

Climate Change and Insurance Pricing

EIOPA, along with national supervisors, is currently working on a discussion paper about pricing in the context of climate change.

The paper is a follow-up work from the opinion on sustainability within Solvency II EIOPA published last year where EIOPA noted that a very common argument for undertakings not to include climate change-related risks in their pricing methodology, is the fact that many non-life insurance business have short term duration of contracts (typically 12-month contracts) which allow them to re-price contracts annually, which also means that they may be able to adjust the price if the risk changes.

In the discussion paper, EIOPA would like to look in more detail at the feasibility of repricing annually to adjust to adapt the price: e.g. there may be commercial or societal limits to repricing, and continuous increases in premium may over time lead to the risk of the industry crowding itself out of certain risks as well as the risk of an increasing protection gap.

EIOPA has posed the following questions to the Actuarial Association of Europe.

Response deadline is 4 July 2020

Questions to the AAE:

All responses are indicative. In practice, processes, models, governance and approaches will differ between undertakings, which operate in competition with each other. Actuarial considerations are just one factor influencing the choices made by undertakings.

1. Please shortly describe the pricing processes and existing organisational models set up by insurers. (Which are the departments involved in the pricing process? How do insurers take into account the reserving calculation to define prices? How is the actuarial function involved in the process?)

For non-life insurance, pricing for direct writers involves a combination of input from underwriters and actuaries.

Pricing needs to reflect

- The overall level of premium
- The relative risk premium of different policyholders (to avoid cross subsidies and anti-selection)
- Risk profile analysis
- The cost of reinsurance for large claims and extreme events.
- The cost of capital required to support the business
- Competitive pressures
- Time value of money (investment return) in some instances where claim payments are expected to take some time, e.g. lines of business involving third party liabilities

In addition, reinsurers' pricing will be influenced by the appetite of global capital providers. After a very severe market event, reinsurers' capital will be constrained, insurers' appetite for catastrophe protection can increase, and the cost of reinsurance will tend to increase. Conversely, more capital tends to be available after a run of good years, catastrophe demand can

decrease and reinsurance prices tend to reduce. This underwriting cycle is an important driver in overall premium levels at the customer level.

The Solvency II Actuarial Function is not typically involved directly in pricing, but provides high level input via the annual opinion on underwriting. Similarly, the Solvency II Technical Provisions and/or booked reserves are generally not directly taken into account in pricing, because Technical Provisions and booked reserves may not be assessed at a granular enough level for pricing purposes.

The process is similar for *life insurance*, with the following particular features, some of which may be company dependent.

Desired product features and charges often originate within a “commercial” area which will incorporate input from market, distribution channels and other relevant sources. Pricing may be carried out within this area or as a combined effort with Finance.

Generally, desired targets are set for profitability, e.g. present value of profits as percentage of premium and/or return on capital. Profitability may be assessed using a projection of future cash flows and requirements for capital and technical provisions based on a set of assumptions for all parameters which may require to be agreed with the Head of Actuarial Function. This will take into account Article 209 of the Solvency II Directive, which requires premiums for new business to be “sufficient, on reasonable actuarial assumptions, to enable life insurance undertakings to meet all their commitments and, in particular, to establish adequate technical provisions.”

Material risks are identified to ensure they are within risk appetite, with suitable escalation where significant additional risks (e.g. in relation to investment, mortality or other variables) or guarantees are involved.

Proposed reinsurance impacts on risk mitigation, cost of capital and cost of cover provided will be allowed for in profitability and risk analyses.

The impact of statutory accounting rules (local GAAP) and insurance contract law have to be considered as part of the process.

Sensitivity analysis is likely to be required where profitability is dependent on assumptions made, and robust back testing where appropriate.

Operational authorities may allow pricing flexibility for operational areas for certain levels of decision making, with sign off at senior levels required for more significant decisions, with reference to an Executive Pricing Committee or similar for material decisions. Risk functions will be represented on the senior committee. Material decisions will be reported to Executive Committee and potentially Board.

Underwriting and pricing policies may be maintained and reviewed frequently. Compliance with these policies would be required to be signed off by the senior executive responsible on a regular basis.

2. Which factors are considered to build the premium (to build the technical price, to capture commercial aspects (customer behaviour), market aspects (regulatory, market constraints), societal aspects...)?

Non-life

Pricing actuaries use technical pricing models to capture effects such as

- Expected cost of claims, in terms of frequency and severity for “attritional” and large claims;
- Claims inflation.
- Analysis by specific perils within the one policy (e.g. fire, theft, liability, wind, flood, hail etc...)
- Relative riskiness of different policyholders, including allowing for geo-coding
- Any regulatory restrictions (e.g. inability to charge males and females different rates even if the data shows a difference in risk)
- Likelihood of lapse/renewal at different price points
- Price elasticity and customer behaviour
- Variations in profit margins
- Cost of reinsurance and capital
- Expenses and investment returns
- Discounting of future cash flows

Actuarial analysis as set out here is one input to pricing decisions, and is overlaid with competitor analysis and underwriters’ expert judgement to arrive at the customer premium.

Life

Required parameters for which assumptions need to be set, together with factors considered, are detailed below.

Assumption	Considerations
Mortality/morbidity/longevity	Historic development of particular variable, allowing for statistical significance of company data, and taking account of available knowledge of market experience. Input from reinsurers may be valuable given their larger books and potentially deeper experience. Assumptions should also allow for projected future development of experience, taking into account variables impacting on lives in question.
Economic – interest rates, discount rates, investment return	Current interest rates, allowing in derivation for affected product of product specific features, e.g. in relation to investment portfolio composition (which may reflect estimates of returns available from sustainable investments where relevant).
Expenses	Most recent data available relating to expense of processing contracts (acquisition and maintenance), and available projections on how expense base will develop relative to book of business.

Mix of business	Mix of business of similar products, allowing for any market considerations
Cost of capital	Rate required to be earned on capital used, taking into account risk free rates and risk premium targeted

Charging structures created, guarantees provided and covers available will be based on assessment of market demand, suitability and, where appropriate, e.g. for investment products, value for money.

3. Looking at climate change, what factors are relevant for pricing of insurance products?

For *non-life insurance* the main relevant factors are:

- The fact that insurance is normally sold on a one-year basis, with the ability to reprice or change terms and conditions annually
- The impact of climate change tends to be on the frequency and severity of more extreme events rather than typical “attritional” claims experience
- The possibility of using cover exclusions or refusing to renew certain risks, e.g. flood prone properties
- Reinsurance coverages which are available

For *life insurance* the main relevant factors are:

- Impact of climate change on mortality and morbidity
- Investment outcomes available on sustainable v non-sustainable investments

4. How do undertakings incorporate climate change factors in pricing of the insurance products?

For *non-life insurance*:

- For direct writers, the cost of extreme events is typically covered by reinsurance, so direct writers would tend to factor in the increasing cost of reinsurance cover, rather than factoring in climate change effects directly
- Reinsurers analyse frequency and severity of climate-related risks and allow for the fact that historical data will not necessarily reflect experience over the next year. Therefore, reinsurance pricing would allow for trends in frequency and severity. In particular, more recent trends in the frequency of storms or floods are used to override longer term average frequency to arrive at more appropriate frequency for events
- Reinsurers’ analyses would also reflect the outputs from Catastrophe Risk models based on historical data, but adjusted to allow for climate effects. Catastrophe models are updated where there is sufficient evidence to justify an increased probability or severity of the event

For *life insurance*, reinsurance can play a significant part in the coverage provided to customers by direct writers. The cost of extreme events may also be covered by reinsurance. (Re)insurers will carry out sensitivities in profitability analysis (see above) to allow for climate change factors. These factors will also be addressed in risk analyses associated with pricing exercises.

5. Do you agree with the very common argument for undertakings not to include climate change-related risks in their pricing methodology, based on the possibility to re-price annually? Is this valid for non-life, health or for life contracts?

From a *Non-life (including health)* perspective, this is a valid argument from each individual insurer's point of view. It is true to say that prices cover only the next year and that longer-term trends such as climate change will be reflected gradually over time. In practice the effects of climate change are felt through higher reinsurance costs (often after a major event rather than gradually year-by-year) and the effects of climate change are mitigated by policy exclusions or refusing to renew cover for uninsurable risks.

Life contracts are often long term in nature, and climate change-related risks should generally be included in pricing methodology where this is the case.

6. Please add for each following factors a short description on how they are relevant for pricing and re-pricing process (any example provided is welcome) in practice:

- frequency of events,
- severity of events,
- location of events,
- insured losses related to events,
- mortality, morbidity, contract duration or competitive environment and
- expected scenarios.

For *non-life insurance* all of the above are relevant to technical actuarial pricing.

However, for climate-related risks it tends to be more difficult to make adjustments based on past data. Pricing actuaries and underwriters need to consider how relevant past data is for future risk periods. In particular, climate change can cause assumptions which may have been accurate in the past to become obsolete.

This is where catastrophe models can help. Catastrophe models are updated regularly with new sets of parameters that are calibrated based on the latest geological and atmospheric data, as well as past data. For this reason, catastrophe models are an essential tool to help quantify the possible impacts of climate change.

Frequency of events

In general, we expect extreme weather-related events to become more frequent as climate change continues. Note that the extreme weather can range from drought (causing wildfires and crop failure) to a higher probability of landfall hurricanes (causing widespread property damage and flooding). This means that analysing past frequency of these events may not help when estimating future frequency of events. From a pricing perspective, any manual adjustments to observed frequency should be done with care and be validated by the technical pricing and underwriting teams.

Pricing actuaries and underwriters will need to rely more heavily on catastrophe model outputs to ensure that the frequency assumptions are appropriate for the risk period. The number of risks modelled by catastrophe models are increasing year-on-year. This helps the pricing team distinguish between "modelled" risks and "un-modelled" risks. For un-modelled risks, there is greater uncertainty as to how relevant the past data is to estimate future frequency of events. When pricing modelled or un-modelled risks, the pricing team will need to sense check all

outputs and consider a range of scenarios to understand how sensitive the results are to changes in frequency of events.

Severity of events

More severe weather events can lead to more severe insured losses, depending on the location of events. The pricing team will need to consider scenarios where the severity of events is much worse than that observed historically to estimate the impact on rate setting.

Location of events

Developed countries have a higher value of insured property. Therefore, location is extremely important when pricing climate-exposed risks. If the frequency and severity of extreme weather events in developed countries increases, then we can expect material changes in the following:

- Number and location of risks the (re)insurer is willing to cover
- Tighter terms and conditions
- Higher deductibles
- Lower limits
- Increase in risks deemed uninsurable

Insured losses related to events

(Re)insurers will need to manage exposures very closely to avoid accumulations of risk in areas that might experience a higher frequency and severity of severe weather events. As climate change takes hold, we can expect insured losses to increase. This will directly affect the pricing of risks. Again, there will be uncertainty as to how relevant past data will be for future events, as well as second-order effects like demand surge. Reinsurers are expected to harden rates significantly as insured losses increase. There will be tighter terms and conditions and covers will be restricted to named perils only.

Multi-year contracts that are cat exposed will generally be avoided as reinsurers will be reluctant to commit to long term terms and conditions.

As rates harden, we could see more appetite for risk in the reinsurance market in the short-term. However, if more extreme weather-related events cause high insured losses in the medium term, we can expect this appetite to reduce. Reinsurers will likely place a cap on exposures in a particular location or for a particular peril.

Expected scenarios

Scenario modelling will be crucial for pricing teams to estimate how exposed they are to climate-related risks. Reinsurers will expect cedants to prepare realistic disaster scenarios and monitor their exposures very closely in the coming years.

For *life insurance*, the premium has to be high enough to establish adequate Technical Provisions. Neither discrimination is allowed nor a permanent subsidisation by other contracts. It is important to identify the group of envisaged policyholders. Underwriting procedures have to be

adequate in order to ensure an adequate treatment of the risk and a consistency with the parameters used for premium calculation.

Example Longevity: Female persons have a significant higher life expectancy compared to male persons. As gender is no longer allowed as a parameter in tariffing, it is necessary to assess the future composition of the new business and resulting portfolio and to reflect this in the premium (may depend on target groups of the salesforce). A permanent control is necessary to ensure the validity of these assumptions. In case of adverse deviation, an increase in technical provision is required.

7. Data on climate change relevant factors are important to determine the price of insurance coverage.

a. How often are data sources updated or amended in order to keep them up to date?

Data is continually updated insofar as practically possible.

Insurers tend over time to be able to analyse data more precisely, e.g. geo-coding analysis to identify high risk or uninsurable risks, or potential differentiation of mortality experience.

b. In case data is not available or does not fully reflect expected future developments, how is this taken into account in pricing/underwriting?

This can be allowed for by factoring in trends from the past or by employing expert judgement.

For reinsurers, data may be adjusted in-line with other market trends or benchmarked against similar portfolios. Reinsurers will have access to a catastrophe modelling team that model expected losses at different return periods for the exposures in question. Reinsurers are reluctant to price any cat covers without accurate exposure data. In Reinsurance, pricing may also consider stress and scenario modelling on various assumptions, with reference to policy limits / other contract features.

c. Is there a forward-looking element in pricing/underwriting, especially for contracts with a longer duration than 1 year?

Yes, there is a forward-looking element, even for 1-year contracts, and especially for multi-year contracts. Multi-year contracts are very much the exception for non-life insurance but, as covered above, not for life insurance.

Reinsurers which rely on proprietary cat modelling software will be taking account of new events each year as they are added to the software's library of events. If a modelling software does not explicitly assume a climate change trend, pricing may be adjusted to rely on more recent years.

d. On which data could forward-looking elements be based on (e.g. data collected from stress testing or catastrophe modelling)? Can such data can be provided by external sources? Any example is welcome (e.g. data provider, type of data).

We have covered this question only for non-life, where it appears particularly relevant. For direct writers the key consideration (relating to climate risks) is the current and likely future cost of reinsurance. This can change abruptly after large market losses.

For reinsurers, rates generally harden significantly after a large market loss. The main reasons are as follows:

- Less risk appetite amongst reinsurers after suffering losses so they ask for higher prices in the negotiation phase
- Less competition as some reinsurers might withdraw from the market completely
- Pricing tools and cat models have been updated and parameterised with the new large losses
- Brokers are influential in determining what the market rate for reinsurance is
- Increases in insurer appetite for catastrophe protection

Data is used from the cedants themselves, the cat modelling provider, other similar cedants/portfolios and market benchmarks. These all influence the forward-looking prices.

- e. Are there examples of (major) changes following an event or new research results?

We have covered this question only for non-life, where it appears particularly relevant.

2020 hurricane modelling predicts above average activity during the Atlantic hurricane season. This can be seen in significant Catastrophe Risk rate hardening for July renewals. Some estimates put rate increases in the region of 25% but we will know more when the contracts are incepted.

Additionally, some reinsurance programs have relatively loose wording around what is a natural peril. Many cedants are attempting to get recoveries from Covid-19-related claims on the basis that it is natural and it was not specifically excluded. In light of this we can expect much tighter wording in reinsurance Catastrophe Risk treaties and they will cover named perils only.

In 2011 the magnitude 9.0 Tohoku earthquake in Japan exceeded all loss expectations and triggered a series of tsunamis. RMS, the cat model provider, released a new model in 2018 for Japanese earthquakes and tsunamis. In terms of insured losses, the model assesses losses for buildings, business interruption, contents, commercial losses, builder's risk, tsunami inundation, fire following earthquake, liquefaction, and landslides. This model update helps reinsurers better understand the risks and potential for accumulations in the Japanese book.

8. One main argument often used to not actively include climate change in underwriting/pricing is the short duration of P&C contracts that allows adjusting prices relatively easy for the next period.
- a. Is there evidence for such price adjustments in light of climate change (e.g. after flood events)? Any example provided is welcome.

In the reinsurance space there is a lot of evidence of hardening of rates in light of more extreme weather events. 2017 was a particularly expensive year for many reinsurers as hurricanes Harvey, Irma, and Maria caused around US\$92bn of insured loss. In the same year, Californian wildfires caused about US\$14bn of insured losses.

Reinsurance rates increased in 2018 and 2019 in response to these market losses. In the aftermath of the wildfires, many insurers imposed strict limits on the regions in California they can write business.

- b. Have you already identified specific LoBs that are more impacted by climate change in the near future?

Property risks (home and commercial), motor damage risks are the first that come to mind. However, there can be impacts much more widely.

Agriculture insurance and reinsurance are very quickly impacted by any change in weather / climate. In particular, parametric (re)insurance offers cover linked directly to weather data. Agriculture is also a line of business where insurers / reinsurers may have data going back several decades. When pricing, modellers are already having to consider the validity of the full history of data when determining return periods of extreme events.

- c. Are there obstacles in adjusting prices for insurance coverage such as a competitive environment or the potential loss of business? How are competition and profit margins taken into account when deciding on the pricing?

Competition and anti-selection are key factors in pricing.

Insurers need to avoid being left with the bad risks and therefore need to ensure that their pricing and policy wordings and exclusions are in line with their competitors. Any insurers which simply accepted all the risks that others were unwilling to cover would not survive.

In addition insurers need to manage exposure and would not aim to be over-exposed to a particular location. As their exposure increases the price charged for incremental risks may increase. On the other hand, the price for a similar risk in a different location may reduce to ensure they have sufficient geographical diversification.

- d. If prices can be adjusted, are those adjusted each and every time data suggest or only if certain thresholds are breached (e.g. profitability drops below a certain point)?

There is no hard and fast rule. Each insurer/reinsurer has its own "risk appetite" which would be the framework in which such decisions are made.

9. What are potential implications of climate risks for pricing processes, considering the forward-looking nature of climate change impacts? (e.g. higher risk premiums in future years due to physical climate impacts; stop offering a material share of contracts in a specific climate-change scenario)

Key risks are

- (i) a growing level of insurance exclusions as certain risks become effectively uninsurable, or prohibitively expensive for the policyholder, and
- (ii) the requirement for some form of insurance to deal with the worst hitting aspects of systemic risk events, e.g. pandemics.

These cannot be addressed in isolation by (re)insurers, and need a market/regulatory/societal response.

Another consideration is the risk of long-tail latent claims related to climate change to Non-Life insurers. These could arise, for example, where coal based energy producers might be sued in the future for what they do today. Insurers could face these additional claims long after the policy cover period has expired (similar to asbestosis) – and without any recourse to additional premiums.

10. Do you have ideas or concrete examples how insurer could limit the impact of climate change on the premium (e.g. through contract design or engaging with policyholders)?

This is a difficult problem!

The overall aim is to provide the correct incentives to policyholders so that their aggregate behaviour would promote climate change benefits. However, these incentives will not necessarily change the insurance risk at the individual customer level.

For example, if a home insurer were (say) to offer lower premium rates to policyholders with high levels of home insulation, and conversely to charge higher premiums to policyholders with lower levels of insulation, this could cause some perverse effects:

- Claims levels would likely be unaffected.
- Customers with higher premiums / lower levels of insulation would select to use a different “less responsible” insurer.
- The “responsible” insurer would then be left with those customers with high levels of insulation but would make a loss, as they had charged a lower premium, but had not maintained the cross subsidy expected from the other customers.

Conclusion: it is difficult for insurers acting in isolation in a competitive market to incentivise climate friendly customer behaviours.

Another example of perverse incentives possible with of risk pools. For example, a government may create a flood-risk pool which provides insurance to otherwise uninsurable property risks. The pool would be funded by a levy on property insurance. The existence of pool insurance now provides an incentive for further building on flood plains, which is the opposite of what was intended.