Deloitte.

Climate Finance – approaches for the evaluation of carbon risks

Status quo and future development

Climate change is currently not only present on the global political agenda, but the consideration of climate risks is also gaining importance in the valuation of assets. This is reflected by one of the most recent headlines in the Financial Times on 14.01.2019 regarding Asset Management:

Larry Fink urges his global investment manager BlackRock to take much more account of the potential impacts of climate change when implementing his investment activities. As the world's largest fund manager, BlackRock lags significantly behind its competitors in terms of climate change.

James Thornton of ClientEarth, a major organization of environmental lawyers, explained that in 2019 BlackRock, as the largest trustee, had an obligation to take extensive measures to protect its investors from the effects of climate risk. On the other hand, there are potential legal consequences.

According to ShareAction, a movement in the field of sustainable investing, the current view on carbon cost risk within the asset management community is varying. In addition, the attention to this issue is very diverse although the caution of institutional investors is increasing. Without precise mechanisms to measure them, it will be difficult for investors to manage them effectively.

The ability of pension funds to value the carbon exposure of a managed security accordingly is something that is discussed in other Financial Times articles. This shows the increasing importance of the issue.

As stated by George Sarafeim, an Assistant Professor of Business Administration at Harvard Business School, it is of great importance for certain funds to quantify carbon risk.

Prof. Dr. Martin Hellmich, partner responsible for the valuation of securities in the area of Audit & Assurance at Deloitte, works together with Prof. Dr. Rüdiger Kiesel, professor for Energy Trading and Finance at the University of Duisburg-Essen, on the identification of quantitative approaches and their extension, in order to take into account carbon risks in the valuation of assets.

Initial Situation

Data sets from National Oceanic and Atmospheric Administration (NOAA, party closed by the Trump administration) and NASA show:

- The five warmest years in the global record have all come in the 2010s.
- The 10 warmest years on record have all come since 1998.
- The 20 warmest years on record have all come since 1995.

A report by Swiss Re found the total economic loss from natural catastrophes and man-made disasters increased by USD 337 billion in 2017, from USD 180 billion the year before. This means, according to the study, almost a doubling of the losses of USD 180 billion reported in 2016.

As a consequence Lloyd´s of London posted in 2018 its first loss in six years. Citing the impact of a series of natural disasters. A relevant publication by the AXA Group, the large insurer, has warned that more than 4 degree Celsius of warming this century would generally result in a situation in which significant risks would no longer be insurable.

Climate Risks

Risks and uncertainty factors relating to the climate can be subdivided as follows:

- **Forecasting risks:** Scientific forecasts that relate, for example, to the sensitivity of the Earth's climate system and the nature and strength of possible second-round effects, are subject to considerable uncertainty and may contain errors.
- **Political climate risks:** The economic consequences of climate change can increase the number, scale and intensity of political conflicts within and between states. However, there is also considerable uncertainty as to which regulatory measures are adopted by national and supranational actors, how they are implemented, and what the consequences are.
- **Economic climate risks:** The expected rise in the global average temperature and sea level as well as climatic events such as extreme heat, heavy precipitation or hurricanes can cause considerable economic damage. Examples include physical damage to the infrastructure, lost workdays or deaths due to epidemics and crop failures caused by flooding or extreme drought.

In the area of economic climate risks, it is possible to distinguish between physical climate risks and the carbon risks:

- **Physical climate risks:** Physical changes in climate lead to modifications of climate pattern and extreme weather events. These may alter supply and demand pattern of many industries and lead to physical damages of assets, which may trigger adaption costs and economic loss of value.
- **Carbon risks:** The translation into a low-carbon economy (decarbonization) will alter the financial viability of a part of the capital stock and business models. The associated financial risks and opportunities will change the performance of assets and portfolios.

We deal exclusively with carbon risks, which is why we specify this term:

Carbon risks are those risks which are correlated with greenhouse gas emissions (GHG emissions), i.e.

- **Industrial carbon-related policy risk:** GHGemission caps or taxes.
- **Market constraints:** Changes in the demand and prices for energy linked to an energy transition.
- **Climate litigation:** Lawsuits can create liabilities due to past emission for targeted companies.
- **Investment regulatory frameworks:** Mechanisms that impact the cost and availability of capital; capital requirements and taxes on capital.
- **Fiduciary duty related litigation:** Claims of negligence for institutional investors if carbon bubble bursts. So carbon risk relates to regulation, litigation, competition, production and reputational risk.

Importance of the topic for Asset Management

Carbon Bubble: There is consensus that to avoid the uncontrollable consequences of climate change, the increase in the global average temperature must be limited to 1.5 degrees Celsius compared to the pre-industrial age. The restrictions on CO_2 emissions mean that a significant portion (approx. 30–50%) of the global reserves of fossil fuels can no longer be used to generate energy. From today's perspective, these reserves and the associated assets are therefore overvalued. States and private companies that own reserves of fossil fuels thus have reduced capacities to repay their debts. This has a negative impact on the value of equities and affected government and corporate bonds. Energy companies, for example, may be exposed to negative price shocks. Equities such as corporate bonds from issuers in carbon-intensive sectors, including consumer goods, manufacturing, transportation and traffic, are also likely to be subject to significant price adjustments.

There are different approaches to quantify the total output of the economic effects. One example is the Climate Value at Risk (Klima-VaR, cf. Dietz et al. (2016)). Here, for example, an extended version of the William Nordhaus' Dynamic Integrated Climate Economy (DICE) model is used, to estimate the impact of climate change on GDP growth. Based on this approach, continuing the current intensity of GHG emissions would imply a 99% quantile of 16.9% of the current value of global financial assets, while limiting emissions to a 2 degrees Celsius scenario would still imply a 99% quantile of 9.2% of the current value of global financial assets.

Attempts to quantify possible effects on the EU financial system (pension funds, banks and insurance companies) can be found, for example, in Weyzig et al. (2014). The approach is based on estimates of the exposure to equities, bonds and loans from and to companies processing fossil fuels and the corresponding commodities themselves. These exposures are estimated at EUR 260–330 billion for pension funds, EUR 460–480 billion for insurance and EUR 300–400 billion for banks. The authors conclude that a rapid and structured transition to a largely decarbonized economy will lead to average losses of 3%, 2% and 0.4% for pension funds, insurance companies and banks. However, a slow and uncertain transition would lead to significantly higher losses.

Climate change and the associated risks lead to a significant change in the perception of important investors and trigger corresponding changes in behavior:

- Norway state pension funds stops investing in more than 60 companies because of climate change; Norges Bank (2017).
- Mark Carney, governor of the Bank of England, has suggested the risks arising from climate change should form part of its annual stress tests for banks from 2019 (Financial Times, Dec 2018).
- Investors overseeing more than USD 11 billion in assets, including Schroders, Legal & General Investment Management and two of the biggest US pension funds, have called on power companies to commit to ending coal use by 2030 and spell out preparations for a global shift towards low-carbon fuels (Financial Times, Dec 2018).
- Climate Action 100+ is a five-year initiative led by investors to engage systemically important greenhouse gas emitters and other companies across the global economy that have significant opportunities to drive the clean energy transition and help achieve the goals of the Paris Agreement. Investors are calling on companies to improve governance on climate change, curb emissions and strengthen climate-related financial disclosures. Launched in December 2017 Climate Action 100+ has more than 310 members by today.
- In 2018 a growing number of companies have announced their own emissions targets against the backdrop of bruising climate negotiations at an international level, including IKEA, MAERSK, Schneider and the BT Group.

Brief overview of current approaches to the impact of climate risks on the valuation of financial assets, asset allocation, equity and debt capital costs, share prices and credit spreads

Litterman et al. (2017) investigate in the context of the Asset Pricing Theory the problem that an agent must balance the known costs of mitigating climate change with the uncertain benefits of mitigating the problem. This balancing is done by solving a dynamic optimization problem to determine the optimal strategy for mitigating climate change. A quantitative result presented suggests that the emission price of CO_2 should rise from USD 35 to USD 60 by 2050 under given circumstances.

The Expected Utility Theory uses known probabilities (or unique estimates). We do not have these in climate change models.

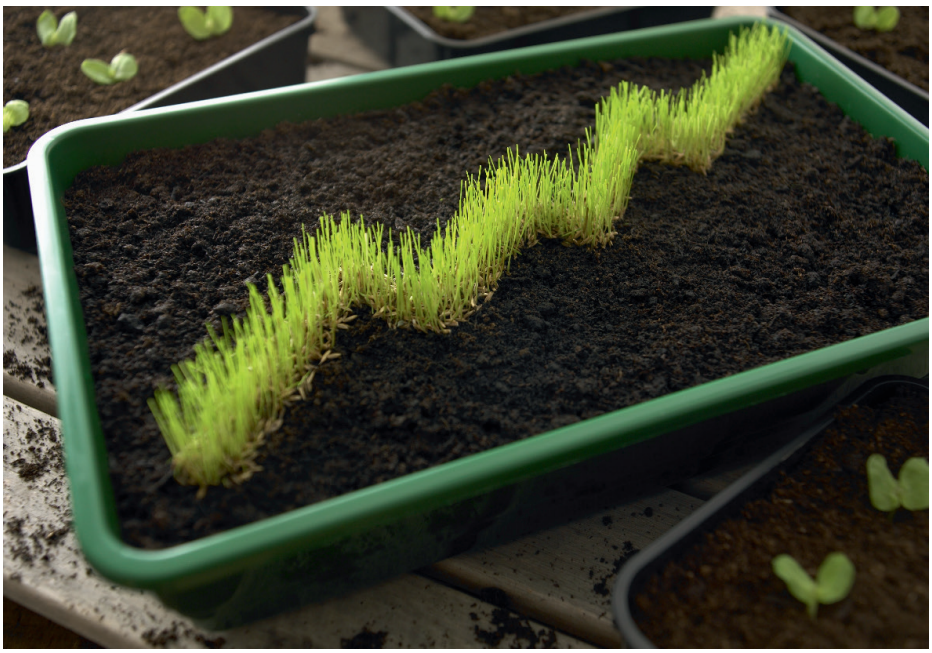
- **Risk:** We are able to specify a unique P – typically for well-known financial markets such as stocks, options, mortality and risk.
- **(Knightian) Uncertainty:** We are not able to specify a precise P – typically for less liquid financial markets – credit risk, operational risk.
- **Ambiguity:** We are facing several possible specifications P_1, P_2.

Fischbach, Kiesel, Mahayni (2018) extend Litterman et al. (2017) by introducing ambiguity aversion in the optimization problem. The smooth ambiguity model of Klibanoff et al. (2005) handles situations, where the decision maker does not know the true random distribution that describes the decision problem. Instead he is faced off with a whole set of possible distributions. The prior reflects the beliefs/information of the decision maker over the different distributions. The resulting carbon tax is equivalent to a carbon price of around EUR 110 for the year 2050 for the model with ambiguity.

Tian et al. (2016) apply a multifactor model to address the impact of the EUA (European Emission Allowances) prices on the stocks of electricity companies.

- They show that stock prices tend to positively respond to EUA price changes for those producers that use predominantly green energy in their generation.
- For carbon intensive producers, they find an inverse relationship between stock and returns and EUA price changes during Phase II.
- The conditional correlations between EUA returns and electricity stock volatility are found to be significant in Phase II and insignificant in Phase I.

A simple regression reveals the relation of CDS spreads of electricity producers and EUA prices. The EUA price is positively correlated with the CDS spread. An increase of the EUA price by one euro increases on average the CDS spread of electricity providers by about 3 basis points. To assess the default risk of a company often the expected loss is calculated. As the expected loss is given as the exposure-at-default times the credit spread, the linear relationship of EUA price and CDS spread has a direct effect on the default risk.



Görgen et al. (2017) calculate model portfolios based on an extension of the approach of Fama and French (1993). They construct a capital market-based carbon risk factor to measure the sensitivity of a company to a transition to a decarbonized economy. The study uses carbon-related company data from the Thomson Reuter ESG database.

Kim et al. (2015) quantify the effects of carbon risks on the cost of equity and come to the conclusion that its reduction of 10% in the so-called carbon intensity (CO_2 emissions/sales) should lead to a reduction in the cost of capital of 8 basis points for given sales.

Fichtner (LEF, 2018) conducted a study on the relationship between carbon risks and equity capital costs of German and Austrian companies. This study uses data from 81 listed companies with published emission data in the period between January 2016 and December 2018. Among other things, it shows that carbon intensity and equity costs are positively correlated, and that published sustainability reports and strict regulation reduce equity costs.

Kleimeier and Viehs (2018) examine the impact of disclosure of carbon intensities, emission levels and the cost of carbon emissions on borrowing costs. They come to the following conclusion:

- Greater transparency regarding carbon emissions leads to better credit conditions, especially for companies where there is a lack of information.

- In particular, the response to the annual questionnaire of the Carbon Disclosure Project (CDP) and the voluntary disclosure of carbon emissions lead to significantly lower spreads for loans compared with companies that do not publish the data.
- When assessing creditworthiness, financial markets and creditors take into account existing information on the environmental role of firms.

The relationship between CDS spreads and carbon risks was investigated at the Chair of Energy Trading and Finance at the University of Duisburg-Essen on the basis of Bloomberg data for European energy groups and large German companies. Data on carbon intensity and sector information from the EU ETS Company Data-base were used.

The following difficulties exist when financial institutions or asset managers map carbon risks:

- The future path of decarbonization of the global economy is uncertain and there are also numerous options at national level regarding the future level of emission restrictions and the resulting economic viability of the use of alternative technologies.
- There are no historical data for models available.
- The distribution of forecasts for the future world climate is asymmetric and leptokurtic (i.e. has “fat tails”): extreme deviations from the assumed mean value are significantly more likely than the normal distribution assumption would suggest.
- Financial actors have shorter time horizons than the currently expected time to materialization of climate risks.

Important source of information

The Carbon Disclosure Project (CDP) is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts.
https://www.cdp.net/en

To help regulators and investors to identify and assess the risks and opportunities created by the new carbonconstraining policies Carbon Market Data offers the EU ETS Company Database.
https://carbonmarketdata.com/en/home

Your contacts

Andreas Koch
Partner | FSI Asset Management
Tel: +49 (0)172 864 4546
akoch@deloitte.com

Prof. Dr. Martin Hellmich
Partner | FSI Asset Management
Tel: +49 (0)173 975 3809
mhellmich@deloitte.com

Deloitte.

Issue 03/2019