growth, and technology development--which help to describe the pathways to achieving those degrees of warming. Our analysis also indicates that 75 (58%) of the 130 companies disclosed their use of at least two physical risk scenarios to inform their adaptation plans, either RCPs or--less often--SSPs. Using multiple physical climate risk scenarios can help companies consider a greater range of potential futures, and possible outcomes.

Implementing Adaptation Plans Is Often Challenging

Less than half (48%) of the 1,459 companies with adaptation plans have an implementation timeline of 10 years or less, according to the responses to S&P Global Sustainable's 2022 CSA. About one-third (35%) have already implemented at least one of the measures in their adaptation plans or aim to implement their plan within five years (see chart 3).

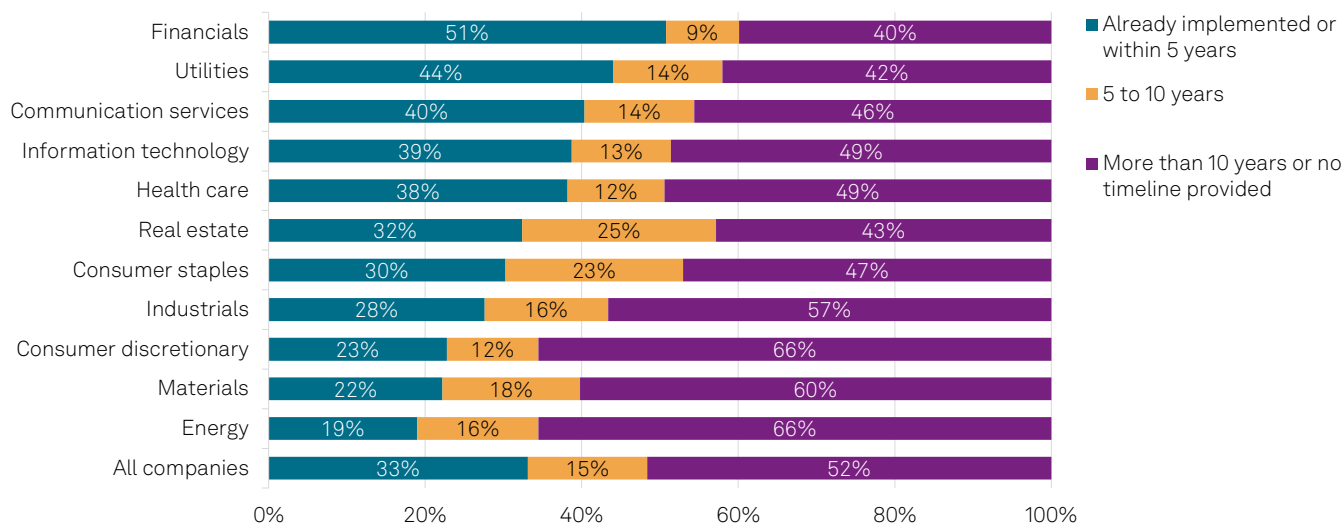
The utilities sector stands out, in that 58% of companies have already implemented adaptation plans or will implement them within the next decade. Utilities companies were also the most likely to view climate risks--both physical and transition risks--as financially material to their operations. About 79% of utilities companies with adaptation plans responded in their CSA that they recognize potential (material) financial impacts from climate risks.

Despite the energy sector having the second highest proportion of companies with adaptation plans, the timelines for implementation appear to lag those for all other sectors. Only 35% of energy companies--mainly in oil and gas, but also equipment and services--have an implementation timeline of less than 10 years (see chart 3). In contrast, only one-quarter of financial services companies have adaptation plans, but more than half (98 of the 193 companies in our sample) have already implemented them or aim to do so within five years. The difference is likely partly because of climate risk disclosure requirements for financial services companies, including banks. Companies with adaptation plans in the industrials, consumer discretionary, materials, and energy sectors seem to see less urgency in addressing adaptation, with more than half indicating they will not take action for at least a decade or that they have no definite timeline for action (see chart 3).

Chart 3

Less than 50% of companies with adaptation plans are implementing them within 10 years

Percentage of companies with adaptation plans by implementation timeline



Data as of April 5, 2023. Results based on responses from 1,459 companies with adaptation plans assessed in the 2022 S&P Global Corporate Sustainability Assessment. Source: S&P Global Sustainable1.

Companies face several stumbling blocks on the path to adaptation. The benefits to companies--and other stakeholders--of investing in climate adaptation and resilience are well known (European Environment Agency, 2023). However, progress on developing and implementing adaptation plans can often be limited or slow, due to a number of challenges (see "[Crunch Time: Can Adaptation Finance Protect Against The Worst Impacts From Physical Climate Risks?](#)" published Jan. 13, 2023).

- Investments in adaptation and resilience tend to be less attractive for investors than mitigation, due to uncertainty as well as difficulties in quantifying the benefits of measures to be implemented and forecasting the returns.
- Also, some investments--such as those in public infrastructure, where the useful life of assets spans multiple decades--may not generate a return for investors.
- In addition, the physical climate risks companies face may not be comprehensively understood, too distant, and/or misaligned with companies' business cycles. In the worst case, where adaptation strategies are in place, they may be ineffective and could

result in maladaptation--that is, where interventions increase both the exposure and sensitivity to climate hazards (Schipper, 2020).

Such challenges may stop or slow companies' efforts to adapt to the physical impacts of climate change. Nevertheless, the intensity of exposure often influences companies' decisions about whether or not to invest in adaptation (Linnenluecke et al. 2013).

Investment-Grade Companies Seem Ahead In Reporting On And Addressing Adaptation

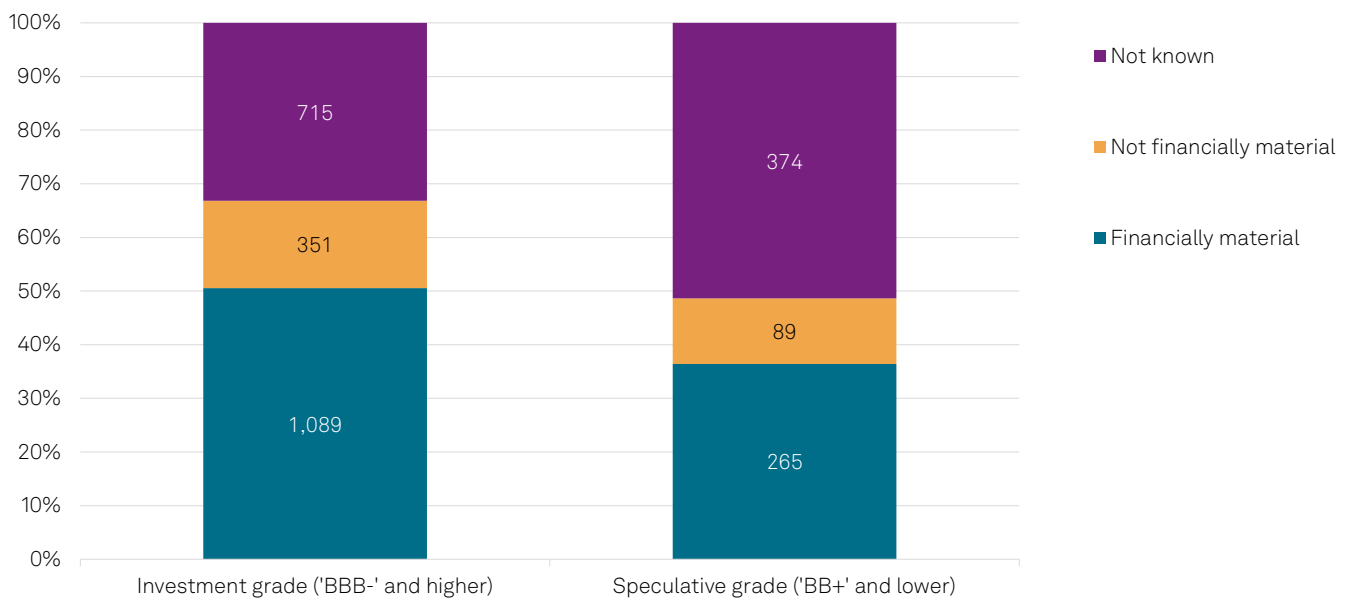
On average, about half of the companies in our sample with investment grade credit ratings ('BBB-' or higher) recognize the potential financial impacts of physical climate risks. This is based on responses from companies we rate to questions in S&P Global Sustainable1's 2022 CSA about the potential financial materiality of climate risks.

Of the 6,871 companies responding to the 2022 CSA, 2,883 are rated by S&P Global Ratings, of which about 31% (897) disclosed that they have an adaptation plan. Of those 897 rated entities, we find little variation by rating category in how they view the potential financial impacts of climate risks. These companies are more likely to already be aware of--and give higher priority to--the potential financial impacts from climate risks, given their progress on adaptation planning. A little over half (1,089) of the 2,155 companies with an investment grade credit rating--with or without adaptation plans--responded to the CSA that they recognize the potential financial impacts of climate risks to their operations (see chart 4).

Chart 4

About half of investment-grade companies acknowledge potential financial impacts of climate risks

Percentage of rated companies responding to the 2022 CSA, both with and without adaptation plans



Data as of April 5, 2023. Results based on responses from 2,883 rated companies with or without adaptation plans assessed in the 2022 S&P Global Corporate Sustainability Assessment. Not known--Cases where no public or private info is available, Source: S&P Global Sustainable1.

About 52% (1,020) of the 1,986 rated companies disclosing that they don't have adaptation plans, indicated they do not know whether climate risks are financially material (see chart 5).

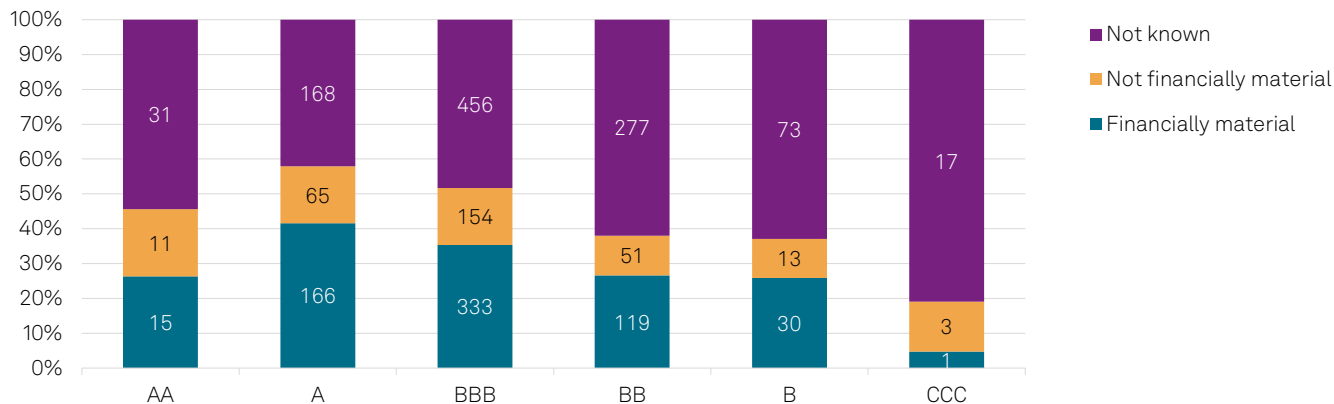
Of these companies, about 26% (or 150) with speculative-grade ratings ('BB+' or lower) recognize the potential financial materiality of climate risks, as do about 37% (514) with investment-grade ratings ('BBB-' and higher; see chart 5). A similar trend is observed when identifying opportunities from climate change, with investment-grade companies without adaptation plans (77% or 636) more likely to expect opportunities than lower-rated entities (23% or 186).

The proportion of companies that expect financial opportunities to arise from climate change is higher among companies with adaptation plans (87% or 622 of 745 companies). This proportion does not vary significantly by rating category. We believe this is because companies with adaptation plans are more likely to have completed analyses to identify opportunities, irrespective of their creditworthiness.

Chart 5

Companies in the 'BB' and lower rating categories tend to view climate risks as not financially material or not known

Percentage of companies by rating category responding to the 2022 CSA, without adaptation plans



Data as of April 5, 2023. Results based on responses from 1,983 rated companies without adaptation plans that responded to the 2022 S&P Global Corporate Sustainability Assessment. "Not known" includes companies that responded "not known" in the CSA; companies that did not answer the physical risk adaptation plan question or left the question blank; and companies whose adaptation plans could not be verified using publicly available sources. We exclude companies with 'AAA' ratings due to the small sample size. Source: S&P Global Sustainable1.

Large Companies Appear To Be Making Better Progress

The adaptation planning of companies with midsize and large capitalization tends to be more advanced than that of smaller companies. Large-cap companies, those with market capitalizations of \$2 billion or more, are more likely to have spare resources (financial and human) that could be allocated to support adaptation efforts. At the same time, they may also be sufficiently diversified to accept and adapt to physical climate risk exposure due to their large asset bases and supply chains. Public scrutiny of larger companies may also be more intense, prompting preventative action to avoid reputation risks (see Marquis et al. 2016).

When we analyzed the adaptation plans of 130 companies, we found that more mid- and large-cap companies use climate scenarios in their physical risk assessments than small-cap companies. Larger companies in our sample also tend to integrate climate risk analysis into their financial planning much more widely than smaller companies. That said, most companies--regardless of size--do not input findings from climate risk assessments into their financial plans. We also find that larger companies tend to use more advanced methods--such as bottom-up,

asset-level physical risk assessments--to estimate potential exposure to the physical impacts of climate change. However, the use of less advanced methods is widespread, irrespective of company size.

Regulation And Disclosures May Bring Further Action On Climate Change

Regional disparities are apparent among companies making progress on adaptation. Consequently, the impacts from physical climate risks will be heterogeneous. Countries in South Asia face 3x more potential economic losses annually (about 12% of GDP) than the world average by 2050 under a slow transition scenario (SSP3-7.0), while Europe and North America are expected to be less exposed, with about 2% GDP at risk (see "[Lost GDP: Potential Impacts Of Physical Climate Risk](#)," published Nov. 27, 2023). Companies' exposure to climate hazards is likely to contribute to decisions on adaptation, but other factors may help explain the pace of progress at the regional level.

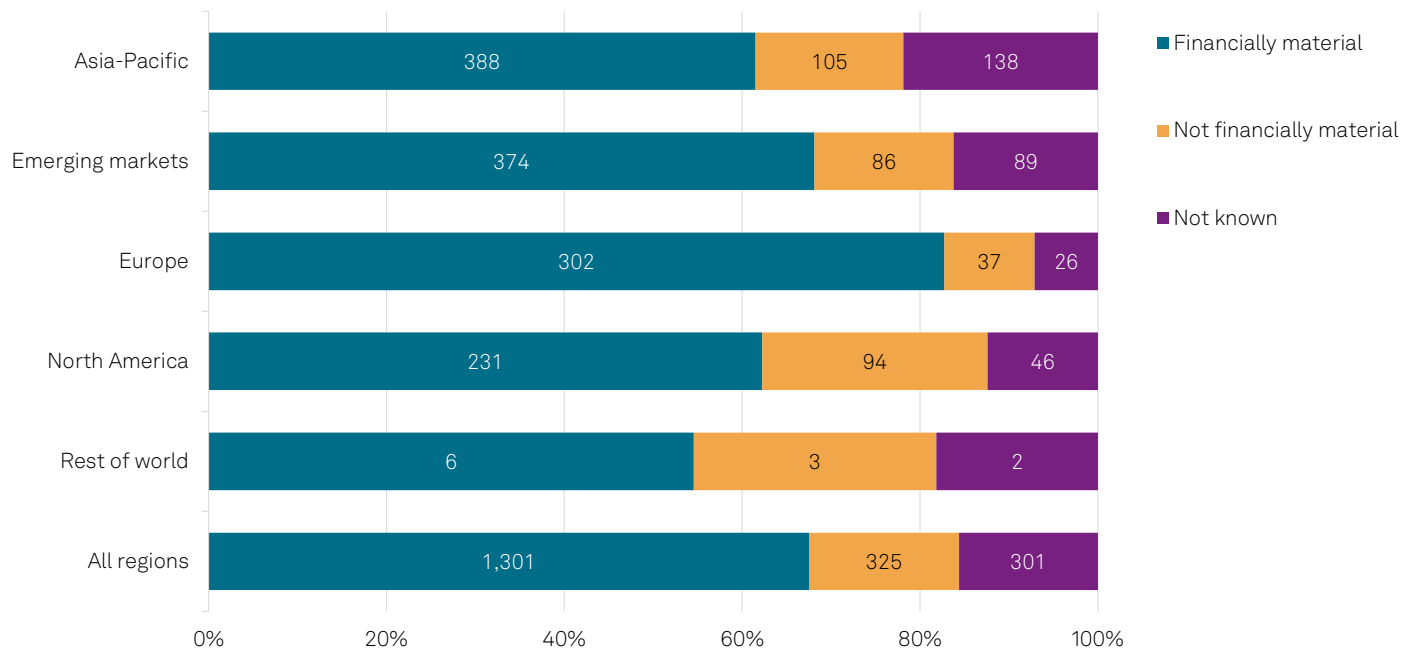
European companies show greater awareness of climate risks

This may have contributed to why 83% (302) of 363 European companies with adaptation plans report that climate risks are likely to have a financial impact on their operations (see chart 6). This finding is based on responses from 1,927 global companies with adaptation plans in S&P Global Sustainable1's 2022 CSA.

Chart 6

Over 80% of European companies report that climate risks could be financially material

Percentage of companies by region with adaptation plans reporting to the 2022 CSA



Data as of April 5, 2023. "Not known" includes companies that responded "not known" in the CSA; companies that did not answer the physical risk adaptation plan question or left the question blank; and companies whose adaptation plans could not be verified using publicly available sources. Results based on responses from 1,927 companies with adaptation plans assessed in the 2022 S&P Global Corporate Sustainability Assessment. Source: S&P Global Sustainable1.

Of companies without adaptation plans, a higher share in Europe than in other regions reported that climate risks could have a financial impact on their operations. Specifically, these entities accounted for 42% (314) of 753 European companies without adaptation plans. This figure is more than double the global average of about 18% (1,392), based on 7,867 company responses. Another study yielded similar findings, with greater awareness of physical climate risks, better insurance penetration, and economic development suggested as the reason for the relative maturity of European companies' progress on adaptation (Li, 2024).

More-stringent environmental regulations and climate risk disclosure requirements in Europe appear to drive increased awareness of potential financial impacts from climate hazards. In turn, this prompts companies' actions on adaptation. For example, the European Sustainability Reporting Standards (ESRS) and the International Financial Reporting Standard (IFRS) S2 disclosure requirements are both based on the recommendations of the TCFD. However, the ESRS have already been adopted for use by all European companies, subject to the Corporate Sustainability Reporting Directive (CSRD). Reporting requirements will be phased in over time, starting with large public-interest companies in 2024 (see "[Navigating CSRD: Regional Regulations, Global Repercussions](#)," published Nov. 21, 2023). By contrast, in the U.S., the Securities and Exchange Commission (SEC) has published its final rule on climate-related disclosures, including companies' exposures to physical risks (SEC, 2024). Previously, there was no federal requirement in the U.S. to explicitly disclose climate risks. Furthermore--since Jan. 1, 2023--11,700 firms currently subject to the EU's Non-Financial Reporting directive have been required to disclose their alignment with the EU Taxonomy, including on climate adaptation. As more disclosures are published, we believe awareness among European companies will increase, as will the number and quality of disclosures on the potential financial impacts of physical climate risks.

Overall, global adaptation plans show several shortcomings

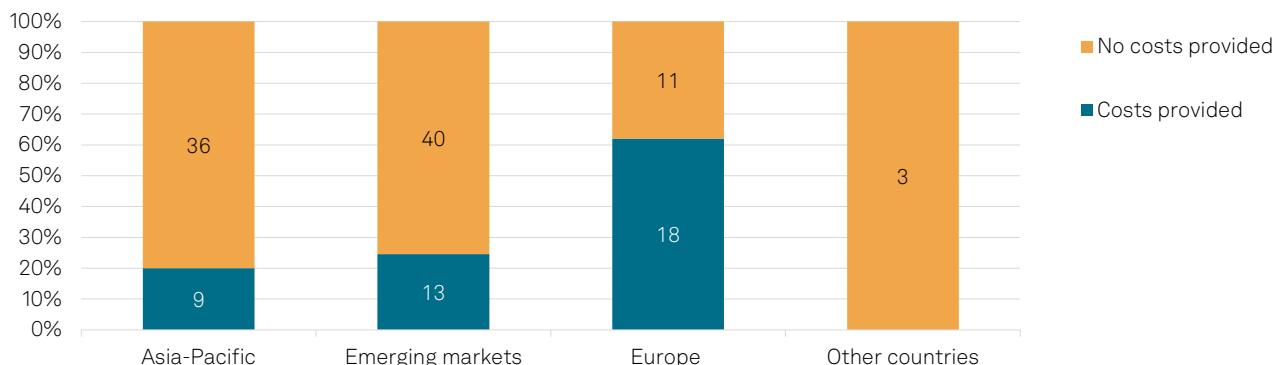
Compared with companies in other regions, those in Europe are farther ahead with adaptation planning. But in all regions in our sample (see Appendix), climate adaptation plans still have some way to go. Based on our examination of the adaptation plans of 130 companies across regions, we find that:

- **European companies are more likely to use advanced quantitative approaches to assess their exposures to physical climate risks.** Nevertheless, this applies to only about 20% of the 29 European companies' adaptation plans we reviewed. European companies are more likely to apply multiple climate scenarios to assess physical risks and granular, asset-level, analyses, rather than aggregated portfolio-wide reviews. However, across regions, about 48% of all 130 adaptation plans use less advanced methods--including qualitative analyses and/or assessments that are restricted to certain assets--meaning that risks may be underestimated or not assessed at all;
- **Input climate risk analysis into their financial planning.** We find that 45% (13) of the 29 European companies use the outputs of physical risk assessments in their financial plans. This compares with just 14% (nine) of the 53 companies in emerging markets, whose adaptation plans we reviewed, and an average of 29% (32) for all 130 adaptation plans; and
- **Estimate the cost of measures required to adapt their operations to climate hazards.** This applies to 62% (18) of the 29 European companies. A significantly higher share of companies globally--69%--do not quantify adaptation costs at all, based on our review of all 130 adaptation plans (see chart 7). This may signal many companies are only just starting to translate the outputs of climate risk assessments into strategic plans and concrete actions.

Chart 7

Nearly two-thirds of European companies provide the costs of their adaptation measures

Percentage of companies by region



Data as of April 5, 2023. Results based on assessment of 130 companies with adaptation plans. “Costs” refers to the anticipated financial costs disclosed by companies to implement adaptation measures, we exclude costs that reflect the quantification of potential impacts from climate hazards. Source: S&P Global Ratings.

A minority of companies disclose that they are integrating the outputs from climate risk assessments into their financial plans. Based on our analysis of 130 companies' adaptation plans, we find that 24% (31) of companies provide details on how the outputs of their physical risk analyses (including identified risks and/or opportunities) could affect and/or inform their financial plans. A greater number of companies (41% or 53 companies) have identified physical climate-related risks but do not currently disclose that they input these findings into their financial plans.

In emerging markets, most companies without adaptation plans do not know if climate risks will affect their operations. This was reported by 81% (1,877) of 2,326 companies in those markets, without adaptation plans, in S&P Global Sustainable1's 2022 CSA. This is despite greater potential vulnerability to economic losses in those countries as absolute hazards become more extreme. Slower progress may make some climate risks more difficult to adapt to. Limits to adaptation--that is, the point at which objectives or system needs cannot be insulated from intolerable risks through adaptation (see Klein et al. 2014)--suggests some areas may be unable to be protected. An example is inability to protect low-lying islands from sea-level rise due to economic and physical limits, when expected costs exceed the impacts averted. This may be a particular challenge for more vulnerable countries, emphasizing the urgency of adaptation and resilience investments in the short term.

Adaptation Gaps And Credit Risks

A company's degree of vulnerability to physical risks through extreme weather events and chronic changes in climate depends on several factors. These include the geographic location of assets; the location's economic development and exposure; and companies' choices, alongside the implementation and success of adaptation and resilience investments. Although we have seen various magnitudes of financial impacts for corporates, clarity on how physical climate risks are transmitted to credit risk often remains low.

Climate risk exposure may not translate into material credit impacts

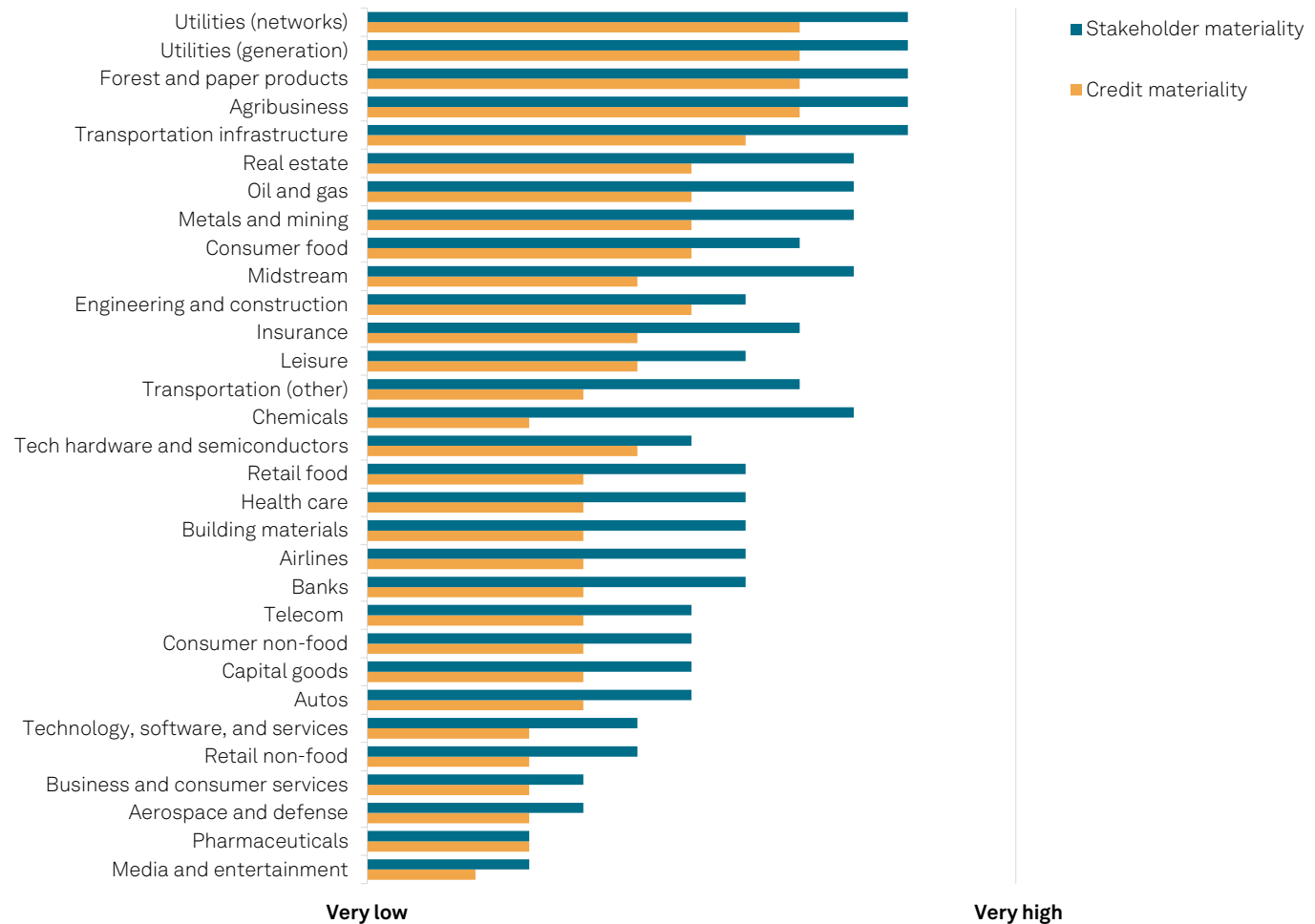
The materiality of worsening climate hazards matters to companies. Companies' sensitivity to physical climate risks is helpful in understanding the extent to which they may be exposed to climate hazards. However, some of those hazards may or may not result in financial impacts.

In some cases, climate hazards may have a limited financial impact while the impact on stakeholders is high (see "[Materiality Mapping: Providing Insights Into The Relative Materiality Of ESG Factors](#)," published May 18, 2022). The materiality of different environmental (and social) factors varies depending on the perspective, whether stakeholder or credit, as well as on the evolving and dynamic interactions between these two dimensions. Based on a combined assessment of stakeholder and credit materiality by sector, we observe that companies with fixed, long-life assets are most likely to be affected by worsening physical climate risks (see chart 8). For an example materiality map, see "[ESG Materiality Map: Utilities Networks](#)," May, 18, 2022.

Chart 8

Physical climate risks are generally more material for companies with fixed, long-life assets and those more heavily reliant upon the natural environment

Stakeholder and credit materiality of physical climate risks, by sector



S&P Global Ratings' materiality maps provide an illustration at a point in time, of our findings on the relative materiality of physical climate risks, from both the stakeholder and credit perspectives, for the sector. It does not represent any new analytical approach to the treatment of physical climate risks in our credit ratings. See our ESG Criteria for more information on how we incorporate the impact of physical climate risks, and other ESG credit factors, into our credit ratings analysis. Source: S&P Global Ratings.

The way that physical climate risks may influence the creditworthiness of companies varies.

Interdependencies between companies' value chains and the local specificities of adaptation mean that the financial impacts of physical climate risks on companies will affect almost all stakeholders to some degree.

- **Direct impacts** can manifest through damage to assets and/or disruption to operations (including increased operating or production costs), and result in higher-than-expected investments to rebuild (and adapt to) the damaged asset base. Chronic climate changes--such as water or heat stress--may also reduce companies' productivity.
- **Indirect impacts** may materialize as even greater financial risks. These include reduced access to capital or higher cost of debt, increased insurance premiums, and/or reduced coverage, litigation, or unforeseen stakeholder reactions to the climate event (political, regulatory, or legal for instance). Our recent rating actions on corporate entities, related to physical climate risks, have mainly stemmed from these indirect effects rather than from the asset damage caused by climate risk. The presence of an adaptation plan may, however, reduce these indirect risks, if and when they materialize.

Despite rising exposure to climate hazards, predicting precisely where and when physical risks may crystallize--and the magnitude of any associated economic losses--is inherently uncertain.

Likewise, there is no certainty regarding the outcome of measures that companies and governments may take to adapt to and cope with the physical impacts of climate change. In addition, for most companies, the potential impacts related to physical climate risks are yet to materialize. These are some reasons why only a small proportion of our ratings on nonfinancial corporates have changed as a result of physical climate risks ("[Why Climate Risks Are Changing So Few Corporate Ratings](#)," published April 12, 2023). We also believe that, regardless of the amount of uncertainty, the level of historical greenhouse gas emissions means that many of the physical risks from climate change will materialize irrespective of today's policy choices. This implies companies and governments will continue to face rising exposure, placing even greater emphasis on adaptation (see for example "[North American Wildfire Risks Could Spark Rating Pressure For Governments And Power Utilities, Absent Planning And Preparation](#)," published Nov. 29, 2023).

The global impact on economic growth from climate hazards will likely be heterogeneous.

Up to 4.4% of the world's GDP could be lost annually if adaptation isn't adopted, disproportionately affecting developing economies (see "[Lost GDP: Potential Impacts Of Physical Climate Risks](#)," Nov. 27, 2023). The impacts from physical climate risks are more likely to be permanent in less developed economies, with readiness--that is, countries' ability to adapt to and cope with physical climate risks--being one of the main factors explaining why some countries can cope with climate hazards, while others take longer to recover and face relative wealth losses ("[Is Climate Change Another Obstacle To Economic Development?](#)" published Jan. 16, 2023). Companies with operations located in countries that are better adapted to physical climate risks are more likely to indirectly benefit from more robust infrastructure--such as tropical storm, early warning systems in Hong Kong--and policies that provide effective support in the face of, or following, climate shocks.

Several company-specific factors may offset credit risk

The scope, scale, and diversity of a company's operations, which do not apply only to climate-related exposure, are key components of our credit risk analysis under our corporate ratings methodology.

Many corporate entities show diversification by assets, geography, suppliers, and customers, which partly explains the so-far limited impact on our ratings from physical climate risks. If an

extreme weather event were to affect supply chains, for example, such companies could potentially turn to other sources to avoid material operating disruptions and limit the impact on their credit profiles. On the other hand, when a company's operations are highly concentrated--in terms of asset, geography, or supply chain for instance--this could have a negative impact on our credit risk assessment.

Indirect effects of physical climate risks are typically more uncertain, though they could have a greater financial and credit impact than direct effects. Economic losses could, for instance,

result from high legal costs, especially when linked to death or injury. These potential economic losses could vary widely and stem from various stakeholders; hence they are typically hard to predict. For instance, historical data on U.S. utilities shows that legal developments following wildfires in serviced territories, and the resulting settlements, took many different forms, owing for example to varying numbers of plaintiffs or amounts at stake. Other indirect effects can come through other channels, such as markets (via price volatility and changes in the supply or demand of goods), which can have both positive and negative financial implications. For instance, extreme weather events affecting crops could lead to higher product prices and better margins for some companies, despite costs related to damage incurred, provided such entities are sufficiently large and geographically diverse.

Many entities can rely on insurance coverage to help manage losses. However, exposure to increasingly extreme weather events can push up the cost of insurance and lead to coverage becoming unaffordable or unavailable. We have observed a significant rise in the cost of insurance in areas that frequently experience weather-related losses. Also, some insurers have withdrawn from certain markets--for example, Florida where hurricanes are common, and California, which tends to face wildfires--where writing new business or renewing policies is financially unattractive. In our view, the future availability and affordability of insurance coverage could create additional risks for corporates.

Looking Ahead

Corporates are increasingly exposed to worsening physical climate risks--with potential impacts touching all sectors in some way, and to varying extents--without efforts to adapt.

We found that companies' ability to adapt to and cope with the physical impacts of climate change varies significantly. Action on adaptation is still at an early stage for most companies, potentially leaving many underprepared to face climate hazards. As the potential damage associated with physical climate risks rises, this will test the resilience of companies' strategies and the ability to operate without incurring related additional costs.

In our view, corporate entities represent key drivers of climate action. In public discussion on how to address the threats posed by physical climate risks, and finance those efforts, the spotlight is often placed upon governments and other stakeholders. Yet companies play a unique role in channeling finance--and other benefits, such as technology--to support those most vulnerable to climate risks. Amid rising awareness of physical climate risks among financial market participants, and mounting insured losses, we expect new disclosure standards to accelerate companies' understanding and disclosure of, and plans to respond to, climate-related impacts, alongside a deeper assessment of the financial implications. At the same time, financing rising adaptation costs may become more difficult amid higher interest rates and slower economic growth. This adds another hurdle to companies' progress on adaptation, particularly in developing countries.

Related Research

- [ESG In Credit Ratings Deep Dive: ESG Factors Drove 13% Of Corporate And Infrastructure Rating Actions Since 2020](#), Mar. 13, 2024
- [Key 2024 Sustainability Trends Driving The Year Ahead](#), Jan. 15, 2024
- [Criteria | Corporates | General: Corporate Methodology](#), Jan. 7, 2024
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- [Lost GDP: Potential Impacts Of Physical Climate Risks](#), Nov. 27, 2023
- [Navigating CSRD: Regional Regulations, Global Repercussions](#), Nov. 21, 2023
- [Why Climate Risks Are Changing So Few Corporate Ratings](#), Apr. 12, 2023
- [Adaptation Planning Is The Next Step For Companies To Prepare For Climate Risk](#), Feb. 21, 2023
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- [Agriculture Industry Is Still Sweating This Year's Droughts](#), Oct. 13, 2022
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Appendix

Summary statistics of the companies used in our analysis are provided in the tables below. Limitations are described thereafter.

Table A1

Regional breakdown of the 6,871 companies used in our analysis from the 2022 S&P Global Sustainable1 CSA

Region	Number of companies
Asia-Pacific	2,847
Emerging markets	1,646
Europe	705
North America	1,419
Other	254

Source: S&P Global Sustainable1, S&P Global Ratings.

Table A2

Industry breakdown of the 6,871 companies used in our analysis from the 2022 S&P Global Sustainable1 CSA

Industry	Number of companies
Communication services	346
Consumer discretionary	958
Consumer staples	519
Energy	198
Financials	831
Health care	507
Industrials	1,274
Information technology	893
Materials	679
Real estate	413
Utilities	253

Source: S&P Global Sustainable1.

Table A3

Summary statistics of the 130 companies in S&P Global Ratings' deep dive assessment

Region	Number of companies
Asia-Pacific	45
Emerging markets	53
Europe	29
Rest of world	3

Source: S&P Global Sustainable1.

Table A4

Summary statistics of the 130 companies in S&P Global Ratings' deep dive assessment

Region	Number of companies
Consumer staples	18
Energy	15
Health care	1
Materials	65
Utilities	31

Source: S&P Global Sustainable1.

Limitations

We describe some of the limitations and assumptions of our analysis below (this list is not exhaustive):

- **Our analysis is limited to those companies choosing to respond to the 2022 S&P Global Sustainable1 CSA.** This may limit the diversity of responses and/or any inferences.
- **The analysis of adaptation plans focuses on the adaptation plans of 130 companies.** We intentionally restrict our analysis to companies in regions and sectors more exposed to physical climate risks, namely South Asia, Central Asia, and Sub-Saharan Africa; and to the materials, energy generators, utilities, and consumer staples sectors. We also include some European entities in our sample to understand companies' progress on adaptation in countries generally less exposed to climate hazards. As a result, there may be companies located in other regions or sectors not included in our analysis that are more or less advanced in their analysis of (and measures implemented to address) physical climate risks.
- **As with all estimates pertaining to the distant future, there are inherent uncertainties** associated with climate science, including the crystallization and severity of climate risks (see "[Model Behavior: How Enhanced Climate Risk Analytics Can Better Serve Financial Market Participants](#)," June 24, 2021, which describes some of these uncertainties and potential mitigants).
- **Aside from physical climate risks, companies are also exposed to transition risks.** Although we note the materiality of transition risks, we intentionally exclude them in the analysis for this research. To gain a comprehensive understanding of companies' vulnerability to climate risks, both transition and physical climate risks should be considered.

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