Illustrative example

The purpose of this exercise is to demonstrate the application of the methodology presented in chapter "Measuring the impact of financial assets on the investment portfolio" of this white paper. A specific case is used to analyze the impact of transition risk on a corporate bond portfolio, illustrating how this methodology can be applied in a realistic context to assess the impact of climate change on the risk of an investment portfolio.

The analysis is developed based on a fictitious portfolio of 8,414 corporate bonds issued by companies from various economic sectors, including energy, financial activities, manufacturing, and utilities (e.g., electricity, water, gas). These issuers operate in multiple countries, with a diversified geographic distribution across regions with varying levels of regulatory pressure and commitment to climate change.

Sectoral and geographic diversity is detailed in Figures 25 and 26, which show:

- Economic sectors: issuers are classified according to NACE codes[68], with a higher concentration in financial activities, energy, industrial and supply services.
- Geographical distribution: The main regions are Europe, with a significant concentration in France, as well as the United States and China.

In addition, the impact measurement methodology takes into account the sectoral and geographic composition of the issuing counterparties' revenues. Where detailed information is not available, it is assumed that revenues are fully concentrated in the country and primary sector reported by the issuer.

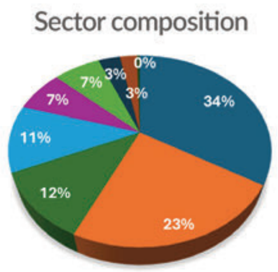
This diversity allows us to capture the complexity inherent in transition risk analysis, highlighting how changes in policies, regulations, technology and markets can significantly impact companies that rely heavily on fossil fuels.

The exercise simulates a short, medium and long term analysis defined for the years 2025, 2030 and 2050 respectively under a Delayed Transition scenario; see chapter 'Climate risks' for more details on scenarios. This scenario assumes a continuation of fossil fuel use without significant changes until 2030, followed by a strict implementation of climate policies after that year. These policies include an initial regional fragmentation of carbon prices, converging to a global price by 2070, with the goal of limiting global temperature increase to less than 2°C by 2100. This context creates a disorderly transition and poses greater long-term economic impacts and risks, especially for energy-intensive and carbon-dependent sectors.

The fictitious portfolio has a total value of approximately 22 billion euros and is intended to replicate a real investment portfolio of a financial institution at the end of 2023. The data

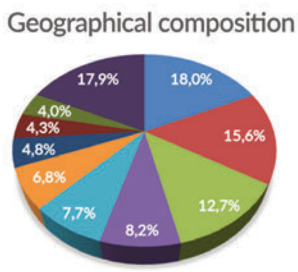
[68] Statistical classification of economic activities: https://eur-lex.europa.eu/ES/legal-content/summary/statistical-classification-of-economic-activities-nace-revision-2-1.html

Figure 25: Classification of the sample portfolio by macroeconomic sector.



Sector	Weight in the portfolio
FINANCIALS	33.6%
ENERGY	23.3%
INDUSTRIALS	11.5%
UTILITIES	11.3%
CONSUMER STAPLES	7.2%
COMMUNICATION SERVICES	6.9%
OTHER	3.6%
HEALTH CARE	2.5%

Figure 26: Sample portfolio ranking by main issuer country.



Country	Weight in the portfolio
France	18.0%
USA	15.6%
China	12.7%
Italy	8.2%
Germany	7.7%
United Kingdom	6.8%
Switzerland	4.8%
Spain	4.3%
Netherlands	4.0%
Rest of World	17.9%

includes market prices and interest rates as of December 31, 2023, providing a realistic framework to contextualize the analysis in the economic conditions of that period.

In terms of financial instruments, the portfolio includes:

- Coupon bonds and zero-coupon bonds.
- variety of coupon payment frequencies, including annual, semi-annual and quarterly.
- A smaller, insignificant portion of the portfolio consists of callable and perpetual bonds, which are modeled as plain vanilla bonds.

The calculation follows the methodology described in section 'Measuring the impact on the investment portfolio of financial assets', starting with the assignment of each economic sector in the portfolio to a CPRS (Climate Policy Relevant Sector). These sectors are assigned a key variable based on the NGFS scenarios. These variables allow the estimation of a shock for each sector and geography at the time horizons of the analysis, comparing the climate transition scenario (delayed transition) with the baseline scenario (current policies).

For example, Figure 27 shows the projected evolution and impact of the shock for the variable representing projections of primary energy production from fossil fuels (EJ/year). This variable is linked to the CPRS sector "Energy - Fossil" and is used to estimate the impact on the activities of the fossil fuel energy production sectors. This approach is extended to all sectors and geographies in the portfolio and applied to each issuing counterparty.

Once the sectoral and geographical analysis is complete, the specific impact of the climate shock on each issuer counterparty is calculated. A structural valuation model is used to assess the impact of this shock on the issuer's creditworthiness. Based on this analysis, the bond is repriced to calculate a weather spread that reflects the change in the bond price due solely to the transition shock.

This process is repeated for all the bonds in the portfolio and for the three time horizons chosen (2025, 2030 and 2050), making it possible to quantify the financial impact

[69] According to the scenario narrative, there are no differences between the two scenarios until 2030, which means that the impact on the sector is zero during this period. From 2030, the impact starts to increase, reaching an estimated shock of 62% in 2050. The data were obtained using the Management Sustainability Solutions (MS^2) tool, using scenarios provided by the NGFS.

Figure 27: Climate policy impact (%) on the CPRS Energy - Fossil sector in 2050, comparing the delayed transition scenario (green) with the current policy scenario (blue) [69].

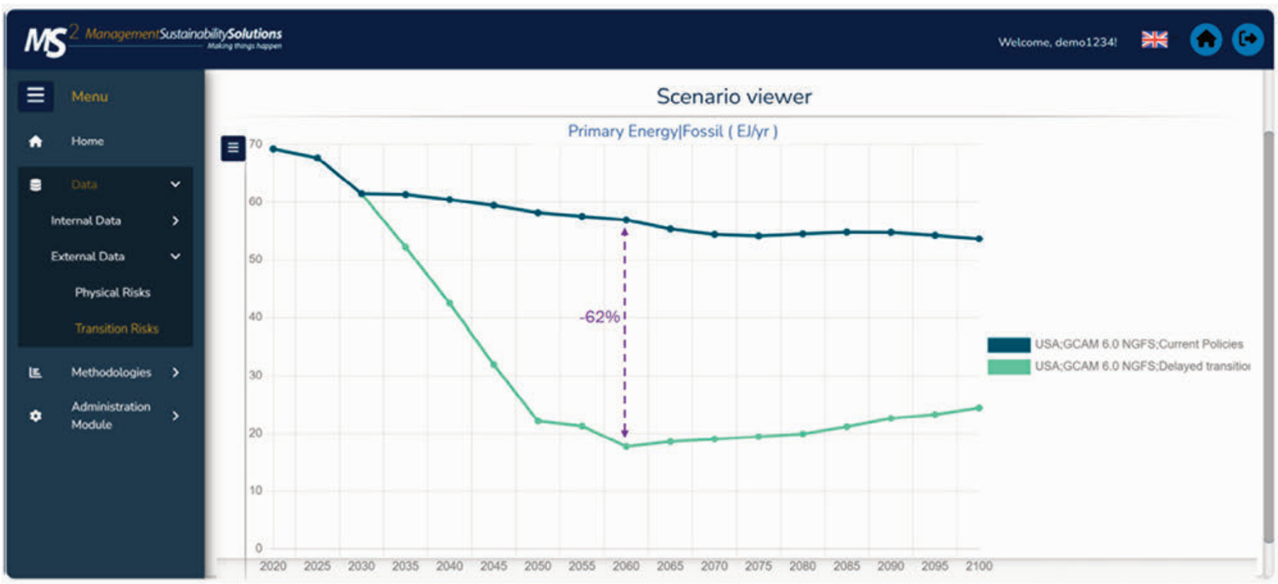
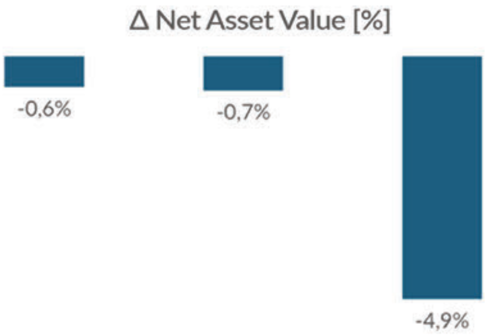


Figure 28: Projected impact on the Net Asset Value (%) of the corporate bond portfolio under the delayed transition scenario, by time horizon (2025, 2030 and 2050). The values reflect the estimated losses due to transitional climate stress relative to the current policy baseline.



Year	Δ Net Asset Value [%]	Δ Net Asset Value [€]
2025	-0.6%	- 138,914,962 €
2030	-0.7%	- 155,061,394 €
2050	-4.9%	-1,095,737,591 €

(loss or increase in NAV) of the climate transition risk under the chosen scenario.

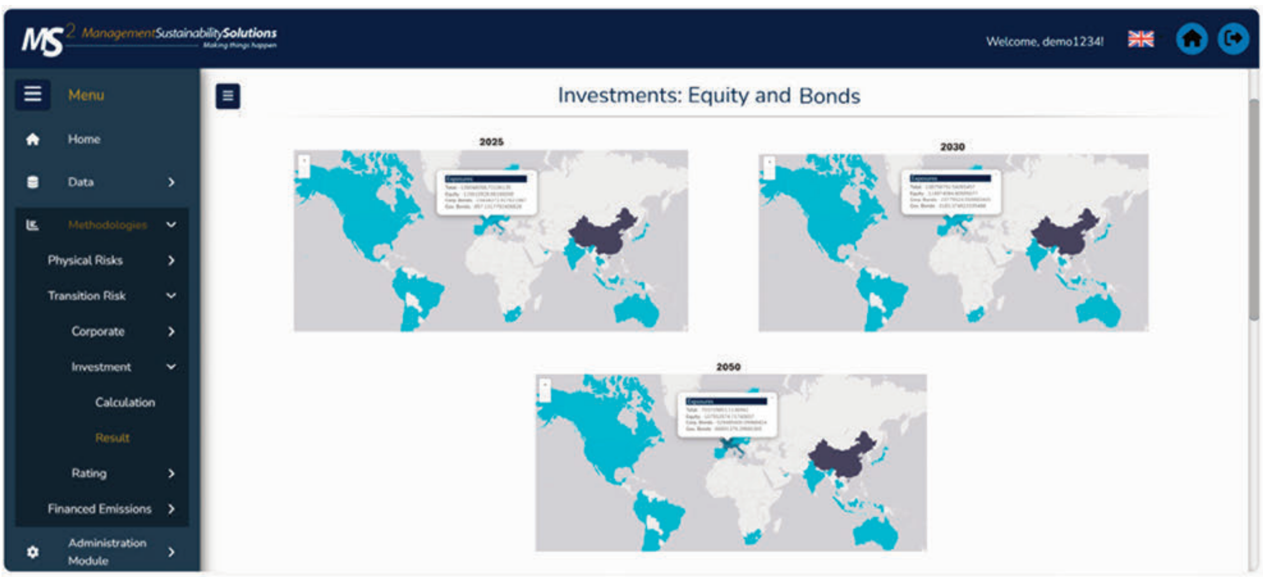
As shown in Figure 28, the NAV of the analyzed corporate bond portfolio experiences a loss in line with the trend predicted in the delayed transition scenario. This scenario predicts a more significant climate transition risk in the long term, with an estimated loss of 4.9% in 2050, while the predicted impacts for 2025 and 2030 are significantly lower, reaching only 0.6% and 0.7% respectively. This is because in this scenario no significant changes in decarbonization policies are expected before 2030. As a result, the economic sectors do not show any significant impacts until this year.

From 2030 and during the 2030-2050 period, a disorderly transition is projected due to the need to implement stricter policies to meet climate objectives. This process will have a negative impact on certain sectors of the economy, while other sectors will see opportunities arising from the environmental transition. These effects, whether positive or negative, will vary according to the specific characteristics of the issuing counterparties and will have a differentiated impact on the value of the portfolio's assets.

The time trend described above is also observed in Figure 29, which shows the evolution of risk over the three years

[70] The intensity of the risk varies according to the geographic exposure of the portfolio, influenced by the specific composition of the portfolio and the different ambitions and pace of implementation of climate policies in each region within the scenario used. The image was created using the Management Sustainability Solutions (MS^2).

Figure 29: Evolution of climate transition risk represented by a geographic map showing the distribution of risk over the three years analyzed [70].



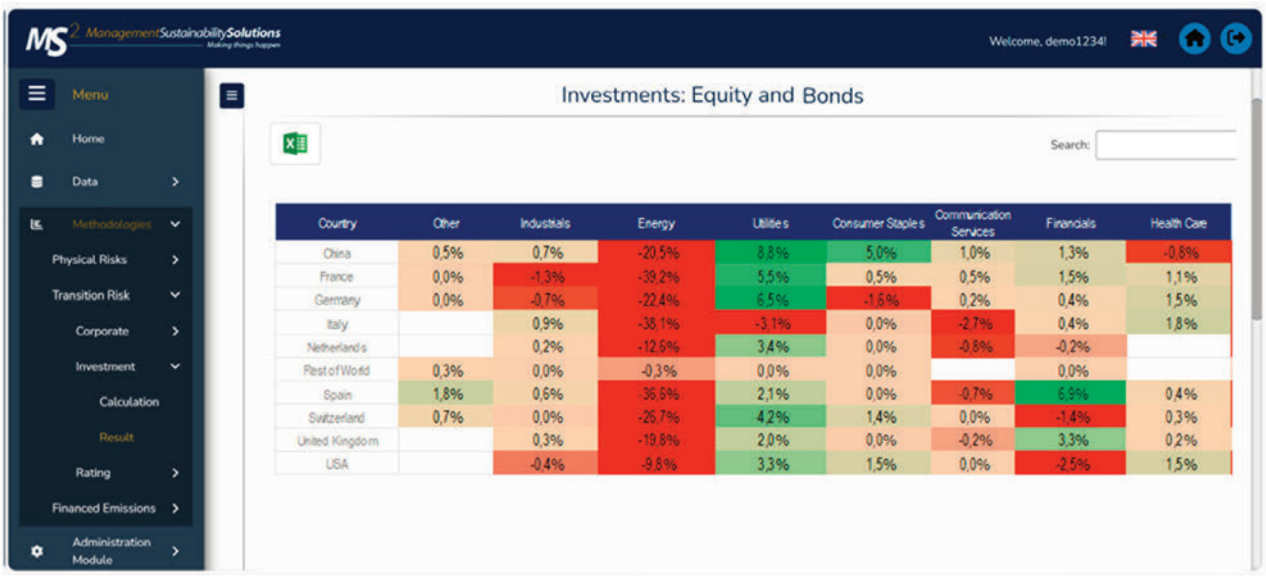
analysed on a geographical map. The figure shows a higher long-term risk, albeit at different levels depending on the geographical exposure of the portfolio. These differences are due both to the specific composition of the portfolio and the relative weight of the exposures in each region, as well as to the different ambitions and expected speed of adoption of climate policies in the scenario considered.

Finally, a more detailed analysis by country and major macro sector of the issuing counterparties is presented in Figure 30, which provides a granular view of the estimated impacts in the projection year 2050.

Figure 30 shows significant differences in projected impacts across countries, reflecting different expectations of future climate policies in each region. These differences are even more pronounced at the sectoral level. For example, the "Energy" sector in this portfolio consists mainly of bonds issued by companies linked to the fossil fuel sector, which faces a significant phase-out of fossil fuels in the scenario analyzed for 2050.

On the other hand, other sectors, such as the "Utilities" sector, have a potentially positive impact. This sector includes counterparties active in electricity generation, some of which use renewable source. These companies could benefit from the climate transition thanks to the projected increase in energy demand, driven by the electrification of the economy that will accompany the gradual phase-out of fossil fuels. For their part, sectors such as the "Financial" sector show a mixed behavior, since they can benefit from the opportunities arising from financing the transition, but they can also be affected in certain cases

Figure 30: Breakdown of the projected impact on the Net Asset Value of the corporate bond portfolio under the delayed transition scenario, presented according to the geographic and sectoral distribution of the issuing counterparties. The values shown are weighted percentages based on the portfolio value of each country - macro sector combination, highlighting the differences in the expected impacts according to the characteristics of each region and economic sector.



Country	Other	Industrials	Energy	Utilities	Consumer Staples	Communication Services	Financials	Health Care
China	0,5%	0,7%	-20,5%	8,8%	5,0%	1,0%	1,3%	-0,8%
France	0,0%	-1,3%	-39,2%	5,5%	0,5%	0,5%	1,5%	1,1%
Germany	0,0%	-0,7%	-22,4%	6,5%	-1,6%	0,2%	0,4%	1,5%
Italy		0,9%	-38,1%	-3,1%	0,0%	-2,7%	0,4%	1,8%
Netherlands		0,2%	-12,6%	3,4%	0,0%	-0,8%	-0,2%	
Rest of World	0,3%	0,0%	-0,3%	0,0%	0,0%		0,0%	
Spain	1,8%	0,6%	-36,6%	2,1%	0,0%	-0,7%	6,9%	0,4%
Switzerland	0,7%	0,0%	-26,7%	4,2%	1,4%	0,0%	-1,4%	0,3%
United Kingdom		0,3%	-19,8%	2,0%	0,0%	-0,2%	3,3%	0,2%
USA		-0,4%	-9,8%	3,3%	1,5%	0,0%	-2,5%	1,5%

(for example, if they have holdings in industrial groups with high emissions). The industrial and productive sectors also show different impacts depending on the type of issuing counterparty.

It should be noted that the results show an aggregate value that takes into account a large number of bonds and counterparties, each with specific characteristics in terms of geographical location, sectors of activity, financial structure and resilience to climate transition risks. The methodology used allows each bond and counterparty to be evaluated individually, starting with a granular analysis that ensures a high level of detail.

However, by consolidating the results into an aggregated view, although some of the specificity of each asset is lost, an overall perspective is obtained that facilitates the identification of the materiality of the risks and the main drivers of the projected impact. This approach, which combines granularity and aggregation, provides a comprehensive view of the climate risks associated with the portfolio.

This practical exercise has demonstrated how the methodology described in section "Measuring the impact on the investment portfolio of financial assets" can effectively assess the impact of transition risk in a corporate bond portfolio. The results highlight that sectors such as energy, particularly those linked to fossil fuels, face significant negative impacts under decarbonization scenarios, while other sectors may benefit from the opportunities associated with the electrification of the economy and increased demand for renewable energy. The granularity of the analysis was key to identifying specific counterparties with increased vulnerability, underscoring the importance of a detailed approach to risk management.

The integration of quantitative analysis such as this is essential for incorporating climate transition risks into strategic portfolio management. This approach not only facilitates regulatory compliance, but also strengthens the financial resilience of institutions in the face of climate challenges. It also makes it possible to anticipate potential losses and adjust exposures according to projected scenarios.