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Discussion paper: Insurance sector climate-related transition risks

DISCLAIMER: THIS DISCUSSION PAPER PRESENTS PRELIMINARY RESULTS AND METHODOLOGICAL IDEAS AND CONCEPTS THAT ARE INTENDED FOR DISCUSSION AT THE EIOPA WORKSHOP ON INSURANCE SECTOR CLIMATE RELATED TRANSITION RISKS.

THE IDEAS, METHODOLICAL CONCEPTS AND RESULTS PRESENTED IN THIS PAPER ARE NOT FINAL AND SHOULD NOT BE QUOTED OR CONSIDERED REPRESENTATIVE OF ANY PARTICULAR EIOPA POSITION ON THE ISSUES COVERED IN THIS PAPER.

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1 Executive summary

EIOPA plans to carry out a focused analysis of the sensitivity of insurers' balance sheet to climate-change related financial risks. The work is a pilot/learning exercise which aims to support future work and possible future stress-testing.

The main objective of this work is to assess key financial risks embedded in insurers' asset portfolios in relation to the transition to a low-carbon economy. A secondary objective is to assess additional risks related to claims inflation and insurance availability in increased nat. cat. scenarios associated with climate change. The exercise will consist of three separate building blocks, i.e. elements 1, 2 and 3, summarised in Table 1.

Table 1: Overview of the framework

Element	Risks investigated	Coverage	Approach
Element 1	Transition risks (assets)	Equity and corporate bonds that can be linked to physical assets, i.e. a subset of the asset portfolio of insurers	Top-down based on data reported under Solvency II
Element 2	Transition risks (assets)	General approach based on sectors to complement the first element. Cover also assets not included in element 1 (e.g. government bonds).	Top-down based on data reported under Solvency II
Element 3	Physical/liability risks	Qualitative survey	Survey to industry (to sample of large insurers)

Workshop and this discussion paper

EIOPA is currently exploring the methodological aspects of such an exercise and engaging with various counterparts, both internally and externally. In order to support this effort, EIOPA is publishing this discussion paper. It describes the framework for the 2020 sensitivity analysis and provides some key preliminary findings based on parts of the methodology under consideration for this exercise.[1]

The paper is published ahead of a workshop organised by EIOPA in February 2020 in order to stimulate and inform the debate at the workshop, and to seek inputs from interested parties. Workshop participants in particular are invited to provide comments during the workshop, or in writing in advance by sending an email to st-team@eiopa.europa.eu with the subject "2020 sensitivity analysis background paper".

In particular, EIOPA is seeking feedback or other considerations on the following issues that can help inform this work:

- Previous experience in analysing transition scenarios - how were they formulated, and what time horizon did they consider (instantaneous or multi-periodic)?

[1] This paper does not constitute a formal proposal, but is intended to stimulate discussion

- Further issues EIOPA could or should consider regarding the methodologies for generating price shocks
- Are we approaching any scientific convergence and best-practice that EIOPA should take into consideration in this exercise?
- Approaches to deal with data gaps and limited coverage
- Possible approaches for assets not covered in element 1, and how to consider consistency between the three elements of the exercise (especially the first two)
- Previous experience in analysing physical risks in relation to climate-change that can inform the qualitative questionnaire

2 Framework for the 2020 sensitivity analysis

2.1 Objectives

The main objective of this work is to assess key financial risks embedded in insurers' assets portfolios in relation to the transition to a low-carbon economy. Preliminary analysis indicates that it is unlikely that one single approach is able to support a complete analysis. Therefore, different approaches will be employed to various parts of the exercise. This will also support the aim of drawing lessons for future work.

A secondary objective is to assess additional risks related to claims inflation and insurance availability in increased nat. cat. scenarios associated with climate change. A limited survey with industry will be employed to collect information for this purpose. The survey is expected to be launched in Q2 2020.

Box 1: What are transition risks?

Transition risks are financial risks that may arise from the process of adjustment towards a low carbon economy. A range of factors influence this adjustment, including: climate-change related developments in policy and regulation, the emergence of disruptive technology or business models, shifting sentiment and societal preferences, or evolving evidence, frameworks and legal interpretations.

The international community has defined a mandate to limit the man-made contribution to global warming to well below 2°C above pre-industrial levels. Achieving this objective requires decarbonizing the economy in the course of this century. This decarbonization is set to have significant implications for high-carbon emitting sectors. As the economy decarbonizes, companies that fail to properly anticipate this transition are set to be exposed to economic risks.

Source: EIOPA[2] and 2 Degree Investing Initiative (PACTA Tool)

2.2 Approach

The exercise will consist of three separate building blocks, i.e. elements 1, 2 and 3.

The first building block of the exercise is a detailed sensitivity analysis for assets (equity and corporate bonds) that can be linked to physical production (e.g. barrels of oil produced, or megawatts of power generated) in a set of key technologies (element 1).

[2] Opinion on Sustainability within Solvency II (EIOPA-BoS-19/241)

However, as it is only possible to do this for a subset of the asset portfolio of insurers, this work will be complemented by a more general approach to other assets based on NACE and CIC codes (element 2). These two elements constitute the main part of the exercise and require a top-down analysis performed by EIOPA (mainly) on data already available to the Authority.[3]

Finally, element 3 will consist on a limited bottom-up survey to large insurers (see Section 5) used to collect mainly qualitative information about the effects of climate change on certain key business parameters in the insurance sector.

3 Element 1: Sensitivity analysis for equity and corporate bonds that can be linked to physical production

The first element of the exercise is a top-down analysis where EIOPA would map, for each insurer, their equity and corporate bond holdings (where possible) to physical assets in climate relevant sectors (e.g. power plants). This mapping rely on additional information for listed equity and corporate bonds which is obtained through the cooperation with 2 Degree Investing Initiative (2DII) and build on work already done as part of this collaboration. The scope is defined by the availability of data and methodology of the 2DII PACTA toolset.[4]

This chapter presents preliminary results based on Q3 2018 reporting data and explains the expansion that is planned for the 2020 sensitivity exercise.

3.1 Background and preliminary findings

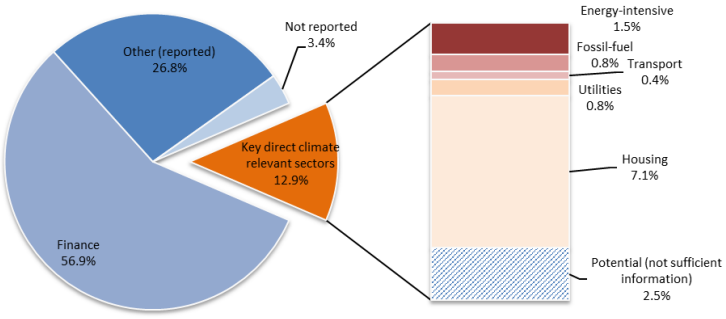
In December 2018, EIOPA published a discussion of climate-change relevant exposures in the insurance sector[5] in its semi-annual Financial Stability Report. This analysis found that direct climate related exposures could account for between 3% and 13% of all investments (including investments held for unit linked business) depending on the criteria employed (especially whether real-estate exposures should be included). It is important to note that these direct exposures might still understate the total potential transition risk, as additional exposures might be held through investment funds for which look-through was not possible and there could be additional sectors (for instance agriculture) at risk in a transition scenario. Finally, potential second round effects were also not considered in these direct exposures.

[3] Some additional data may be collected in cooperation with NCAs and relevant undertakings on CIUs where look-through data is not available.

[4] The 2DII PACTA methodology is free and open-source, see https://2degrees-investing.org/pacta/. EIOPA has used a bespoke implementation in cooperation with 2DII for this work.

[5] See EIOPA Financial Stability Report December 2018

Figure 1 Direct climate relevant exposures from December 2018 Financial Stability Report



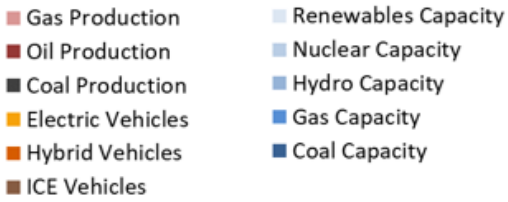
Source: EIOPA Financial Stability Report. December 2018

While generally informative, this analysis was based on very broad sector categories (NACE sectors) which do not offer sufficient detail to assess climate-related transition risks in depth.

In particular, when it comes to corporate bond and equity holdings of non-financial firms, which either emit CO2 during production or produce products that emit CO2 during consumption (i.e. internal combustion engine vehicles), much more detailed data is required to assess the degree of transition risks.

Working together with 2DII, EIOPA has been able to combine reported equity and corporate bond holdings from the insurance sector[6] with detailed real-economy firms level emission data and production data for the following key technologies and sectors[7]:

Figure 2 Technologies for which detailed firm-level emission and production data is available using the 2DII PACTA tool



Source: 2 Degree Investing Initiative

3.2 Assessment of coverage

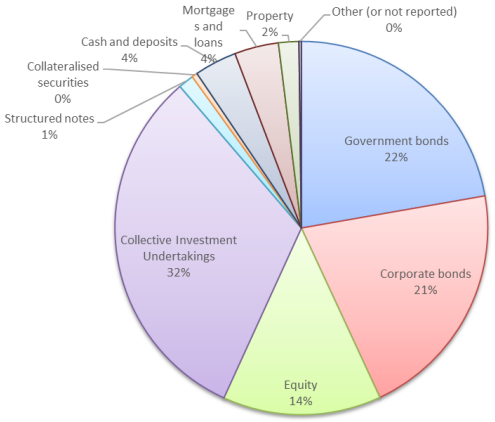
Overall, EEA insurers hold about 14% of their assets in equity (including holdings in related undertakings), 21% in corporate bonds and 32% in collective investment undertakings (CIUs, i.e. funds).[8]

[6] This is based on the asset-by-asset reporting (S.06) under Solvency II

[7] The database also allows a look-through of funds if the fund is publicly traded and detailed data on the funds' holdings are available on commercial databases.

[8] This preliminary analysis focuses on methodological aspects and do not separate life and non-life undertakings. Naturally, the investment portfolio varies by undertaking type, and this will be considered in the final report and analysis

Figure 3: Aggregate investment portfolio of EEA insurers, by CIC category



Source: EIOPA Insurance statistics (Solo undertakings, incl. unit-linked. Q3 2018 data).

That implies that, as this element of the sensitivity analysis is covering equity and corporate bonds (including those in CIUs), such investments could cover up to 60-65% of the insurers aggregate portfolio (with the unlikely assumption that all CIUs contain only equity and bonds). However, as the focus is on *listed* equity and corporate bonds, the maximum coverage of the exercise would automatically be lower as insurers also hold a substantial amount of non-listed securities.

Using data available to 2DII, it is possible to extract the underlying assets for CIUs that are listed and where the content of the fund is available via external data providers. Whenever such look through is possible, the analysis will use the underlying assets in those CIUs. In some countries, however, there are somewhat large holdings in funds where no such look through is available, e.g. if it is a proprietary fund managed in-house.

Overall, of the around 10 500 billion euro in assets held by EEA insurers in Q3 2018, it was possible to map around 6 500 billion euro to listed financial assets with corresponding financial data (see Figure 4). Of that, around 2 100 billion euro is Government debt (which is not linked to physical assets). That means that, overall, exposures of around 4 400 billion euro were mapped to physical production accounts. This is around 40% of the aggregate investments of insurers.

Overall, preliminary findings indicate that around 2/3 of identified equity and corporate bonds were mapped to economic activity (including equity and debt funds).[9]

(life undertakings hold around 11% of their portfolio in equity and 19% in corporate bonds. For non-life undertakings, the corresponding figures are 17% and 29% respectively).

[9] There are around 500 billion euro in assets that are likely to be listed, but where financial data is incomplete. These therefore remain unmapped. This is about 5% of insurers' total investments.

Figure 4: Investment portfolio mapped to listed financial assets and financial data

Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data). Preliminary data.
* For CIUs, 67% have been identified and mapped to market data, but it was not always possible to extract underlying investments in those CIUs.

3.3 Overall holdings in key climate relevant sectors and industries

As noted in the previous section, around 4 400 billion euro of investments were mapped to listed financial assets (equity and corporate bonds) with corresponding financial data. However, of these, only a much smaller share is invested in the key technologies considered for this part of the exercise. Moreover, around half of this is investment via CIUs and as noted in Figure 4, it was not always possible to extract underlying investments in those CIUs.

Currently, the exercise covers the automotive (vehicle production) industry, coal mining, oil&gas extraction and power generation. Table 2 gives an overview of the parts of the investment portfolio that have been mapped to those sectors. It is important to note that these figures and the figures to the left in Table 2 represent a minimum because a non-negligible amount of equity and bond holdings (e.g. unlisted or in CIUs where underlying investment data was not available) was not possible to map.

Table 2: Equity and corporate bonds mapped to sectors using the PACTA methodology - selected sectors

				*Adjusted for mapping coverage**		
Sector	Mapped assets - Euro bn.	Share of total investments	Share of corp. bonds, common equity and bond and equity funds	Euro bn.	Share of total investments	Share of corp. bonds, common equity and bond and equity funds
Automotive	48.2	0.5%	1.0%	89.3	0.8%	1.9%
Coal	24.9	0.2%	0.5%	50.7	0.5%	1.1%
Oil&Gas	113.1	1.1%	2.4%	226.4	2.1%	4.8%
Power	189.9	1.8%	4.0%	350.4	3.3%	7.5%
Total	376.0	3.6%	8.0%	716.7	6.8%	15.3%

Source: EIOPA and 2DII (solo undertakings, incl. unit-linked. Q3 2018 data). Preliminary data. Corporate bonds, common equity and bond and equity funds are defined as in CIC categories 21, 31, 41, and 41. Note (*): The final three columns adjust the euro amount held in the respective sectors by the share of mapped bonds and equity, assuming that the holdings in the mapped and unmapped parts of the investment portfolio are equal and that this also applies for holdings in CIUs.

In addition to the holdings in Table 2, aviation, cement, shipping and steel production are also key climate-relevant sectors. They are not included in Table 2 due to data limitations. However, preliminary findings indicate that corporate bond and equity holdings in those sectors could account for an additional 1%-2% of investments (2%-4% when adjusted for coverage).

Overall, this indicates that *at the very minimum* around *5*% of insurers' total investments is likely to be in key climate-relevant (non-financial) sectors. This is, however, a clear minimum because it assumes that the unmapped part of the investments does not contain assets in these sectors, which is unlikely. The three last columns of Table 2 adjust for this by assuming that the holdings in the mapped and unmapped parts of the investment portfolio are similar. This illustrates that, given this assumption, the overall number could be closer to 7% in automotive, coal, oil&gas and power alone (15% of EEA insurers' holdings of corporate bonds, common equity and equity and bond funds). Aviation, cement, shipping and steel production would come in addition, likely increasing the share of the investments to above 10% when adjusted for the mapping coverage (this would be 20% of the EEA insurers' holdings of corporate bonds, common equity and equity and bond funds).

3.4 Analysis of mapped equity holdings in key sectors and technologies

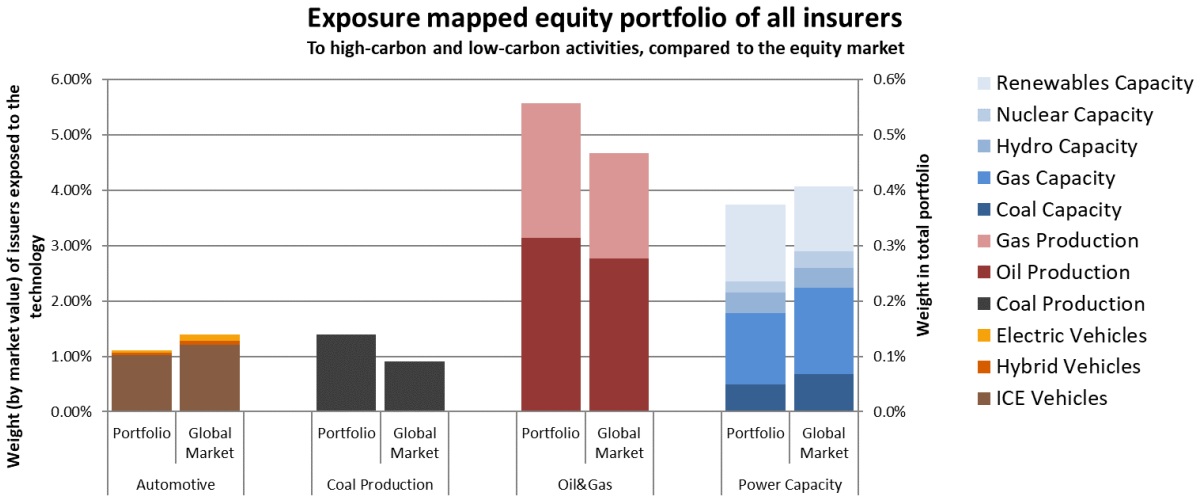
3.4.1 Mapped portfolio weights compared to benchmark

Equity holdings (direct and through CIUs) were mapped (see Figure 4 for an indication of coverage compared to total investment portfolio) and compared to a global benchmark consisting of all free floating equity. Figure 5 shows the results. The left-hand axis shows the percentage of the *mapped* equity holdings in each of the technologies considered. This can be compared to the global benchmark. The right hand axis translates the values into the share in the *total* investment portfolio of insurers to provide a measure of importance overall.

The figure shows that the equity holdings of insurers is slightly overweight in fossil-fuel production than the global benchmark, although overall quite aligned with the benchmark. In terms of absolute exposures, around 11.4, 14.3, 57.3 and 41.8 billion

euros were mapped as equity holdings in the automotive, coal, oil&gas and power sectors respectively.

Figure 5: Exposures in the *mapped* equity portfolio using the PACTA methodology compared to the global listed equity market



Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

Box 2: How to read the alignment charts

The alignment graphs in the next sections show the alignment of the key technologies in the corporate bond and equity portfolio of insurers relative to the IEA transition scenarios: B2DS, SDS, NPS, CPS[10] and the global corporate bond market. For each technology, the value plotted for the insurers' portfolio (solid line) is the planned evolution or 'trajectory' of installed capacity allocated to the corporate bond portfolio over the next 5 years.

The lines separating the color-coded background areas plot the portfolio's 'target production' for each technology under the IEA scenarios. The dotted line shows the planned trajectory of installed capacity in the specific technology for the corporate bond market, scaled to the same starting point as the portfolio.

The model for the assets mapped to physical production uses the following indicators from the scenario, against which the portfolio is compared:

- Electric capacity by fuel expressed in MW (e.g. renewables, coal, gas, oil, hydropower, nuclear)
- Oil production expressed in barrels of oil / year
- Gas production expressed in m^3 / year
- Coal produced expressed in tonnes / year
- Light automotive vehicle production expressed in annual volume by technology (EV, HYB, ICE)

Current and planned production

[10] B2DS is a "below 2 degree"-scenario. SDS is a sustainable development scenario. NPS is a policy scenario that assumes that all policies on the table are implemented. CPS is the "current policy" scenario with no new policies and no new actions are taken.

Current and planned production (for the fossil fuel and automotive sector) and current capacity as well as new capacity (for the power sector) up to 2023 provide forward-looking production and capacity data at the physical asset level. This includes barrels of oil by field, cars by model and factory, and new capacity by power plant. The data is sourced from commercial business intelligence databases.

For all datasets, 2Dii maps this data to their immediate owners and parent company to generate a company's aggregate 'current capacity/production profile' for each technology. These capacity/production plans are linked to the financial securities (equity and corporate bond) issued by the company.

Allocating the production of physical assets to financial assets.

Based on the share of total equity or debt held in a portfolio (individual or aggregate), the model allocates a portion of each corporate issuer's current production plans for each technology to the portfolio. Aggregated over all investments to the portfolio level, this is the portfolio's "current production profile" for a technology. This also defines the insurers' current "exposure" to each technology. The alignment charts in this paper refer to the aggregate portfolio of individual insurers in the EEA.

From macro-level scenarios to micro-level targets.

To calculate production levels consistent with a climate scenario such as the IEA 2°C scenario, the model uses a 'fair share' principle that applies the changes specified by the scenario for a given technology and region equally across all owners of physical assets in that technology's sector in the given region. This creates a set of alternative, forward-looking production and capacity profiles consistent with the scenario for each company and technology. These alternative profiles are then aggregated to the portfolio level to create the portfolio's "target production profile"' under the scenario. This profile is used to determine the insurers' "target exposure" to a technology under the scenario.

The "target exposure" does not assume any change in the composition of the portfolio: it models the changes in production and investment plans that are required across the different companies held in the portfolio in order to match the technology deployment described in the scenario.

The portfolio's "target profile" under the scenario can be compared to the portfolio's currently revealed production and investment plans for each technology to derive the exposure to transition risk as well as the extent to which the portfolio is projected to increase or decrease alignment with the SDS over the next 5 years.

3.4.2 Mapped equity investments - Alignment to global warming scenarios

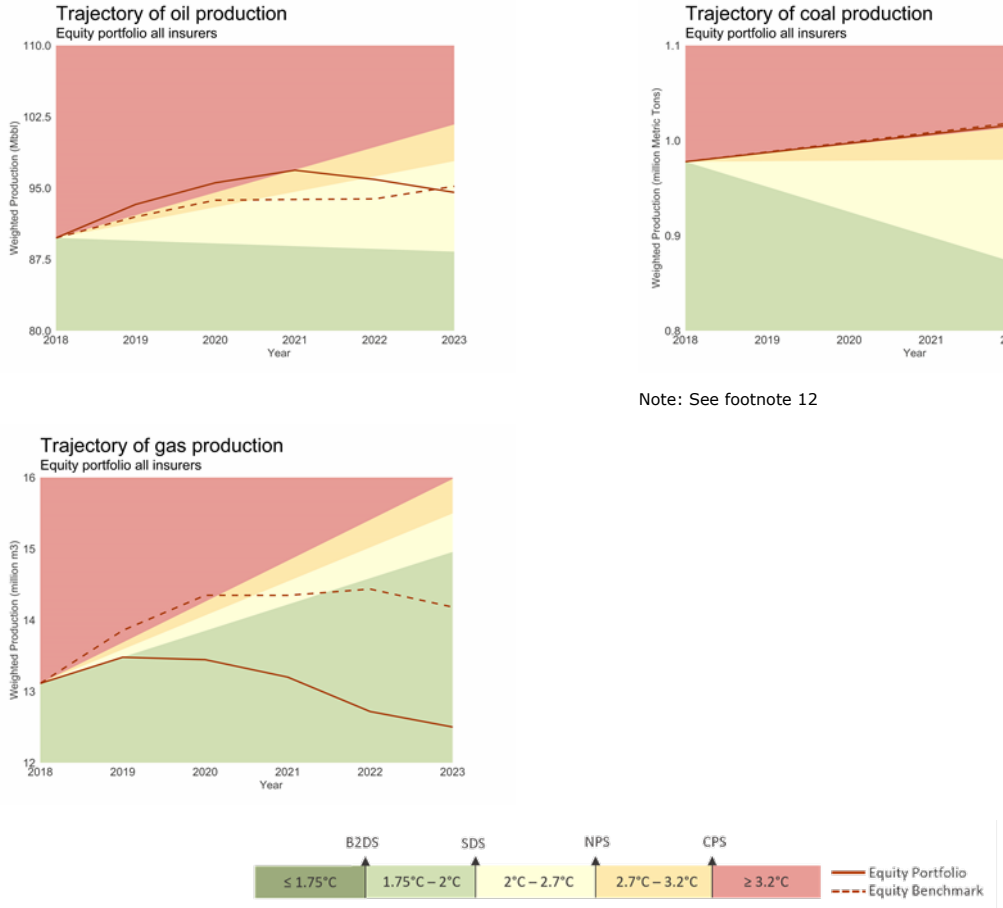
For each of the considered technologies, the equity holdings of EEA insurers is mapped to the current relevant physical production levels, with projections for the next five years[11] using data available to 2DII sourced from different market intelligence agencies and used for the PACTA tool developed by 2DII.

[11] The portfolio weights are considered constant, only production volumes are projected for the next five years.

This is then mapped to the required trajectories to reach a certain global warming outcome, based on publications and research by the International Energy Agency. For detailed explanation how to read these charts, please refer to Box 2.

The trajectories for fossil fuel production signal a certain degree of transition risks. In this sector, oil and coal production would decline in any kind of transition scenario with a policy or technology shock. While some decline is already foreseen in the production of oil from around 2020-2021, this decline is modest and not the case for the trajectory of coal production (see footnote 12 however on the uncertainty around coal production estimates). Overall, it is likely that fossil fuel production represents significant transition risks in the total portfolio of insurers.

Figure A1 - Alignment: Fossil fuel production – equity holdings[12, 13]



Note: See footnote 12

Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

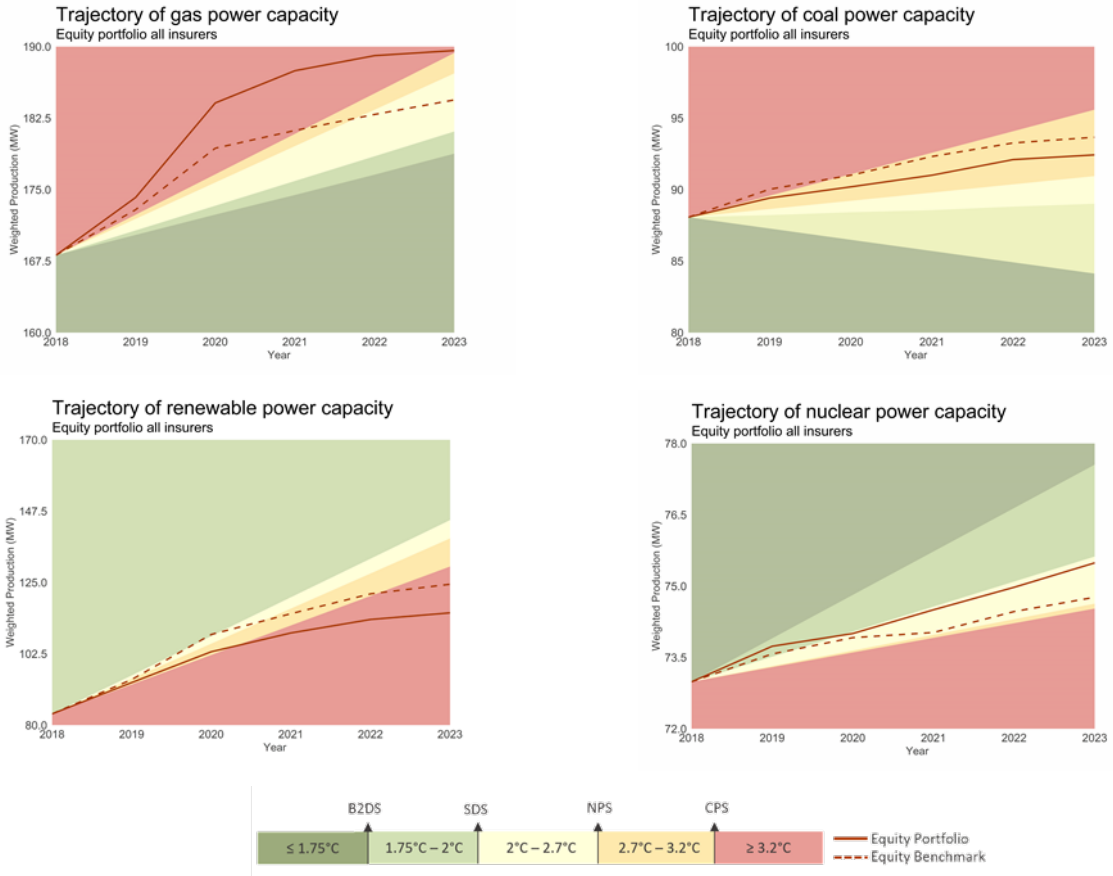
Regarding equity investments in power generation, coal power represents significant emissions of CO_2, and production would need to decline in any scenario limiting global warming to closer to 2 degrees. However, the production capacity implicit in the portfolio of insurers do seem to indicate an increase in capacity, which highlights a

[12] Regarding coal production, forward looking production data was not available at the time of preparation of this report. The chart is therefore based on an assumption that the companies' production follow a trajectory between CPS and NPS. In the 2020 exercise, forward looking data will be employed to complete this analysis. The chart will therefore change considerably.

[13] Oil & gas production profiles have a natural decline as well pressure drop with continued extraction. Additional cap ex is required to maintain well pressures and production. These production profiles illustrate a snap shot of the current disclosed cap ex plans. However, it is likely that the general decline in production would not be seen in a "high oil price world" as cap ex is continued to be deployed on a rolling basis.

potential transition risk. Alternative power generation that emits no or far less GHG such as renewable and nuclear[14] feature far more prominently in scenarios limiting global warming. As the two lower charts show, insurers have invested in capacity that is expected to expand over the next five years, but less than the global benchmark in renewables. Overall, however, large capacity investments in power generation based on fossil fuels do represent a transition risk for insurers.

Figure A2 - Alignment: Power generation – equity holdings

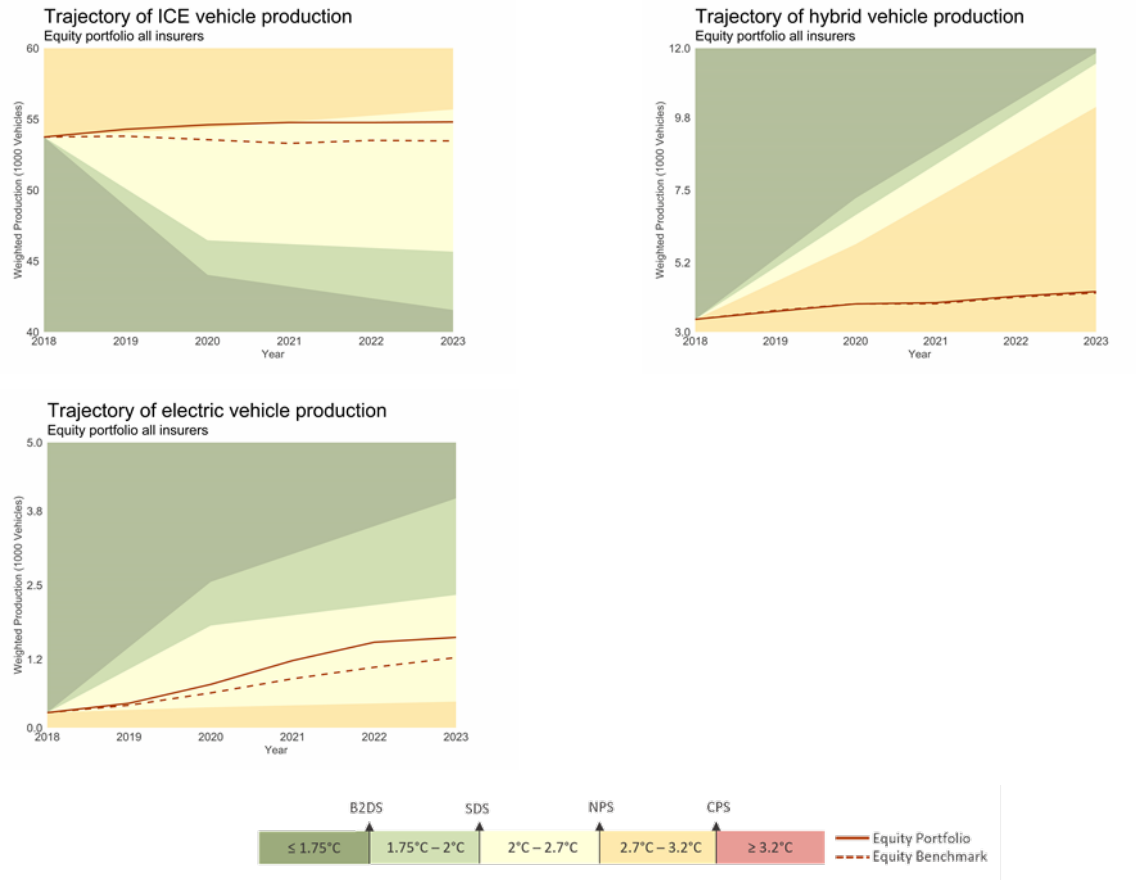


Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

Looking at equity holdings in light vehicle production, the implicit production in the current holdings of insurers is more consistent with a NPS-type scenario, with global warming around 2-3 degrees above pre-industrial levels. In particular, the companies that insurers invest in plan to produce too many internal combustion engine (ICE) cars (a reduction of 25-30% is foreseen in the next 5 years in scenarios closer to 2 degrees) and also do not plan to increase electric and hybrid vehicles fast enough. In terms of transition risks, however, it is likely that the production of the latter can be revamped once technology and cost improves in the next few years as large European automobile makers are investing heavily in technologies that offers alternatives to ICE. In terms of transition risks, this findings indicate that light vehicle production may not represent a major transition risk.

[14] Nuclear is here considered only based on the green-house gas emissions. Other drawbacks of nuclear (see e.g. the EU taxonomy for sustainable activities) such as large costs for new capacity, delays in construction, waste issues and lack of public support) means that nuclear power generation may still be subject to certain transition-linked risks. Those are, however, not considered here.

Figure A3 - Alignment: Light vehicle production – equity holdings



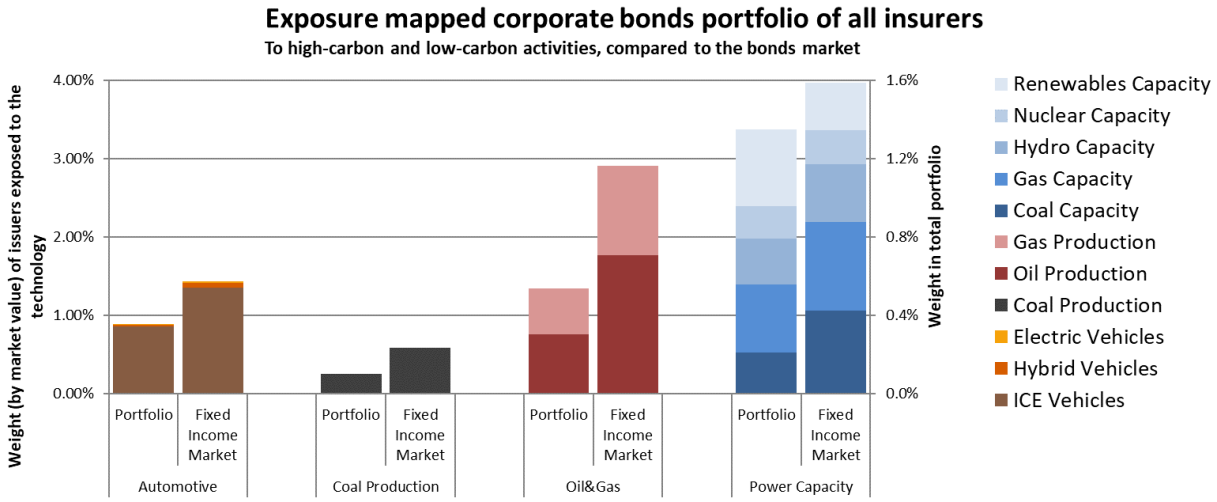
Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

3.4.3 Mapped corporate bond holdings

Similarly to equity holdings, corporate bond holdings (direct and through CIUs) were mapped (see Figure 2 for an indication of coverage compared to total portfolio) and compared to a global benchmark consisting of all listed bonds. Figure 6 shows the results. As with equity, the left-hand axis shows the percentage of the *mapped* bond investments in each of the technologies considered. This can be compared to the global benchmark. The right-hand axis translates the values into the share in the *total* portfolio of insurers to provide a measure of overall importance.

Contrary to the findings for equity, Figure 6 shows that the bond portfolio of insurers is clearly underweight in fossil-fuel production compared to the global benchmark. In terms of absolute exposures, around 36.8, 10.5, 55.8 and 148.2 billion euros were mapped as bond holdings in the automotive, coal, oil&gas and power sectors respectively.

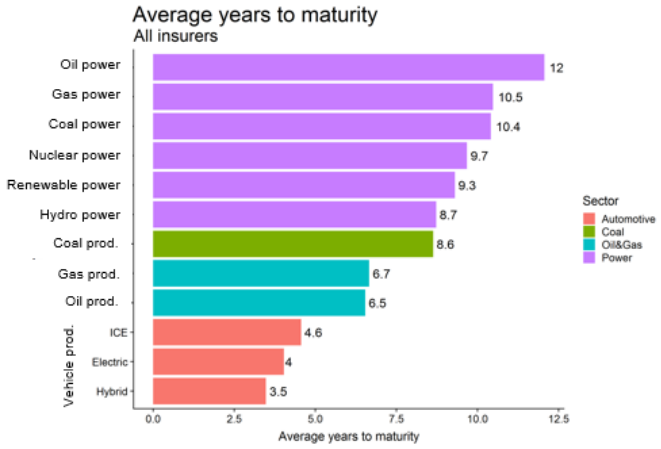
Figure 6: Exposures in the *mapped* corporate bond portfolio using the PACTA methodology compared to the global listed market



Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data). Preliminary data.

While the bond investments may be slightly underweight in fossil fuel production (and power generation), investment in power capacity is still substantial. Moreover, Figure 7 shows that the average years to maturity for these investments is longer than the average time to maturity of all bond investments (the overall time to maturity in the corporate bond portfolio of insurers in 2018 Q3 was around 9 years), indicating that policy changes in the coming years may have a non-negligible impact on the value of the investment portfolio.

Figure 7: Average years to maturity - bond portfolio



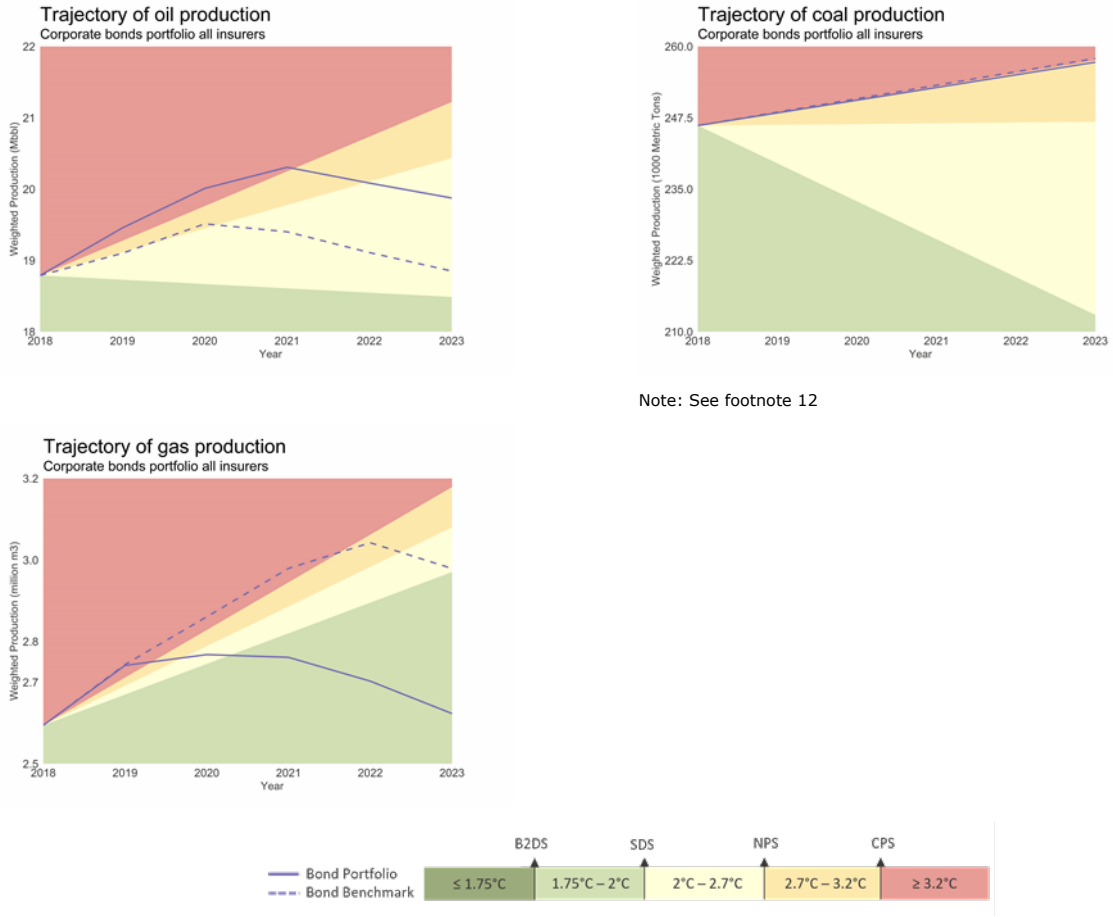
Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data). Preliminary data.

3.4.4 Mapped bond investments - Alignment to global warming scenarios[15]

Similarly to the equity portfolio, it is possible to assess the alignment of the bond portfolio to the different IEA scenarios. The value of a company's outstanding debt depends on its creditworthiness and therefore also on its profitability. Transition risks may therefore also be a potential concern for corporate bonds issued by carbon-intensive sectors.

Looking at the fossil fuel production, both the global benchmark and the investment of insurers already foresee a decline in oil production a few years from now. However, still with this decline, the gap between the portfolio and the required output in warming scenarios of less than 2 degrees are still substantial.

Figure A4 - Alignment: Fossil fuel production – bond holdings



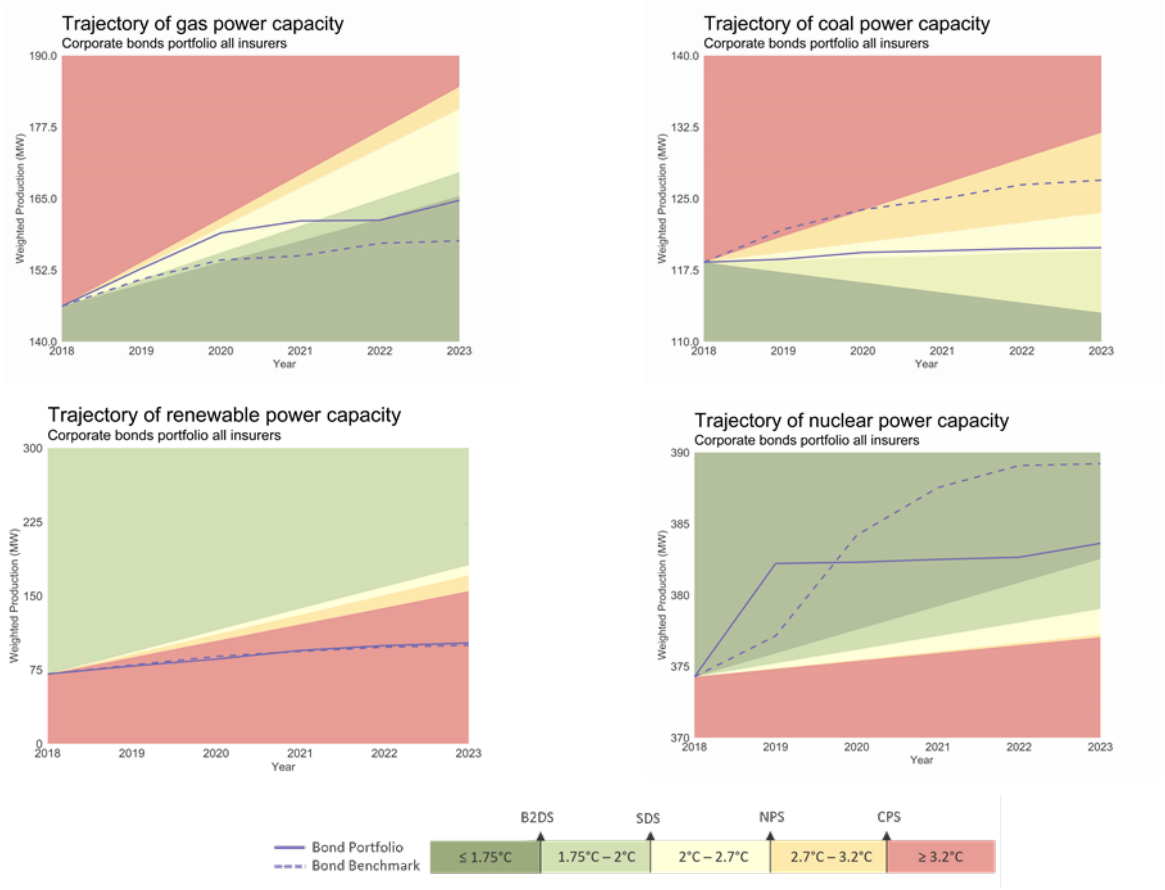
Note: See footnote 12

Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

Also concerning power generation, some capacity changes have been announced, but both the global portfolio and the holdings on insurers are far from aligned with a 2 degree scenario. Investments in renewable is also below what is required in a 2 degree scenario.

[15] Please refer to Box 2 on how to read the alignment charts

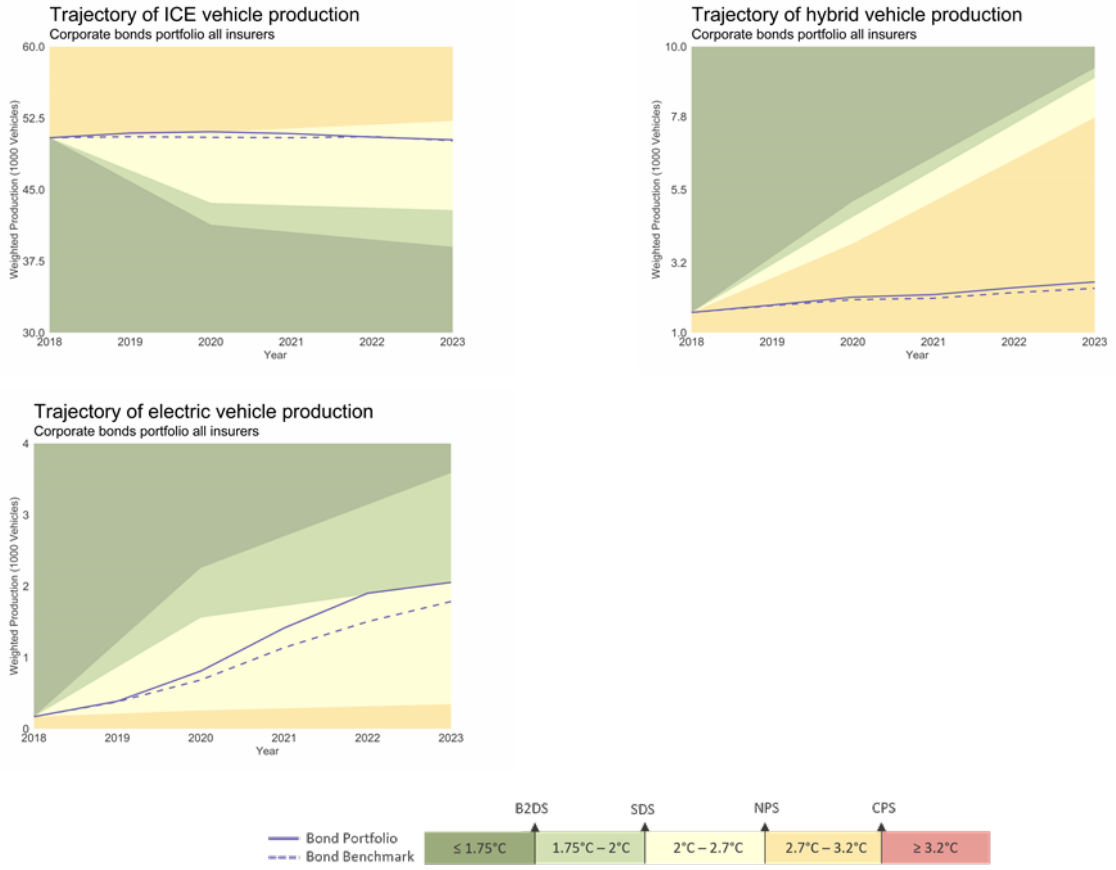
Figure A5 - Alignment: Power generation – bond holdings



Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

Corporate bond holdings in light vehicle production in Figure A6 indicates that overall bond holdings are somewhat better aligned with a "New Policies" (NPS)-type of scenario. Such scenarios include policies and targets announced by governments, but would also have average warming outcomes above 2 degrees.

Figure A6 - Alignment: Light vehicle production – bond holdings



Source: EIOPA and 2DII (Solo undertakings, incl. unit-linked. Q3 2018 data)

3.4.5 Preliminary conclusions and next steps

Preliminary findings identify potential transition risk in the investment portfolios of insurers. Overall, the physical production implicit in both equity and corporate bond holdings are generally not aligned with a 2 degree outcome. As climate risks are forward looking and characterised by deep uncertainty, and climate policies may be sudden and not fully anticipated and priced by investors[16], these findings may indicate a potential risk of re-pricing or even stranded assets in the portfolio of insurers.

However, when looking at only listed equity and bonds in key technologies, the analysis may suggest that transition risk could be limited due to high share of investments that may not be immediately climate relevant in its strictest context. High carbon assets accounts for only a limited share of the portfolio overall. But these preliminary results should be considered conservative estimates because not all corporate bonds and equity has been mapped. In particular, it is possible that some CIUs and unlisted equity and corporate bonds represent significant additional investments in climate-relevant sectors in general and in high-carbon sectors in particular. Moreover, there are clearly potential for second round effects for government bonds and financial bonds that have not been mapped to production data in this analysis. In addition, property investments may be directly vulnerable as well.

[16] Battiston et al, Climate Risk Assessment of the sovereign bonds portfolio of European insurers, EIOPA Financial Stability Report, December 2019

Finally, even with these clear restrictions in terms of coverage, there are still indications that some insurers may be particularly vulnerable. Preliminary analysis indicated that the 10 insurers with the highest share of high-carbon investments have investments in high-carbon assets at a minimum between 15% and 30% of the total portfolio, representing significant transition risk for vulnerable undertakings. In some cases, the amounts invested in high carbon assets are substantial as a share of excess of assets over liabilities.

Next steps

Based on the preliminary findings, EIOPA will carry out a more in-depth analysis using the same analytical framework, in cooperation with 2DII. In particular, this exercise will expand on the preliminary work by

- Use annually reported data which covers a larger share of the market
- Update datasets to increase coverage
- Include as assessment of investments in shipping, aviation, steel and cement
- Analyse undertaking- and business types (e.g. life (unit-linked and non-unit-linked) and non-life) separately
- Use a set of pricing models to assess the potential re-pricing in key transition scenarios for assets where sufficient data is available (see Box 3).

Box 3: Estimating potential re-pricing in key transition scenarios

The main sensitivity scenarios used for assets mapped to physical production will be based on a „late and sudden"-type scenario where policy action is taken to abruptly move to a 2 degree outcome. The sensitivity could be measured depending on a) when policy action is taken and b) how strong the policy measures are (i.e. how fast does the economy move to decarbonize).

Consistent with each scenario, EIOPA will aim to calculate a "stressed" value or price change for each of the identified assets and will assess the sensitives to price changes in the scenarios, based on an instantaneous shock.

For assets linked to physical production in the key technologies described is this chapter, shocks will be modelled in detail in cooperation with 2DII based on the following principles:

- For equity, the shocks will rely on the calculation of the expected change of net income and in turn the expected NPV of future dividends and market price of equity. In detail, this will follow Gordon's dividend discount model, i.e. the net present value of dividends, assuming the ratio dividends to net income stays constant in time and that change in volume of dividend moves proportionally with the change in expected net income. This value will be calculated in „late and sudden"-type transition scenario(s), which can be compared to the current market value (or to values in other scenarios).
- For corporate bonds, the re-pricing will also be based on on a calculation of the expected change of net income. This would be run though the Zmijewski default probability model. The re-evaluation of the bond value is then given by the NPV of the expected returns until maturity, weighted by the default probability.

This detailed assessment would require physical production to be linked to the IEA scenarios. For assets where this information is available, shocks will be based on

the required change in production necessary to meet the targets in a 2 degree scenario.

4 Element 2: General approach for other investments

Due to the data required, analysis with the highest level of detail will be carried out only on equity and bond holdings that have been mapped to physical production in a set of key technologies (see Element 1). This represents only a subset of the investment portfolio of insurers and therefore is not by itself sufficient to draw complete conclusions on the impact of climate-related transition risks in the insurance portfolio.

In addition, therefore, EIOPA will formulate extensions of the scenarios to cover other assets. For those assets, the analysis will rely on broader categories such as asset category, sector codes (NACE code), rating and maturity. It is foreseen that this could cover assets such as government bonds, property and potentially additional sectors. For consistency, also assets covered in Element 1 would be included in this analysis.

There is, however, currently no commonly agreed scenario or broadly accepted methodology yet available for this that cover e.g. property and government bonds. EIOPA will therefore draw on available research to the extent available. For instance, EIOPA expects to draw on research by Battiston and Monasterolo (2019)[17], the climate stress test framework of the Dutch Central Bank (DNB)[18], Bank of England and other relevant research[19]. The planned workshop is intended to support EIOPA in assessing the most viable approaches. Preliminary findings using Battiston and Monasterolo (2019) were published in the EIOPA Financial Stability Report in December 2019.[20]

5 Element 3: Survey to large insurers

EIOPA will also carry out a limited survey to large European insurers with the aim of collecting information about how they would see their business evolution subject to the impact of climate-change.

The survey will be mainly qualitative, but with some quantitative elements. In essence, insurers will be asked about the impact of climate change on selected metrics of their business.

Participants will be asked to assess impacts in general terms on e.g. predicted claims inflation due to worsening loss experience from climate events, predicted premium/rate increases and availability and exclusions from insurance. For this work, EIOPA aims to partner with external expertise on catastrophe events and climate change. It is foreseen that the survey will focus on key perils and geographical areas, including risks arising from effects of climate change on extreme percipitation, droughts and floods.

The survey will be addressed mainly to large groups active in EEA.[21] This would ensure a relevant market share for nat. cat. and other risks stemming from climate change.

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[17] Battiston, Stefano and Monasterolo, Irene, A Climate Risk Assessment of Sovereign Bonds' Portfolio (May 8, 2019). Available at SSRN: https://ssrn.com/abstract=3376218 or http://dx.doi.org/10.2139/ssrn.3376218

[18] Vermeulen, R., Schets, E., Lohuis, M., Kölbl, B., Jansen, D., Heeringa, W., 2018. An energy transition risk stress test for the financial system of the Netherlands. DNB Occasional Studies No 16-7.

[19] E.g. Görgen, Maximilian and Jacob, Andrea and Nerlinger, Martin and Riordan, Ryan and Rohleder, Martin and Wilkens, Marco, Carbon Risk (February 27, 2019 (available at SSRN: https://ssrn.com/abstract=2930897) and https://carima-project.de/wp-content/uploads/2019/08/CARIMA_Manual_english.pdf

[20] See https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/financial-stability-reports

[21] It is proposed to base the survey participants on the list of large groups and solos employed for the EIOPA Financial Stability Reporting. The exact scope will also depend on NCAs assessment of which groups and potentially solos that would be most relevant.