

Climate change scenarios

Risks and opportunities

30 July 2018



Transition risks: How to move ahead

What's it all about?

Across six reports, Kepler Cheuvreux and The CO-Firm have quantitatively analysed how transition risks could impact future company earnings and equity valuations by modelling the utilities, autos and steel sectors under different climate change scenarios. This report provides a one-stop shop for the key takeaways and lessons from these analyses. Specifically, we outline the methodology for integrating transition risks into equity valuations, apply that theory to three companies in each of our selected sectors and recommend how equity analysts, asset managers and portfolio managers could apply our findings.

CLIMATEXCELLENCE

THE-CO FIRM

Authors

Dr. Nicole Röttmer

Jana Mintenig

The CO-Firm

climatexcellence@co-firm.com

Luke Sussams

Sustainability Research Analyst

lsussams@keplercheuvreux.com

+44 (0) 207 621 5186

Energy Transition Risk Project

Biographies at the end of the report



Please refer to the last page of this report for "Important disclosures"

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360

in 1 minute

Transition risks: How to move ahead

This report is the last in a series of six which make up Kepler Cheuvreux (KECH) and The CO-Firm's contribution to the Energy Transition (ET) Risks project (funded by the European Commission). It brings together the main conclusions from our analysis of how transition risks could impact the financial performance of companies through examples from the utilities, autos and steel sectors. The in-depth analysis of these individual sectors can be found in standalone reports that are also publicly available ([link](#)).

Key findings of the report

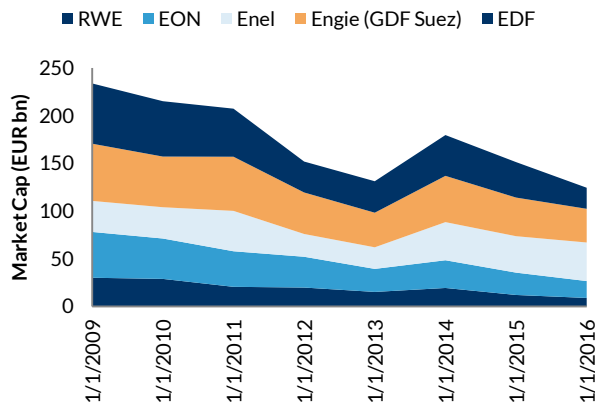
KECH and The CO-Firm's conclusions provide insights into how climate change scenario analysis could tie into traditional company- and sector-level financial assessment. The results should not be seen as an investment recommendation or forecast, however, but as one insight into how the financial performance of companies could vary in the future.

- The low-carbon transition is generally a growth story for the sectors under consideration. Our analysis suggests that a faster transition scenario might even lead to stronger earnings growth compared to a slower transition scenario, e.g. steel and utilities.
- On a company level, financial performance varies significantly, with impacts from transition risks materialising in the short- to medium-term in some cases, e.g. ArcelorMittal's EBITDA could be 45% higher by 2030 in a 2°C scenario than taking no action at all.
- The analysis also shows that there could be discrepancies between company valuations in our climate change scenarios and a market "consensus" baseline, suggesting that the market may not be effectively pricing in all transition risks.
- Analysts often lack conviction that transition risks can affect a company's investment case, whether due to low probability, low severity or, most commonly, because they feel that the risk falls outside of the analyst's time frame.
- A scenario analysis can help analysts manage the great uncertainty around climate change and transition risks, and inform any decision-making thereafter. The next step for analysts is to assign probability weightings to each scenario and begin to factor in the assumptions/inputs of the most likely future into their base case.

This analysis was produced independently from Kepler's Autos, Utilities and Steel teams and does not reflect their views or ratings of any company mentioned.

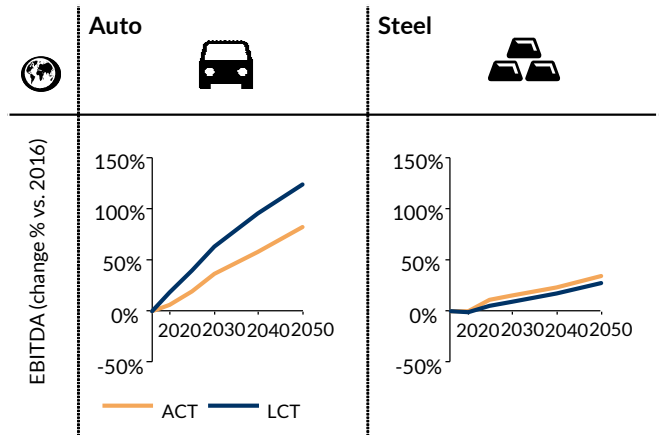
Key findings in six charts

Chart 1: Transition risks can affect the investment case of companies, e.g. EU utilities case study



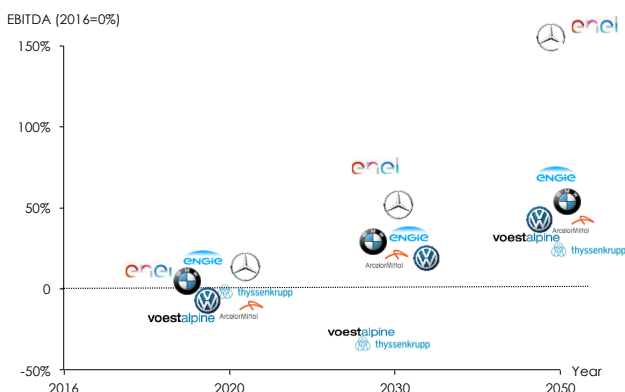
Source: Kepler Cheuvreux

Chart 2: At the sector level, the low-carbon transition could be a growth story



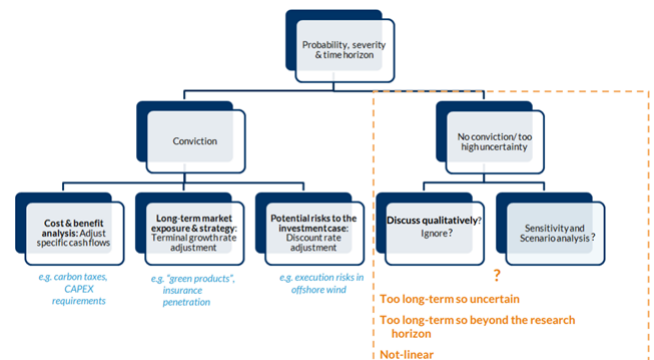
Source: The CO-Firm

Chart 3: At the company level, there are winners and losers (ACT (2°C)/MARKET REVENUE)



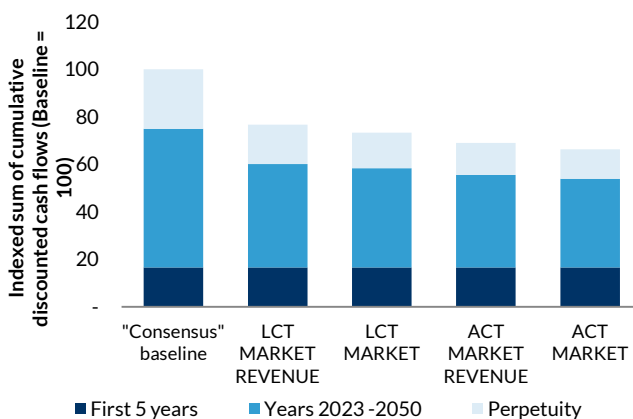
Source: The CO-Firm

Chart 4: Why are transition risks often not integrated into an analyst's investment case assessment?



Source: Kepler Cheuvreux

Chart 5: An example (BMW) of our analysis of climate change scenarios compared to a market consensus baseline



Source: Kepler Cheuvreux

Chart 6: An example (autos) of questions we recommend investors ask companies in light of our analysis

Engagement questions for investors

What are the biggest risks to Daimler's e-mobility strategy in the short term?

What are BMW's plans for diversifying into emerging markets and larger, premium EV models?

What is VW's strategy if the e-mobility transition is led by plug-in hybrids?

Source: Kepler Cheuvreux and The CO-Firm

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The Energy Transition (ET) Risk project

The ET Risk consortium, funded by the European Commission, is developing the key analytical building blocks needed for energy transition risk assessment and is bringing them to market:

1. **Transition scenarios:** The consortium has developed and made public two climate change scenarios, the first (LCT) representing a limited transition extending current and planned policies and technological trends (e.g. IEA ETP RTS trajectory), and the second (ACT) representing an ambitious scenario that expands on the data from the IEA ETP 2DS.
2. **Company data:** Oxford Smith School and 2° Investing Initiative have jointly consolidated and analysed asset level information across six energy-relevant sectors (power, automotive, steel, cement, aircraft, and shipping), including an assessment of committed emissions and the ability to potentially “unlock” such emissions (e.g. reducing load factors).
3. **Valuation and risk models:**
 - a. ClimateXcellence model: The CO-Firm’s scenario risk model covers physical assets and products and determines asset-, company-, country-, and sector-level climate transition risks and opportunities under a variety of climate scenarios. Effects on margins, EBITDA, and capital expenditure are illustrated under different adaptive capacity assumptions.
 - b. Valuation models: Kepler Cheuvreux. The above impact on climate- and energy-related changes to company margins, cash flows, and capex can be used to feed discounted cash flow and other valuation models for financial analysts.
 - c. Credit risk rating models: S&P Global. The results of the project will be used by S&P Global to determine if there is a material impact on a company’s creditworthiness.
 - d. Assumptions on required sector-level technology portfolio changes are aligned with the Sustainable Energy Investment (SEI) Metrics project ([link](#)), which developed a technology exposure-based climate performance framework and associated investment products that measure the financial portfolio alignment.

Acknowledgements

For sharing his insights and providing feedback in the writing of this report, we wish to thank Mark Fulton. Mark is an advisor to the Carbon Tracker Initiative and the 2° Investing Initiative; a senior fellow at CERES; and special advisor to the Climate Bond Initiative.



See seimetrics.org for more information on the “sister” project on companies’ technological exposure

Introduction

What are transition risks?

Climate change has been on the agenda of global governance, business and society for at least 50 years. Over time, greater understanding of climate science has led to a greater sense of urgency among some groups that believe action is needed.

In 2015, this sense of urgency was enshrined in the Paris Agreement, in which 197 parties (governments) pledged to take action to limit global warming to 2°C above pre-industrial levels by 2100, with the ambition to keep it “well below” 2°C.

Delivering the Paris Agreement will require major shifts in the structure of the global economy, including the energy, building, transportation and agricultural sectors. “Transition factors” relate to the risks (and opportunities) to companies, and therefore investors, from this realignment of our economic system towards low-carbon or carbon-positive solutions. These differ from the physical risks of climate change that threaten the global economy (Table 1).

Delivering the Paris Agreement will require major shifts in the structure of the global economy

Table 1: Transition risks differ from physical risks

	Type	Climate-related risks	Potential financial impacts
Transition risks	Policy and legal	Increased pricing of GHG emissions; enhanced emissions-reporting obligations; exposure to litigation	Increased operating costs/reduced demand for products and services results from higher compliance and judgement
	Technology	Substitution of existing products and services for lower emissions options; unsuccessful investments in new technology; costs to transition to lower-emissions technology	Write-offs and early retirements of existing assets; capital investment in technology development
	Market	Changing customer behaviour; increased cost of raw materials	Reduced demand for goods and services; increased production costs due to changing input prices (e.g. energy and water)
	Reputation	Stigmatisation of sector; increased stakeholder concern or negative stakeholder feedback	Reduced revenue from decreased demand for goods and services; decreased production capacity (e.g. delayed planning approvals)
Physical risks	Acute	Increased severity of extreme weather events like cyclones and floods	Reduced revenues from decreased production capacity (e.g. transport difficulties, supply chain interruptions); damage to property
	Chronic	Changes in precipitation patterns and extreme variability in weather patterns; rising mean temperatures; rising sea levels	Increased capital costs (damage to facilities); reduced revenues from lower sales/output

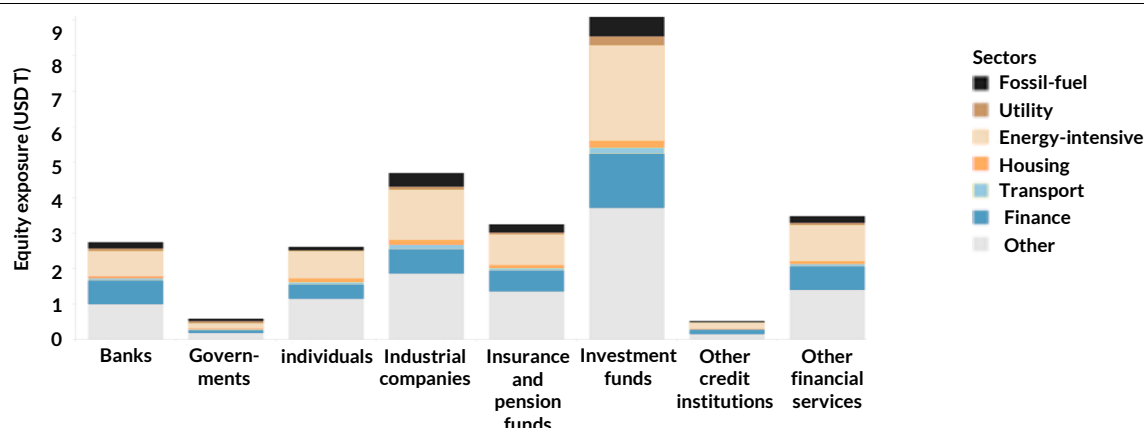
Source: TCFD ([link](#)). For alternative categorisation of risks, please refer to the “Transition Risk-O-Meter: Reference Scenarios for Financial Analysis” ([link](#))

Are transition risks relevant to the financial sector?

The financial sector could be very exposed to transition risks and any subsequent value destruction.

Research has shown that investors’ equity portfolio exposure to the fossil fuel sector is limited (4-13%) in the EU and US. However, its exposure to all sectors that could be affected by the energy transition is large (45-47%), e.g. renewable energy, electric vehicles, etc. (Chart 7).

Chart 7: Equity holdings with exposure to transition-sensitive sectors in the EU and the US



Source: Battiston et al. 2017

A different study, conducted by the Bank of England, found that if energy stocks' dividends began to fall by 5% a year (from 2020), the affected firms' equities would lose c. 40%, equivalent to a fall of c. 11% in global equity market capitalisation ([link](#)). These figures ignore the large exposure to non-energy sectors that could be affected by transition risks to which the financial sector is exposed, e.g. buildings and transport.

However, transition risks are only a threat to financial performance if they are not properly priced in by the financial markets. Our analysis tries to tackle this issue by looking at the presence and scale of any valuation discrepancies between a current market "consensus" baseline and climate change scenarios, and in doing so, inform the reader of the more technical aspects of scenario analysis.

Why conduct scenario analysis?

As shown in Chart 7, transition risks can take different forms and have impacts that branch across sectors, regions and timescales. Inherently, therefore, transition risks are quite uncertain. Among this uncertainty, an analyst needs to decide whether to integrate transition risks into their equity valuation. One way to inform this decision is to consider a range of possibilities that assess the likelihood, severity and time horizon of any impacts resulting from transition risks. Scenarios are an effective tool to do this, as corroborated by the recommendations of the FSB's Taskforce on Climate-related Financial Disclosures (TCFD) issued in 2017 ([link](#)).

For the purpose of starting to assess transition-related risks, target-oriented climate scenarios tend to be the most insightful. The way these pathways unfold is largely determined by a number of central indicators, e.g. economic and population growth assumptions, technology mixes, commodity prices, etc. Different iterations are produced by adjusting these variables.

Transition risks are only a threat to financial performance if they are not properly priced in by the financial markets

Methodology: What was our approach?

Over the course of the ET Risk project, The CO-Firm and Kepler Cheuvreux published five reports (including this one) that aimed to advance the low-carbon transition discourse by modelling the potential impact of transition risks on earnings and valuations at a company-level for the utilities, auto and steel sectors.¹ The earnings charts presented in this report represent a selection of the most insightful graphs, so as to not overburden the reader with too much information. A full breakdown of the results from all scenario combinations, across all sectors, can be found in the accompanying online tool, which you can access through www.et-risk.eu or climatexcellence@co-firm.com.

The first report outlined the methodologies that could be used in bottom-up modelling of transition risks and how this can be integrated into equity valuation methodologies. Reports 2-4 applied the approach outlined in the first report to three companies in the utilities, automotive and steel sectors. This approach is outlined below and available in more detail in the Appendix.

The climateXcellence model

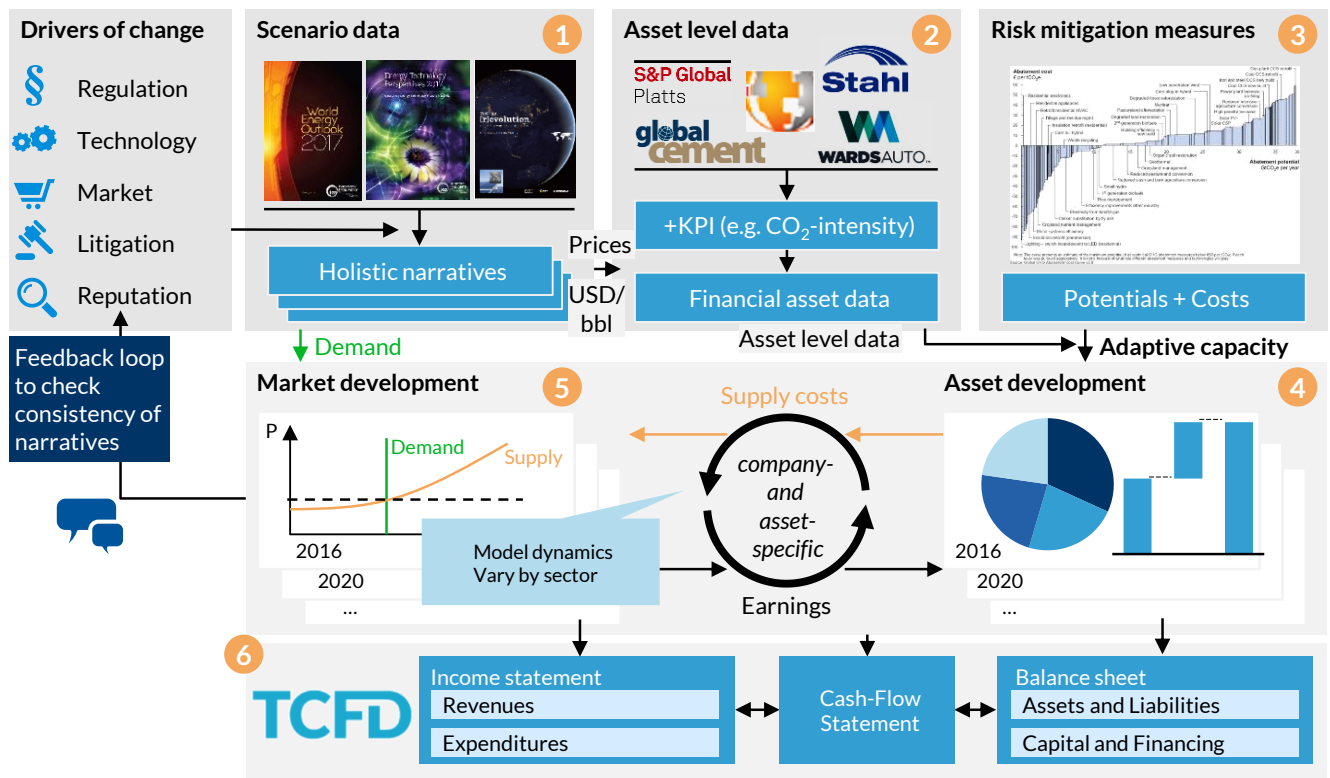
A schematic overview of the general working principles of our modelling of the utilities, auto and steel sectors is depicted in Chart 8. The modelling involved six main steps resulting in changes in financial impact assessment:

1. Derive the key risk drivers to translate a scenario into a narrative.
2. Build an asset-level database with financial information on individual technologies.
3. Conduct a techno-economic assessment of risk mitigation measures ("adaptive capacity").
4. Assumptions about companies' portfolio development with and without adaptive capacities under different scenarios.
5. Calculate financial performance of individual assets in market models.
6. Calculate financial impacts on companies.

The building blocks of the analysis are two climate change scenarios and two company adaptation pathways

¹ An additional case study was published on cement by The CO-Firm

Chart 8: Six steps to financial assessment of transition risks



Source: The CO-Firm

Climate change scenarios

The CO-Firm analysed the financial transition risks from two climate change scenarios from the International Energy Agency's (IEA) 2017 Energy Technology Perspectives (ETP):

- The **Limited Climate Transition** scenario (LCT), based on the IEA's "Reference Technology Scenario" (c. 2.7° C temperature increase by 2100);
- The **Ambitious Climate Transition** scenario (ACT), corresponding to the IEA's "2°C Scenario" (c. 2°C).

Adaptive capacity pathways

Within each climate change scenario, The CO-Firm illustrated the impact of two different pathways for companies' adaptive capacity:

- **"MARKET"** expects companies to grow in line with sector changes in the scenario, relative to their current, and forecast (to 2020/23 depending on the sector) market share by region and technology.
- **"MARKET-EBIT/REVENUE"** acknowledges that financially strong companies (higher EBIT/sales revenues²) can capture a larger share of future profitable growth.

² Depending on the sector, a company's financial strength is measured in terms of sales revenues or EBIT.

These two adaptive capacity pathways are compared against a third path (FROZEN) that illustrates the potential cost of inaction for companies, i.e. no new investment decisions are taken after 2020/23 (depending on the sector).

Earnings and valuation results

Based on the regulatory and technological changes in the markets in the climate change scenarios and adaptive capacity pathways, The CO-Firm is able to calculate company cash flows and earnings using its climateXcellence model.

KECH then takes the company-level earnings data and runs it through a discounted cash flow (DCF) model under the assumptions of its stock/sector equity analysts, i.e. terminal growth rate and discount rate. This results in a valuation for the company under each of the four scenarios.

On its own, this valuation may not be particularly interesting. Therefore, it is compared to a market “consensus” baseline scenario based on Bloomberg data. Any difference between the two approaches suggests that a company could be over/under valued by the market if governments were to take action to mitigate climate change. It also implies that the market is not effectively pricing in all transition risks.

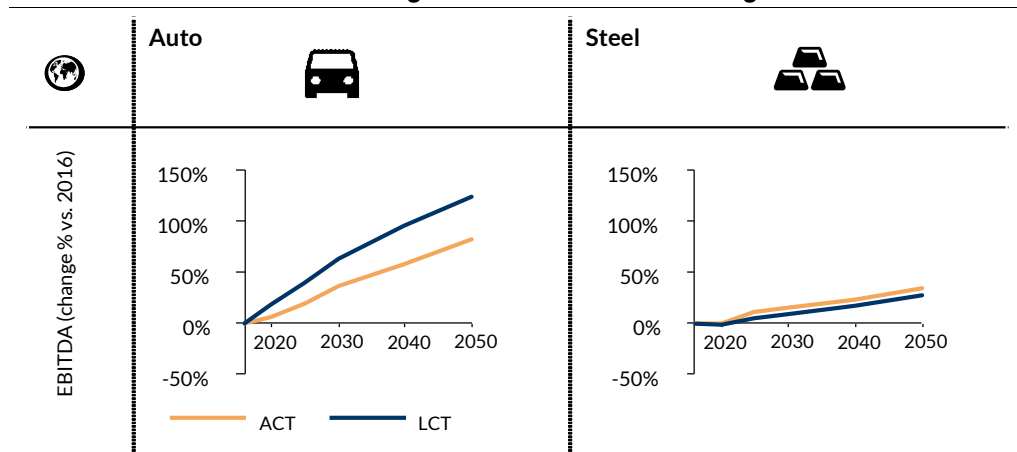
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Company earnings and sector performance: What have we learned?

Is the low-carbon transition a financial growth story?

Under each of the scenarios, the revenues of the utilities, steel and automotive sectors grow globally to 2050. However, growth rates vary significantly depending on the scenario, sector and the company within that sector (Chart 9).

Chart 9: Auto and steel sector earnings to 2050 in both climate change scenarios



Source: The CO-Firm

The passenger vehicles segment grows at a 2.4% compound annual growth rate (CAGR) in the LCT scenario to 2050. Growth is slightly more constrained in the ACT scenario at a 1.8% CAGR. This leads to an absolute percentage change in sector earnings of more than 120% in LCT and 80% in ACT by 2050 compared to 2016 levels.

Our analysis suggests that the crude steel sector could be a special success story: the financial growth in the ACT scenario (a CAGR of 0.9% to 2050) is greater than in an LCT scenario (a 0.7% CAGR), resulting in roughly 35% (ACT) and 30% (LCT) absolute earnings growth, respectively.

For the utilities sector, the same holds true: sector earnings growth is stronger in the ACT scenario than the LCT. The reason for this trend, in both the steel and utilities sectors, is that a significantly higher CO₂ price in ACT allows for more positive business case efficiency improvements across the sector, as well as CCS becoming profitable, which decreases company expenses for expensive CO₂ certificates.

Do transition risks have a material financial impact in the short- to medium-term?

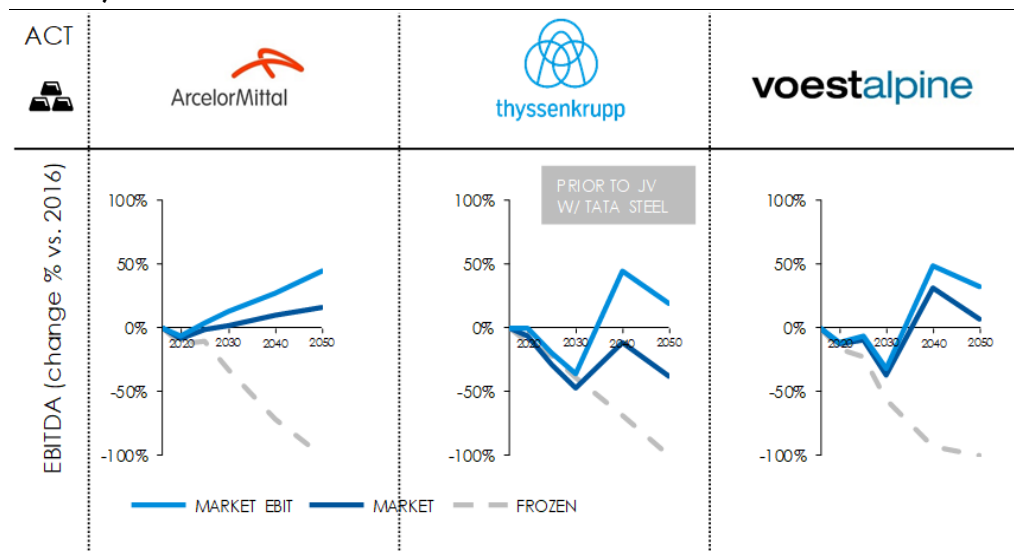
In addition to analysing the potential impact of climate change scenarios on company earnings, we also test future earnings against different strategies that companies might adopt in light of the low-carbon transition.

Generally, climate change scenarios illustrate financial growth stories

Across sectors, we see that risks to EBITDA growth can arise in the short-term if companies do not adapt

We see that adaptive capacity plays a significant role in company earnings (MARKET and MARKET-EBIT) and that the cost of inaction (FROZEN) might materialise as soon as 2020, for example in the steel sector (Chart 10).

Chart 10: Steel company earnings under different adaptive capacity pathways (ACT scenario)³



Source: The CO-Firm

Company earnings results start diverging from 2020 onwards for ArcelorMittal and voestalpine. By 2030, the earnings of ArcelorMittal are 45pps higher in MARKET-EBIT than the FROZEN (inaction) pathway. Thyssenkrupp's earnings in the inaction pathway (FROZEN) remain the same as the two adaptation pathways (MARKET and MARKET-EBIT) to 2030 because investments upgrading its BOF production plants are not yet business case positive. Thereafter, the company's earnings start to diverge across scenarios. Depending on the current position of a company, being passive might reduce earnings in the short-term.

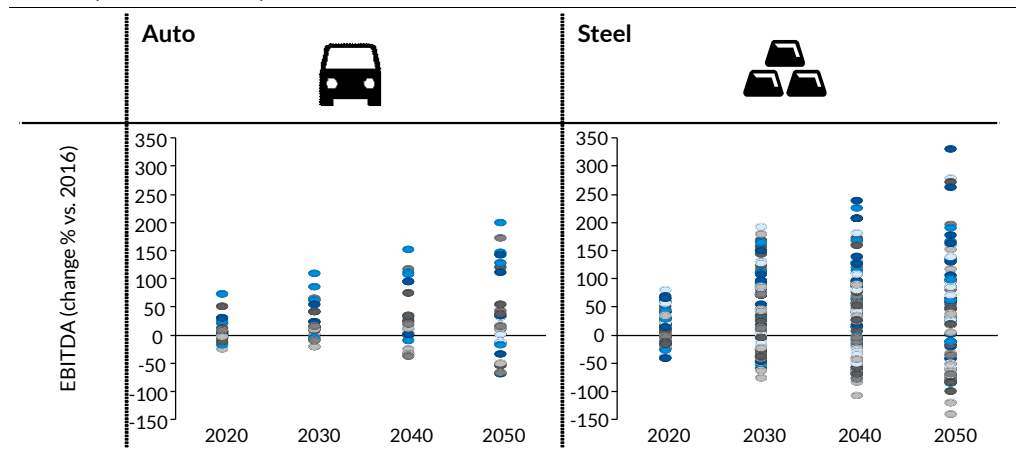
Is it sufficient to analyse the financial impact of transition risks on the sector level?

We find that earnings performance varies significantly across companies. This wide range means that average company earnings do not reflect the majority of sector constituents, as illustrated in the automotive and steel sectors (Chart 11). Therefore, company-level analysis is strongly preferable to assess transition risks if possible.

We see evidence that the low-carbon transition will see winners and losers within each sector, i.e. sector growth will not be distributed evenly

³ Note, the impact of thyssenkrupp's current steel production on the overall group's future steel earnings and valuation will likely be less than when these scenarios were run as a result of its joint venture with Tata Steel Europe (June 2018).

Chart 11: Individual company earnings performance varies greatly in the auto and steel sectors (ACT/MARKET)



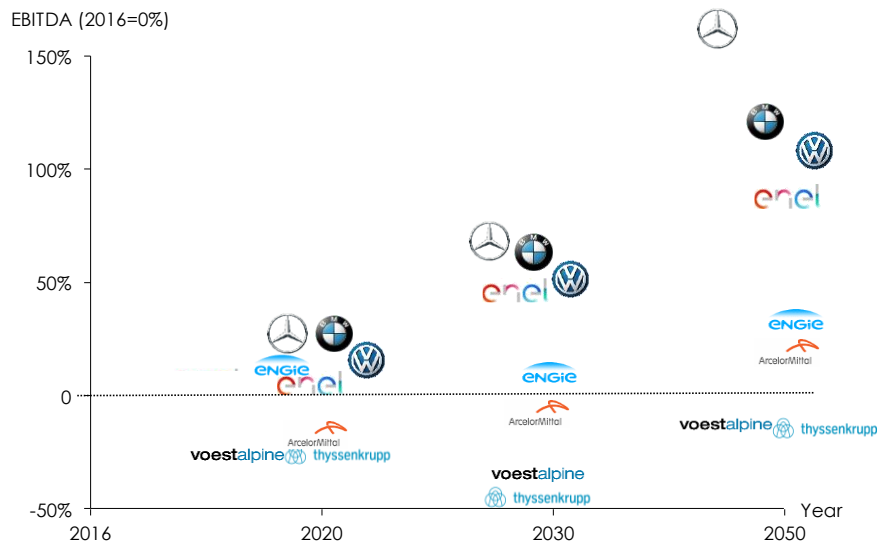
Source: The CO-Firm

We see that the range of company earnings performance is especially large for the steel sector, with a spread of 500pps in 2050. For the automotive sector, the spread is smaller but still significant at 300pps in 2050. This implies that the climate transition will see winners and losers.

Can financial winners and losers be identified in scenario analysis?

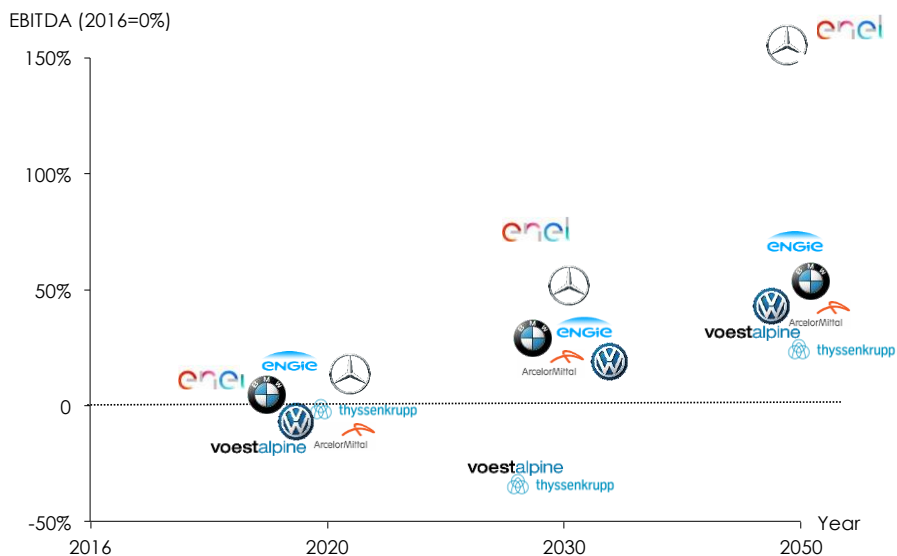
Scenario analysis cannot give an absolute verdict on a company's prospects relative to others because no probability weighting is given to each scenario. It can, however, suggest potential winners and losers under certain circumstances. The CO-Firm's research provides an illustration of how different companies and their assets perform under two IEA scenarios with different temperature constraints. No probability is assigned to these scenarios. The underlying dynamics of the model take a sector perspective, i.e. all companies have the same dynamic capabilities at their disposal to create a data-driven, reproducible basis. Regardless, the different temperature targets in each scenario result in different earnings results for each company, with some potentially coming out winners and some losers (Charts 12 and 13).

Chart 12: Potential winners and losers in the LCT scenario (MARKET-EBIT/REVENUE)



Source: The CO-Firm

Chart 13: Potential winners and losers in ACT (MARKET-EBIT/REVENUE)



Source: The CO-Firm

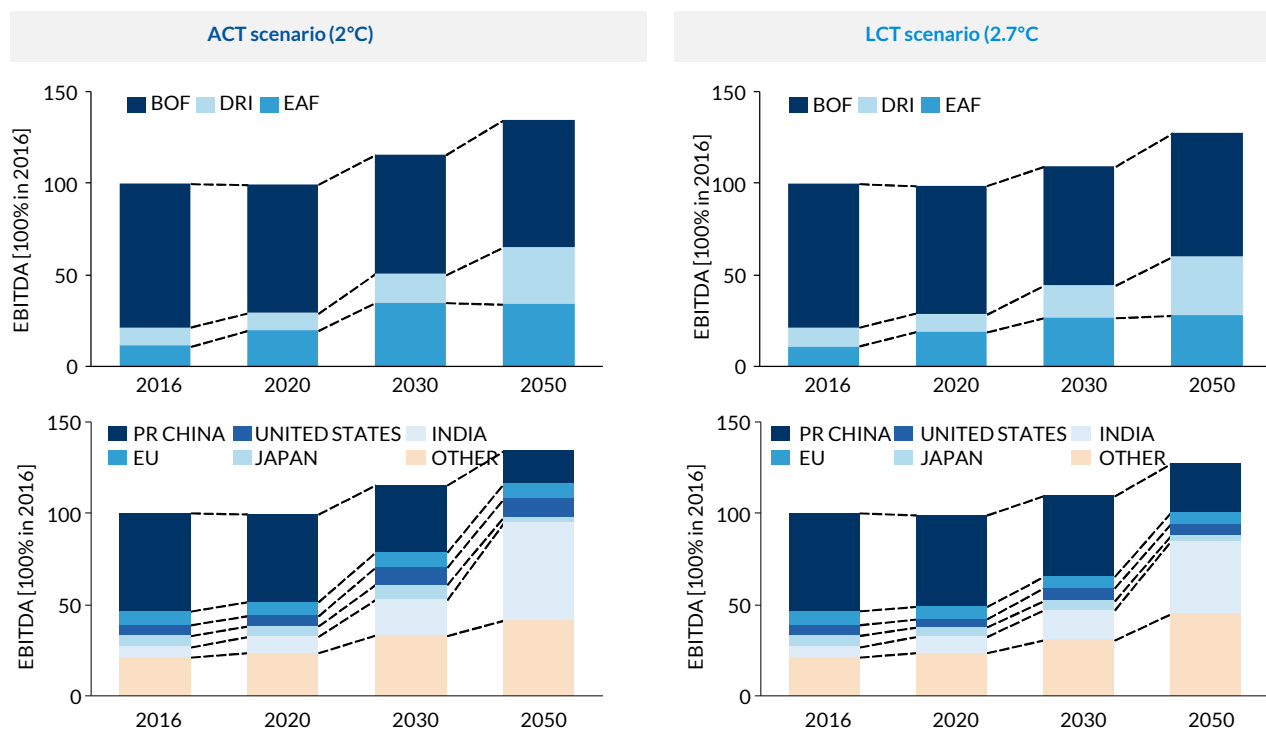
As Charts 12 and 13 show, some companies appear to perform above or below the average in the ACT scenario. For the companies analysed, we generally find a positive picture. This could, however, be attributed to study bias, as our selection focused on the largest companies in terms of market capitalisation. Other qualifiers apply, as the analysis builds on two illustrative adaptation pathways, assuming the same adaptive capacity across all companies, and constraints apply.

What are the key drivers of future company earnings in our scenarios?

The risk drivers differ between the sectors under consideration and the scenarios applied. Generally, we analyse all relevant drivers that impact a plant or product's sales volumes, prices and cost base relative to its competition. In most cases, changing market prices have an impact on the relative competitiveness of each plant technology, and thus the competitiveness of the sales price. Overall demand for the product changes according to the scenario and differs by region. Chart 14 demonstrates this through the steel sector.

Key risk and opportunity drivers are highly dependent on the sector and the scenario applied

Chart 14: Steel production changes technologically and regionally in the steel sector



Source: The CO-Firm

Input prices (such as energy-related costs for electricity or gas) change due to market dynamics when a sector is in transition. Additionally, direct mechanisms that foster the transition towards a selected scenario (such as CO₂ prices) might apply. The relative impact depends on their extent and the resulting relevancy in the sector's (plant's) cost base.

For example, in the steel sector, a significantly higher CO₂ price in ACT means CCS becomes profitable after 2040 which causes an improvement in earnings from the BOF route of steel production compared to its profitability post-2040 in the LCT scenario. In ACT, most countries implement a CO₂ price, which causes developed countries to remain competitive with developing countries. This is not the case in the

LCT scenario where CO2 prices are only implemented in developed countries, which suffer a competitive disadvantage as a result.

What role does a company's adaptive capacity play in the low-carbon transition?

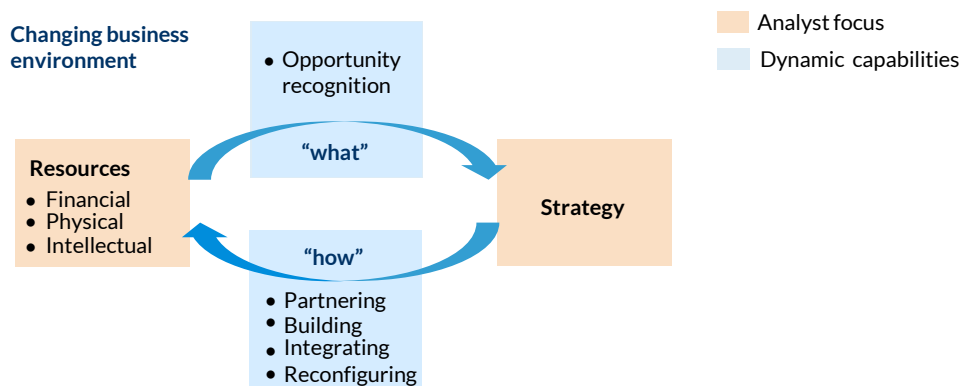
Three key aspects contribute to whether a company is future proof (Chart 15):

- **Dynamic capabilities:** Opportunity recognition, partnering, building, integrating, reconfiguring.
- The current **resource base**, i.e. what is at the disposal of the company to reconfigure. For example, financial means, physical assets, intellectual property.
- **Business strategies** pinpoint where the company aims to go and how it intends to get there. This often comprises a synthesis of trends in its business environment, its resources and its capabilities.

These three components are critical to a company's ability to adapt to a low-carbon transition, i.e. its adaptive capacity.

The current asset base, strategies and dynamic capabilities determine whether a company is prepared for the transition

Chart 15: A conceptual overview for a company's "adaptive capacity"



Source: The CO-Firm

To form an opinion on the adaptive capacity of a company, ask yourself the following questions:

- Asset base:
 - How aligned is the company's current asset base with both future growth markets and future technological requirements, e.g. cost of production and demand? If it is not aligned, how costly is it for the company to make the required adjustments, relative to competitors?
 - Does the company have the financial means to implement the required changes?
 - Does the company already have access to the intellectual property required to implement the transition?
- Strategy:

- Is the company's current, and forecasted (until 2020/23 depending on the scenario), strategy aligned with transition requirements? Does it serve as a step into the right direction?
- Dynamic capabilities:
 - Do you think that the company has realised the opportunity from the low-carbon transition and is acting accordingly?

After answering these questions, the final evaluation regarding **adaptive capacity** is more implicit:

- Do you trust in the company's adaptive capacity to see the changes required by the low-carbon transition early enough and to act upon them in a target-oriented manner, relative to its competition?

How does financial strength impact company earnings?

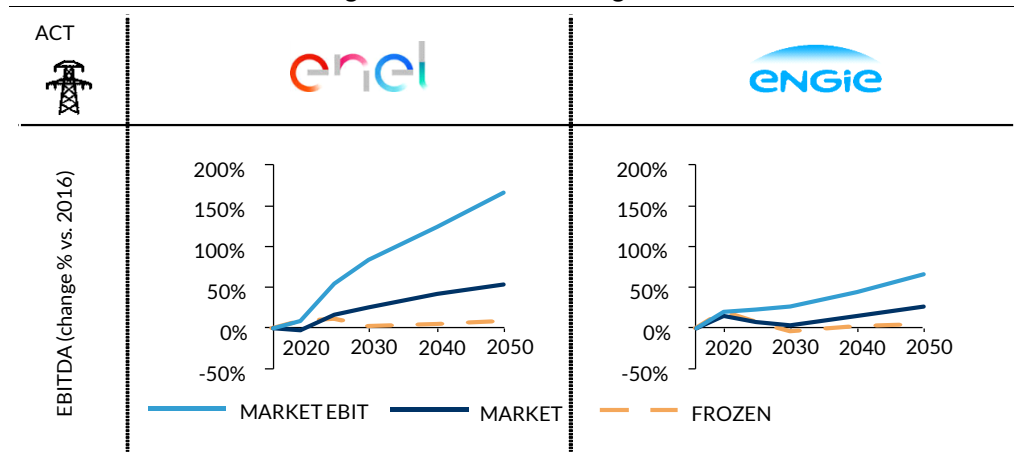
The effect of **financial strength** is analysed in the MARKET-EBIT/REVENUE pathway. The difference between MARKET and MARKET-EBIT/REVENUE pathways illustrate the impact of financial strength on future company earnings.

Utilities

Of the companies analysed, the spread between the two adaptive capacity pathways is largest for Enel (utility) (Chart 16). Integrating a financial strength variable in our scenarios turns a stable, if rather limited, growth story for Enel of +50% in 2050 (compared to 2016) into a 160%+ improvement in the case of ACT. In essence, the inclusion of financial means allows Enel to build upon its current investments in renewables in a number of emerging markets.

The potential to leverage financial capacity for increasing EBITDA differs substantially by company (rather than by sector)

Chart 16: A focus on the earnings curves of ENEL and Engie



Source: The CO-Firm

Steel

Whereas in MARKET ArcelorMittal's performance is slightly below average, financial strength in MARKET-EBIT pushes it to slightly above the sector average, doubling its earnings growth (Chart 10). Except for 2020, ArcelorMittal shows steady growth, profiting from global and **technological diversity**. For thyssenkrupp and voestalpine, EBITDA is more volatile compared to other companies and sectors.

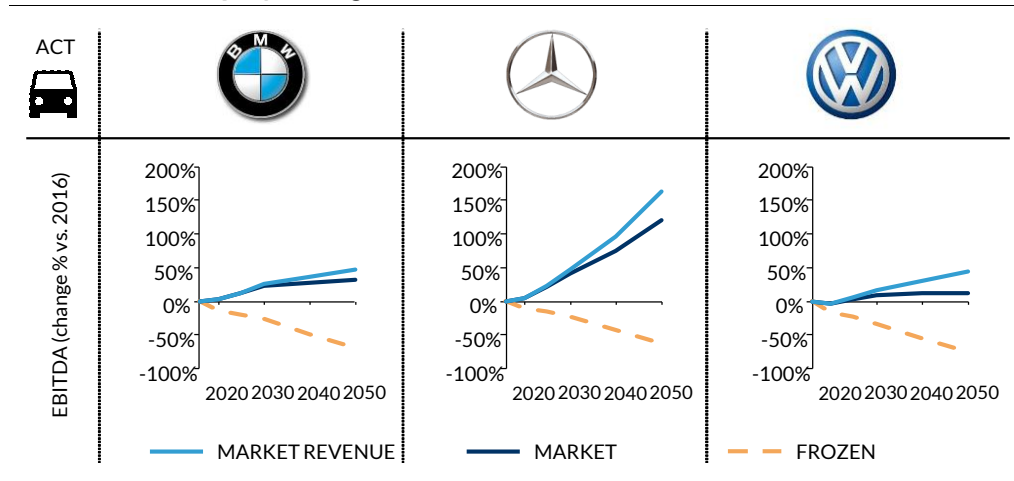
Thyssenkrupp is challenged by a rapidly increasing CO2 price in the ACT

Thyssenkrupp is challenged by a rapidly increasing **CO2 price** in the ACT due to its focus on the carbon-intensive BOF method of steel production, under the assumption that options other than CCS are not viable, e.g. carbon capture and utilisation. After CCS becomes economically viable in 2040, thyssenkrupp is expected to move into a phase of EBITDA growth in MARKET-EBIT where it uses its financial strength to make long-term investments in CCS. Voestalpine faces similar, but less severe, trends compared to thyssenkrupp, as it has significant exposure to BOF. The company is also expected to make profitable investments in DRI, and later DRI with CCS, after 2030.

Automotive

For the automotive sector, earnings results across companies vary significantly. Daimler appears to be the winning company of the three in focus. Daimler sees significant earnings growth due to its **early expansion strategy** in plug-in hybrids vehicles as well as **regional diversity**. Market strength results in 3x earnings in MARKET REVENUE than MARKET (Chart 17).

Chart 17: Auto company earnings curves



Source: The CO-Firm

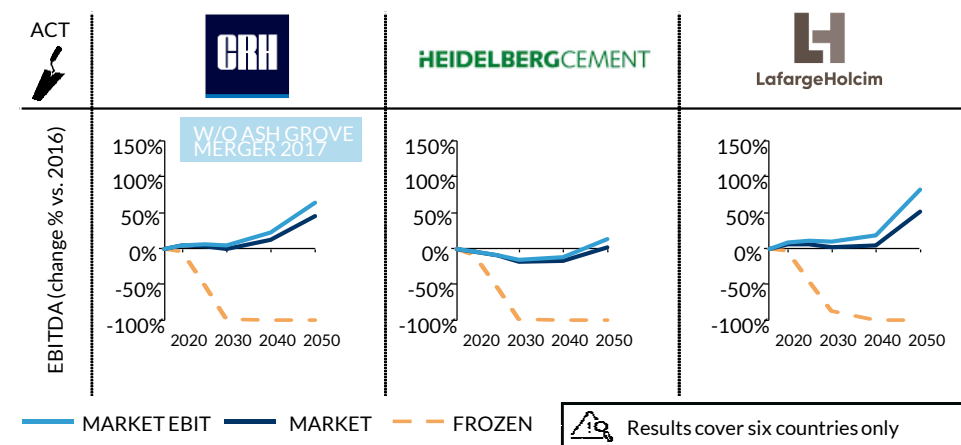
For Daimler, having a competitive advantage in technological expertise, based on its investment plans through to 2023, pays off. BMW and VW benefit from regional growth markets but are less competitive in plug-in hybrids (PHEVs) than Daimler. For all companies, financial strength pays off and boosts EBITDA growth.

Cement

For cement, growth for the companies under consideration is comparatively low compared to the other sectors, the reason being that the focus is not global but restricted to six countries, the major growth countries in the cement sector: India and other emerging Asian countries, the Middle East and Africa are excluded due to data restrictions. Nevertheless, financial strength enables all cement companies to increase EBITDA growth compared to MARKET.

BMW and VW benefit from regional growth markets but are less competitive in PHEVs

Chart 18: Earnings curves for cement companies (covers only six countries)



Source: The CO-Firm

What have we learned?

- The low-carbon transition is generally a growth story for the sectors under consideration assumed that all companies behave rationally. Our analysis suggests that a faster transition scenario might even lead to stronger earnings growth for the sector compared to a slower transition scenario, e.g. steel and utilities.
- If companies fail to act and adapt to the low-carbon transition, the earnings hit can materialise in the short- to medium-term.
- To gain a more complete picture, transition risks should be considered at the company level rather than sector level, if possible, because financial performance varies significantly across firms.
- The underlying analysis provides an illustration of potential winners and losers in the low-carbon transition. Financial stakeholders need to match our scenario assumptions with their company-specific knowledge and opinions.
- The key risk drivers differ across the sectors under consideration and the scenarios applied, but include: the evolution of technology, regional differentiation, as well as direct regulatory measures to promote the transition, e.g. CO₂ prices.
- Adaptive capacity is a result of dynamic capabilities, which allow existing resources (assets, financial pockets, intellectual property) to be put to good use, by means of a strategy. The role of financial strength on adaptive capacity is emphasised in this study as a key determinant of future performance. This of course depends on the extent to which the sector in question requires substantial investment for the low-carbon transition.

**Lessons learned after
conducting scenario
analysis**

Company valuations: What have we learned?

If climate change and transition risks are going to change from a “nice to have” consideration to a mainstream financial metric, one must be able to make the case that they could affect the valuation of a stock, portfolio or sector on a time horizon deemed material by the analyst.

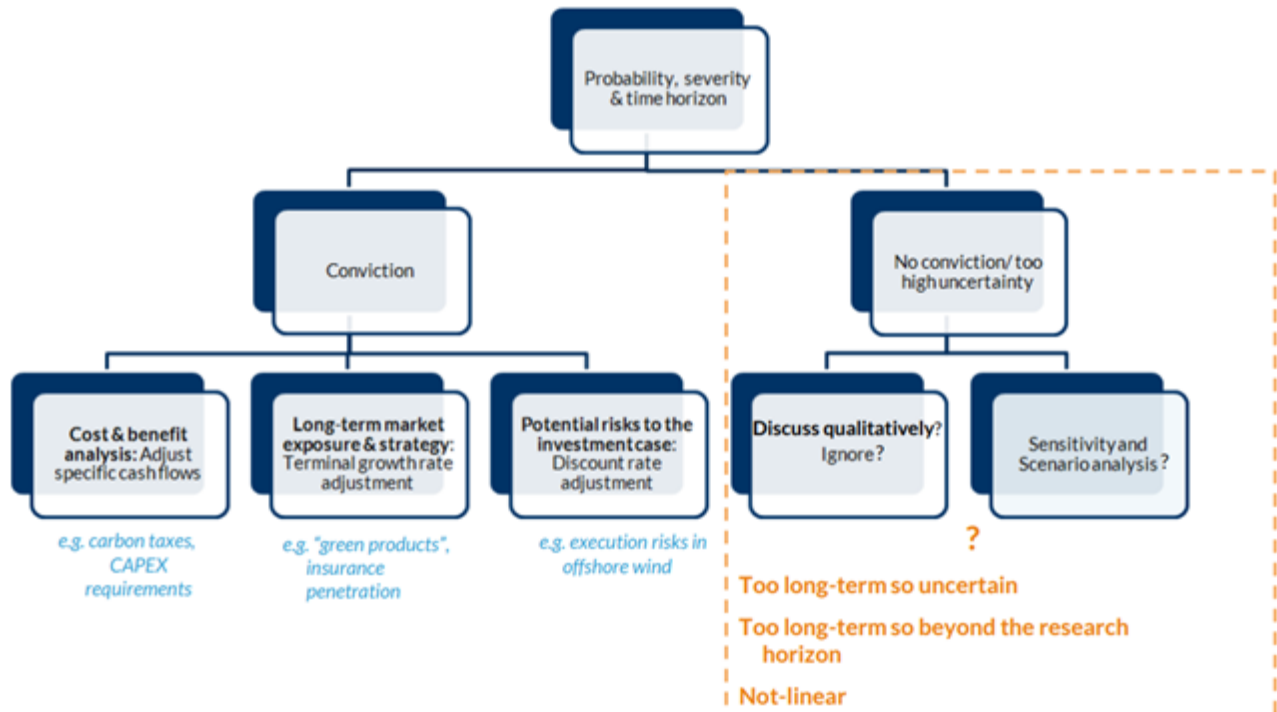
Can transition risks affect the investment case?

Transition risks can affect the investment case more than is currently assumed. In valuing a stock, analysts consider three main criteria when assessing whether a risk needs to be integrated: probability, severity and the degree to which it falls within the analyst’s time horizon (Chart 19).

At present, uncertainty around transition risks is often so great that analysts have little motivation to integrate them into valuation modelling, denoted by the orange box in Chart 19. The value of scenario analysis is in informing analysts about alternative futures outside of their base case, to reduce perceived uncertainty and increase conviction that a risk could change the investment case.

The value of scenario analysis is in informing analysts about possibilities other than their base case

Chart 19: Why might an analyst decide not to integrate transition risks into their valuation models and investment case?



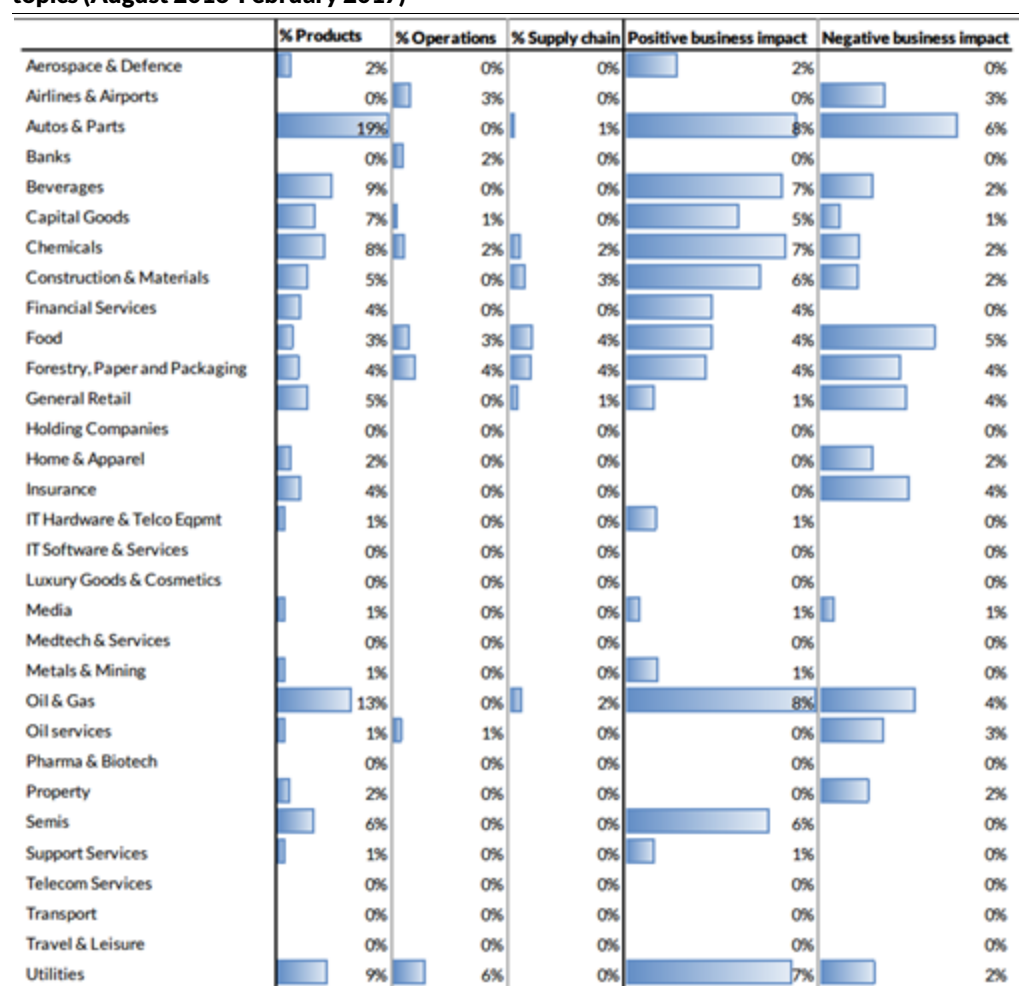
Source: Kepler Cheuvreux

Which sectors discuss transition risks?

Transition risks are not an entirely new phenomenon. Similar factors have been relevant in financial analysis for a number of years but have not been labelled as “transition risks”, for example, air pollution, water quality/scarcity etc. As such, some transition risks are being discussed by sector equity analysts today.

To understand the degree to which transition risks are already being considered, Kepler Cheuvreux’s ESG team scanned its analysts’ research reports (360s, Q&As and Espressos) from August 2016 to February 2017 to identify any comment or analysis on transition risk-related topics. Chart 20 shows the results of the review of around 150 pieces of analysis across 31 sectors and 100 companies.

Chart 20: Percentage of Kepler Cheuvreux publications that mention transition risk-related topics (August 2016-February 2017)



Source: Kepler Cheuvreux

The review found that:

- Transition risks were most often discussed within the autos and parts, oil and gas, and utilities sectors, followed by the beverage, chemicals and capital goods sectors.

- Apart from the food, insurance, oil services and property sectors, these topics are more often discussed from a positive (opportunistic) rather than negative (risk-oriented) perspective.
- Most often, climate change was discussed in relation to the offering of products and services.

On the whole, discussion of transition risks was low. Those sectors that have the highest percentage of mentions, e.g. autos, oil and gas, and utilities, should be expected to discuss these factors because they are the most exposed sectors.

Transition risks can affect the investment case for companies in a number of sectors, i.e. result in significant value destruction in the short term, and, therefore, could be discussed and integrated into mainstream equity valuations more often.

Why should transition risks be considered more widely in equity analysis?

It is often suggested that transition risks are too long-term to materially affect a company's investment case. However, over the past ten years there have been a number of examples of transition risks contributing significantly to severe value destruction of certain sectors in the short term (1-5 years). These examples serve as a warning that transition risks can significantly affect equity investment cases.

Case Study 1: EU utilities – past, present and future

The major utilities in the EU have suffered financially over the past ten years and, according to Kepler Cheuvreux's analysts, the pain may not be over yet. Transition risks have played an increasingly significant role in the tribulations and will continue to do so.

The period between 2003 and 2008 was a boom cycle for EU utilities as coal, CO₂ and spread prices all rose. It was a period of unforeseen profitability. Kepler warned that utilities needed to use this excess cash to prepare for less supporting times.

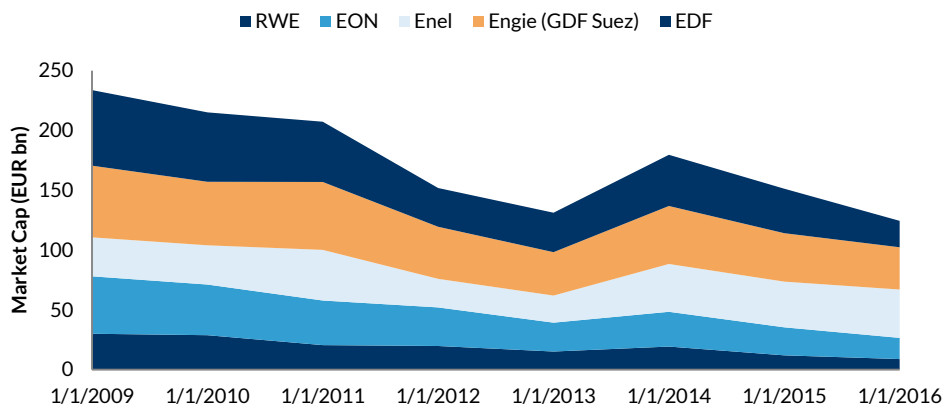
EU utilities instead invested this capital into new conventional generation capacity. Then, when "less supporting times" arrived after the global financial crash (GFC), EU utilities suffered at the hands of falling power demand, e.g. a 5.4% decline in Germany in 2009, and a misread of the growth of renewables. By today's taxonomies, the expansion of renewable energy is firmly a transition risk.

In 2013 an average of 15% of electricity generation was supplied by renewables. On average, only 5% of electricity supplied by the EU's five largest utilities (RWE, EON, EDF, Enel and Engie) came from renewables. The misread of this transition risk contributed to the cumulative decrease of EUR100bn in the market caps of these five EU utilities (Chart 21).

On the whole, discussion of transition risks was low across the board

The expansion of renewable energy contributed to the cumulative decrease of EUR100bn in the market caps of the five largest EU utilities

Chart 21: Five EU utilities have lost over a combined EUR100bn over the past seven years



Source: Kepler Cheuvreux

Kepler Cheuvreux's utilities analyst, Ingo Becker, CFA, predicts that the pain is not over for EU utilities as the sector trends towards decarbonisation. He points to decentralisation, digitalisation, demand response and energy storage as megatrends that mean "*utilities face their structural demise*" (March 2016) ([link](#)).

Case Study 2: The US coal sector to 2016

Between the GFC and 2016, the US coal sector fell from a historical high to rock bottom, which resulted in approximately 30 producers filing for bankruptcy, including the largest US coal producer, Peabody Energy. This was the result of three core drivers, each of which was either unforeseen by the industry or dismissed.

- The emergence of shale gas: The price of shale gas fell dramatically from 2008 onwards as hydraulic fracking swept across the US.
- The growth of renewable energy: Coal lost over 10% of the share of the US power market from 2008 to 2013 as renewable energy grew (along with natural gas).
- Environmental regulations: A host of environmental pollution and air quality regulations were implemented and strengthened that served to constrain the US coal sector, e.g. Mercury and Air Toxics Standards (MATS), Cross-State Air Pollution Rule, etc.

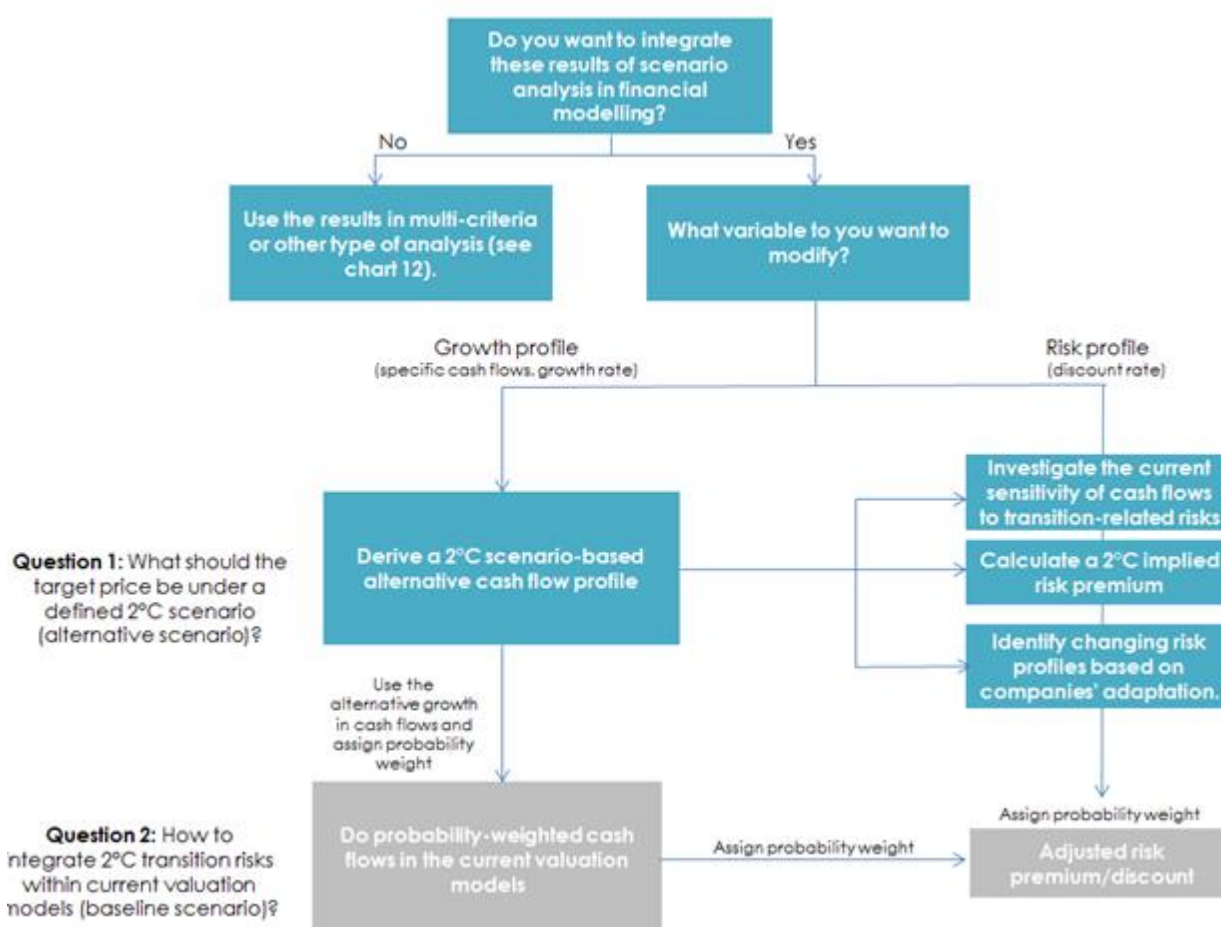
In the midst of this crisis, the US coal industry continued to tell investors that demand would grow both domestically and on the global market (see Peabody's 2014 quarterly disclosures). This absolute dismissal of transition risks such as renewable energy and environmental regulation, and how they interplay with other market trends, resulted in widespread value destruction across the sector.

Methodologically, how could equity analysts integrate transition risks into company valuations?

The schematic below (Chart 22) summarises the options available to analysts looking to integrate transition risks into equity valuations. We believe that DCF models are better suited to scenario analysis than multiple-based models, given the nature of transition risks and opportunities.

We believe that DCF models are better suited to scenario analysis than multiple-based models

Chart 22: A possible decision tree for analysts thinking of integrating transition risks into equity valuation



Source: Kepler Cheuvreux

However, DCF models require making additional assumptions and doing additional research, specifically: 1) short-term cash flows; 2) a terminal (long-term) growth rate; and 3) a discount rate. As Chart 22 suggests, these three core variables can be grouped into factors that affect either the company's growth profile and/or risk profile. Both of these aspects of an equity valuation can be amended to reflect transition risks.

In each of our sector-specific reports (utilities, autos and steel), we seek to answer the following question by adjusting the growth profile of a company: **What could the valuation of a company be under climate change scenarios?**

Adjusting the growth profile

The CO-Firm's modelling outputs are best suited to amending the growth profile of a company rather than the risk profile. Again, two options exist for amending a company's growth profile.

- Extending the forecasting horizon of specific cash flows. This option offers more precise results and therefore is better suited to testing tail/non-linear risks.
- Adjusting the terminal growth rate to reflect the impact of different transition scenarios on global economic growth. This is a simpler but less granular approach.

The granular nature of The CO-Firm's outputs allows our analysis to adopt the first, more detailed approach. This means that:

- In the consensus baseline **and** company valuations in the climate change scenarios we apply company cash flows that are projected for the next five years, for the relevant segment, as downloaded from Bloomberg.
- Thereafter, in the consensus baseline, we apply the relevant KECH analyst's terminal growth rate for the stock to the company cash flows from 2024-50.
- Whereas we apply the annual cash flows projected by The CO-Firm for the company valuation in the climate change scenarios over this period.
- To calculate the company valuation to perpetuity, for both the consensus baseline and our valuations, we apply the KECH analyst's terminal growth rate and discount rate to the average cash flows for the company from 2040-50.
- In essence, therefore, the vast majority of the difference in company valuations in the consensus baseline and the climate change scenarios results from variable cash flows from 2024-50.

Adjusting the risk profile

When conducting a DCF valuation, one must make an assumption about the discount rate, which captures the perception of risk to a company's future cash flows. A company is considered to have high financial risk if the likelihood that investors could receive a return that is lower than what was expected is high. A company with higher financial risk than its peers will have a higher assumed discount rate than its peers, and vice versa.

For each of the utilities, auto and steel reports, we apply the discount rate (and terminal growth rate) of Kepler Cheuvreux's sector equity analyst. We also conduct a sensitivity analysis on the discount rate to understand how variable a company's valuation is to this input, as well as identifying sector-specific drivers that might result in an analyst changing their discount rate (and perception of risk).

Assigning a probability weighting

Our analysis within the ET Risk project identifies how the cash flows and valuations of companies could vary depending on assumptions of transition risks and climate change. A follow-up question to this process is: **How do you integrate transition risks into analysts' current *baseline* valuations?**

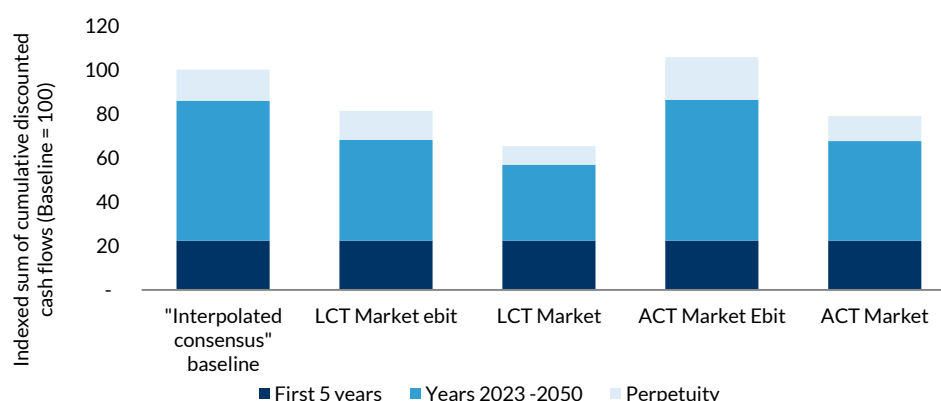
The discount rate captures the perception of risk to a company's future cash flows

To answer this question, analysts must assign a probability weighting to the different scenarios that include various transition risks and incorporate it into their equity valuation models. The scenario analysis in our studies does not assign a probability to each pathway. Therefore, this additional step for a mainstream analyst to take a view on which risks are more or less likely is not tackled in our reports.

Analysis results: How could transition risks change equity valuations of companies?

The full results of our DCF modelling for the nine featured companies (three utilities, autos and steel) can be found in the in-depth standalone reports on each sector. Charts 23-25 below feature the results for one company from each report, drawing on wider conclusions from that study.

Chart 23: While Engie could benefit more from the ACT than the LCT scenario, its valuation is lower in three of the four climate/adaptation scenarios, compared to the consensus baseline



Source: Kepler Cheuvreux

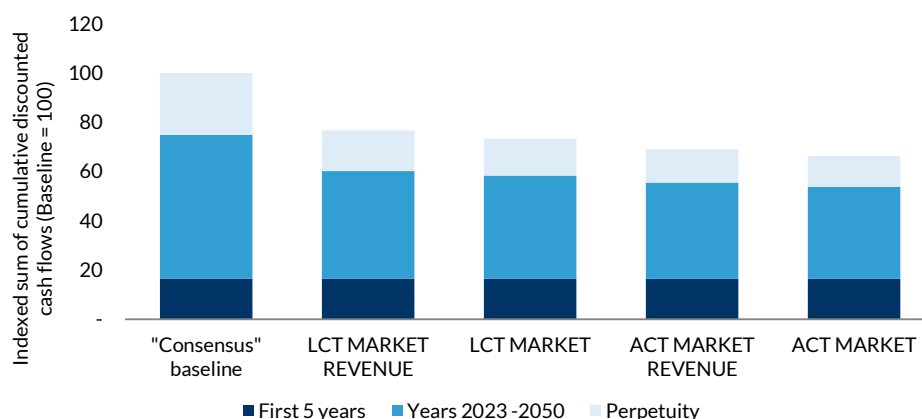
Engie could benefit from a 2°C-compatible Ambitious Climate Scenario (ACT)

Across the three sectors, the regional and technological breakdown of revenue-generating assets is key to company earnings and valuation. For example, in the utilities sector, Engie is assumed to focus on gas technologies in the LCT scenario, which are needed to cover demand peaks, while in the ACT scenario it is able to invest heavily in renewables. In both climate change scenarios, the company is able to profit from adaptation measures, represented by the "MARKET-EBIT" scenarios.

Elsewhere, Enel and EDF are both valued more highly in each climate change scenario than the consensus baseline, suggesting greater alignment with the low-carbon transition.

See the *"Transition Risks for Electric Utilities"* report for full analysis ([link](#)).

Chart 24: BMW appears to be overvalued in the consensus baseline compared to its valuation in the four climate/adaptive capacity scenarios



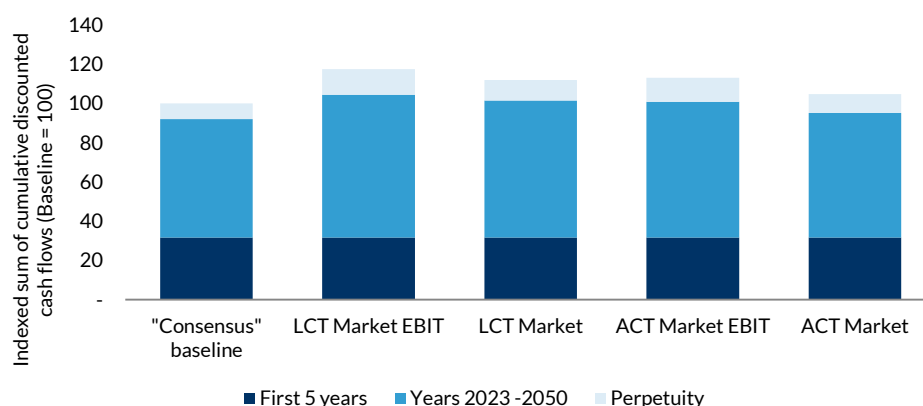
Source: Kepler Cheuvreux

In the automotive sector, BMW's value in climate change scenarios is lower than a consensus baseline, in large part because its expansion plans for electric powertrains are thought to be behind the industry average. Also, BMW's EV portfolio is assumed to focus on smaller vehicles sizes with lower profit margins.

Meanwhile, Daimler's valuation grows under climate change scenarios compared to the consensus baseline, whereas VW trends in the opposite direction.

See the *"Transition Risks in the Automotive Sector"* report for full analysis.

Chart 25: ArcelorMittal's valuation is higher in both climate change scenarios compared to a consensus baseline



Source: Kepler Cheuvreux

In spite of the fact that the steel sector will be severely threatened by the low-carbon transition, ArcelorMittal benefits from having an asset base spanning conventional BOF, lower carbon electric arc furnaces (EAF) and direct reduction iron-based steel production methods. It is also diversifying from OECD countries (Europe and North America) to South American and South Africa-based production.

ArcelorMittal's valuation is higher in both climate change scenarios compared to a consensus baseline

voestalpine's valuation seems to benefit in the different climate change scenarios, while thyssenkrupp's valuation declines compared to a market consensus baseline.⁴

See the *"Transition Risks in the Steel Sector"* report for full results.

What have we learned?

- That transition risks can affect the investment case of a company. Even so, transition risks are discussed sparingly in current equity valuations and are actually integrated into valuations even less frequently.
- This is because analysts still tend to lack conviction that transition risks affect a company's investment case, whether due to a perception of low probability, low severity or, most commonly, that the risk falls outside of the analyst's time frame.
- Scenario analysis can help analysts reduce uncertainty on complex issues. It can indicate how transition risks could affect the future earnings and valuations of companies, sectors and regions, and how this might vary over time.
- Our analysis shows that there could be a discrepancy between company valuations in our climate change scenarios and a market consensus baseline, suggesting that the market is not effectively pricing in all transition risks.
- Upon seeing results like those of this analysis, the next step for equity analysts is to assign probability weightings to each scenario and begin to factor in the assumptions/inputs of the most likely future into their base case.

Lessons learned from integrating transition risks into company valuation

⁴ Thyssenkrupp's valuation is based upon the performance of its steel business segment only, although it is a diversified company. Also, the impact of thyssenkrupp's current steel production on the group's future steel earnings and valuation will likely be less than when these scenarios were run as a result of its joint venture with Tata Steel Europe (June 2018).

Recommendations: How could this information be used?

KECH and The CO-Firm's reports, as part of the ET Risk initiative, seek to broaden the understanding of transition risks and scenario analysis among equity analysts, asset managers, project managers and risk managers. This section outlines how these stakeholder groups can best interpret and use the results of our analysis.

Best practices

Financial service providers are beginning to grapple with the idea of climate change scenario analysis. A few ideas for best practices in this endeavour emerge from our analysis.

- **Focus on the sectors that are potentially most exposed:** Scenario analyses and identifying risk drivers can be time-consuming. Therefore, it is advisable to focus on the sectors that are most likely to be affected by transition risks and opportunities, which at the same time make up a significant proportion of one's equity holdings.
- **Joint effort in scenario selection within the organisation:** The selection of the scenarios, and the narratives within them, is critical to the subsequent credibility and interpretation of the results. Therefore, they should be well understood and accepted upfront. This may also allow a common assignment of probabilities to scenarios after the analysis.
- **Interpret results in the context of drivers and strategies:** Based on the identification of relevant financial risks or opportunities, internal organisational changes can be implemented. This includes, for example, the mapping of new risk drivers in risk assessment. Corporate engagement can only be achieved if risk drivers and corresponding strategies are commonly understood.
- **Discuss the results with the companies concerned:** Outside-in analyses can only work on the basis of assumptions. Companies are often planning more far-reaching plant or product portfolio changes, or entry or exit from certain business areas, than the analyst might know about. Communication with the company can help integrate such factors into an evaluation.

A set of best practices has already emerged

Barriers to use

The application of climate change scenarios and their impact on mainstream financial services faces some barriers.

- **Materiality evaluation:** The financial impact of transition risks might become material outside of the analyst's timeframe for assessing the investment case of a company.
- **Scope of analysis:** A company's product portfolio might span beyond sectors covered by the scenario modelling. The same holds for regional coverage - the country-specific assessment of opportunities and risks might not coincide with global or regional reporting of the company. Data gaps are often par for the course.

- **Ongoing process of reporting development:** Another challenge for financial service providers is that some companies (though not all) are only beginning to conduct their reporting on the basis of scenario analyses. This results in limitations in the comparability of the scenarios and the reported results. The work of the TCFD in creating transparency regarding emerging approaches to valuation and reporting will be critical to facilitating comparability across corporate reporting and the risk analysis of financial service providers.

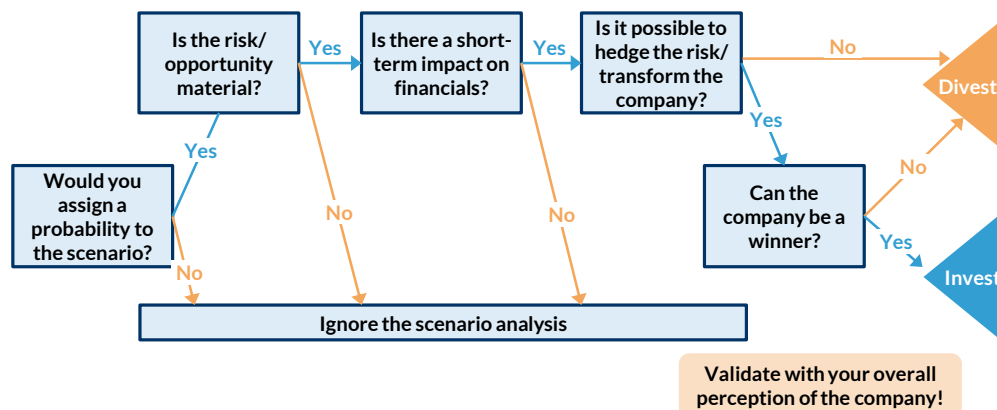
Use by different practitioners

As an equity analyst, ask yourself the following

- To what degree do you **believe the scenario**/do you assign a probability to it?
- Do you consider **climate risk/opportunity to be material** for your sectors and companies?
- Does the risk/opportunity **materialise soon enough** for you to integrate it into your investment case? Or does managing the risks and capturing the opportunities already require preparation on the side of companies that impacts their financial performance within your time horizon?

The schematic below introduces an example decision-tree that an equity analyst might follow when first interpreting a climate change scenario analysis (Chart 26).

Chart 26: How an analyst can interpret their climate change scenario analysis



Source: The CO-Firm

As an equity analyst, ask yourself the following

As an asset manager, ask yourself the following

- Do you want to **foster the transition** by investing strategically into it, for example by supporting companies that are already transitioning, at the expense of a lower current financial performance?
- In the event that a risk manifests itself, **can the company credibly transform?** If so, do you need to engage with the company to either transition within its current business segments or more fundamentally shift to other business segments?
- In the event that the company can transform, do you agree with its belief it will **be a winner in the market?**

As an asset manager, ask yourself the following

- If the company cannot align with the transition, can the risk be **ignored or hedged** outside the business segment/sector concerned?
- Do you need to **divest** from the company due to unacceptable financial risks due to the low-carbon transition?

As a portfolio manager, ask yourself the following

- What are the **risk and opportunity drivers** of the underlying scenario?
- How might transition risks impact the sectors' relative **risk-return** profiles?
- How large is the **gap** between traditional valuation and longer-term scenario dynamics and what are the **main drivers**?
- After performing a scenario analysis, **transparency** should have increased and one could ask whether the **structural characteristics of companies** for have been identified in terms of their resilience.
- To what extent can stock picking impact the **average sector risk**?

As a portfolio manager, ask yourself the following

As a risk manager, ask yourself the following

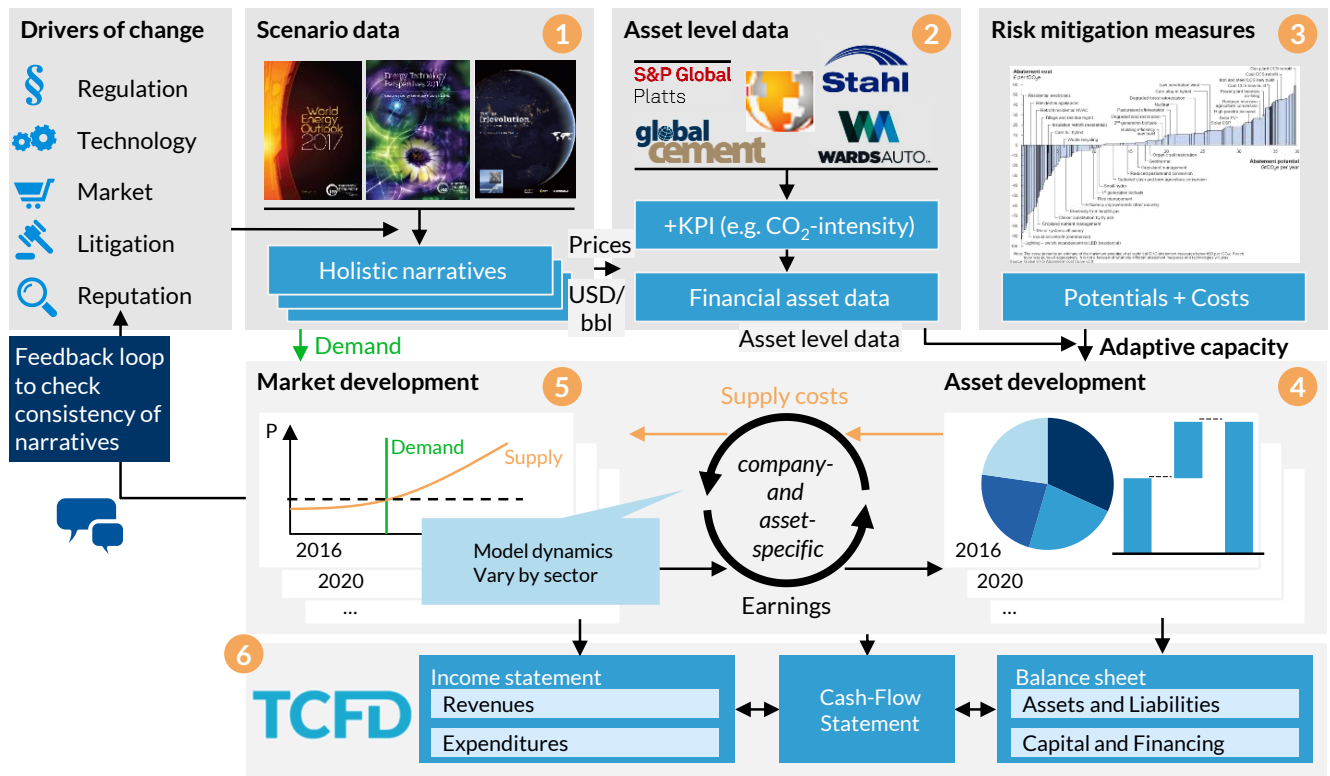
- What are the **drivers and early warning indicators** for climate risks in a 2°C scenario in TCFD-relevant sectors?
- Do I want to assign the scenario a **probability weighting**? If so, which?
- Can I identify the **structural nature of the opportunities and risks** that exist for companies?
- Would a change in the **materiality of risk factors** or new risk factors imply changes to general risk management?

As a risk manager, ask yourself the following

Appendix 1

Overview of the climateXcellence model

Chart 27: How the model works



Source: The CO-Firm

Financial modelling of the different sectors with respect to climate scenario analysis can be divided into six central steps (Chart 16; subsequent numbering is consistent with the chart; for more general information on each of the following steps, please refer to the “Transition Risk Compass”, [link](#)).

When modelling a sector we mostly restrict the analysis to the business field, such as impacts from new car sales, production of crude steel or electricity generation from energy. Other typical revenue streams (e.g. after sales or insurance, production of steel-based capital goods, transmission or energy trading) were excluded from the analysis, as they are less material with respect to climate change and transition impacts.

1. **Derive the key risk drivers to translate a scenario into a narrative.** First, develop a holistic transition narrative by extending scenario data with consistent transition drivers. As a basis, a consistent scenario needs to be chosen (e.g. IEA Energy Technology Perspective 2017 and IEA World Energy Outlook 2017); further steps include analysing, extrapolating, and breaking down available scenario data to country- and region-specific technology pathways. Next, a determination of the main drivers of the scenario based

on current and announced regulatory regimes, climate targets, and anticipated technology pathways, etc. is needed.

2. **Build an asset-level database with financial information on individual technologies.** Since climate transition impacts technologies differently (even within the same sector), building a financially meaningful asset-level database is central to the modeling. The necessary steps vary by sector depending on the asset-level information available.
3. **Conduct a techno-economic assessment of risk mitigation measures (“adaptive capacity”).** Financial modelling of climate risk must incorporate companies’ ability to anticipate transition risk and develop mitigation strategies. With respect to the automotive sector, analysing risk mitigation has to take into account a variety of aspects such as the scenario, the current position of the company, and its financial strength.
4. **Assumptions about companies’ portfolio development with and without adaptive capacities under different scenarios.** This step makes assumption about how companies make use of their available options (Step 3) to adapt their physical asset bases (Step 2) to the changing climate scenario (Step 1). We modeled three portfolio development pathways: FROZEN, MARKET, and MARKET-EBIT/REVENUE.
5. **Calculate financial performance of individual assets in market models:** The financial performance of assets varies depending on the sector dynamics and the scenario under consideration.
6. **Calculate financial impacts on companies.** For the last step, the financial performances of the individual assets obtained in step 5 are aggregated together with the capital requirements for step 3 and 4 at the company level. This step ensures the linkage to the TCFD recommendations by outlining the scenario-related impacts on the income, cash-flow statement and balance sheet.

A more detailed description of all steps and underlying assumptions can be found in the in-depth standalone reports on each sector (see the list below). This could be important because the methodology differs depending on respective market dynamics, as well as availability of information regarding, for example, scenario and asset level data.

Further results of scenario analysis for all companies across the four sectors

This report builds on the following reports, where a more detailed description of the underlying concept of scenario analysis, adaptive capacity as well as a more detailed description of all company results can be viewed.

The Transition Risk-o-Meter: Reference Scenarios for Financial Analysis (2°C Investing Initiative, The CO-Firm, June 2017, [link](#)).

Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities, TCFD (June 2017, [link](#)).

Adaptive capacity: changing colors. Adaptive capacity of companies in the context of the transition to a low carbon economy (2dii, The CO-Firm, Allianz Global Investors, August 2017, [link](#)).

Climate scenario compass: Investor primer to transition risk analysis (Kepler Cheuvreux, The CO-Firm, January 2018, [link](#)).

Climate scenario compass: Transition risks for electric utilities (The CO-Firm, Kepler Cheuvreux, January 2018, [link](#)).

Climate scenario compass: Transition risks for the automotive sector (Kepler Cheuvreux, The CO-Firm, forthcoming).

Climate scenario compass: Transition risks for the steel sector (The CO-Firm, Kepler Cheuvreux, forthcoming).

Climate scenario analysis: Cement's financial performance under 2° C and 2.7° C - A how-to guide for the sector, and three companies across six countries (The CO-Firm, forthcoming).

These reports mostly focus on results that take the 2°C ACT scenario as their basis, in order to not overburden the reader with too much information. A full breakdown of the results from all scenario-pathway combinations can be found in the accompanying online tool, which you can request access to at climatexcellence@co-firm.com, or www.et-risk.eu.

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Rating ratio Kepler Cheuvreux Q1 2018

Rating Breakdown	A	B
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Hold	36%	38%
Reduce	15%	10%
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Total	100%	100%

Source: KEPLER CHEUVREUX

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Europe

Amsterdam

+31 20 573 06 66

Brussels

+32 11 491460

Frankfurt

+49 69 756 960

Geneva

+41 22 361 5151

London

+44 20 7621 5100

Madrid

+34 9 14 36 51 00

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+47 23 13 9080

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+33 1 53 65 35 00

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+46 8 723 51 00

Vienna

+43 1 537 124 147

Zurich

+41 43 333 66 66



America & Asia

Boston

+1 617 295 0100

New York

+1 212 710 7600

Research team



Luke Sussams

Co-author

lsussams@keplercheuvreux.com
+44 207 621 51986

Luke Sussams is a Sustainability Research Analyst focusing on climate change and environmental risk. Previously, Luke worked for over 5 years as an analyst on fossil fuel risk and the energy transition, helping grow the Carbon Tracker Initiative into a world leading think-tank. Luke graduated with distinction from the Environmental Technology MSc at Imperial College London and holds the CFA IMC.



Jana Mintenig

Co-author

jana.mintenig@co-firm.com
+49 40 2281-6551

Jana specialises in modelling climate-related financial risks and opportunities for numerous industries. Furthermore, she has been part of the consultative group of the Science Based Targets Initiative for renewing the transport sector curves. Jana holds a master's degree in economics from the University of Hamburg, with a specialisation in climate economics.



Nicole Röttmer

Co-author

nicole.roettmer@co-firm.com
+49 40 2281-6551

Nicole is the founder of The CO-Firm. She created the climateXcellence toolset and manages the co-operation with investors, banks and the real economy on climate risk assessments. Prior to this, she worked for McKinsey, building the energy efficiency service line and supporting financial clients in optimizing risk management models and processes. She holds a PhD in strategic management from the university of Leiden and a diploma in economics.