Adjusting the pricing process to account for the climate change risk

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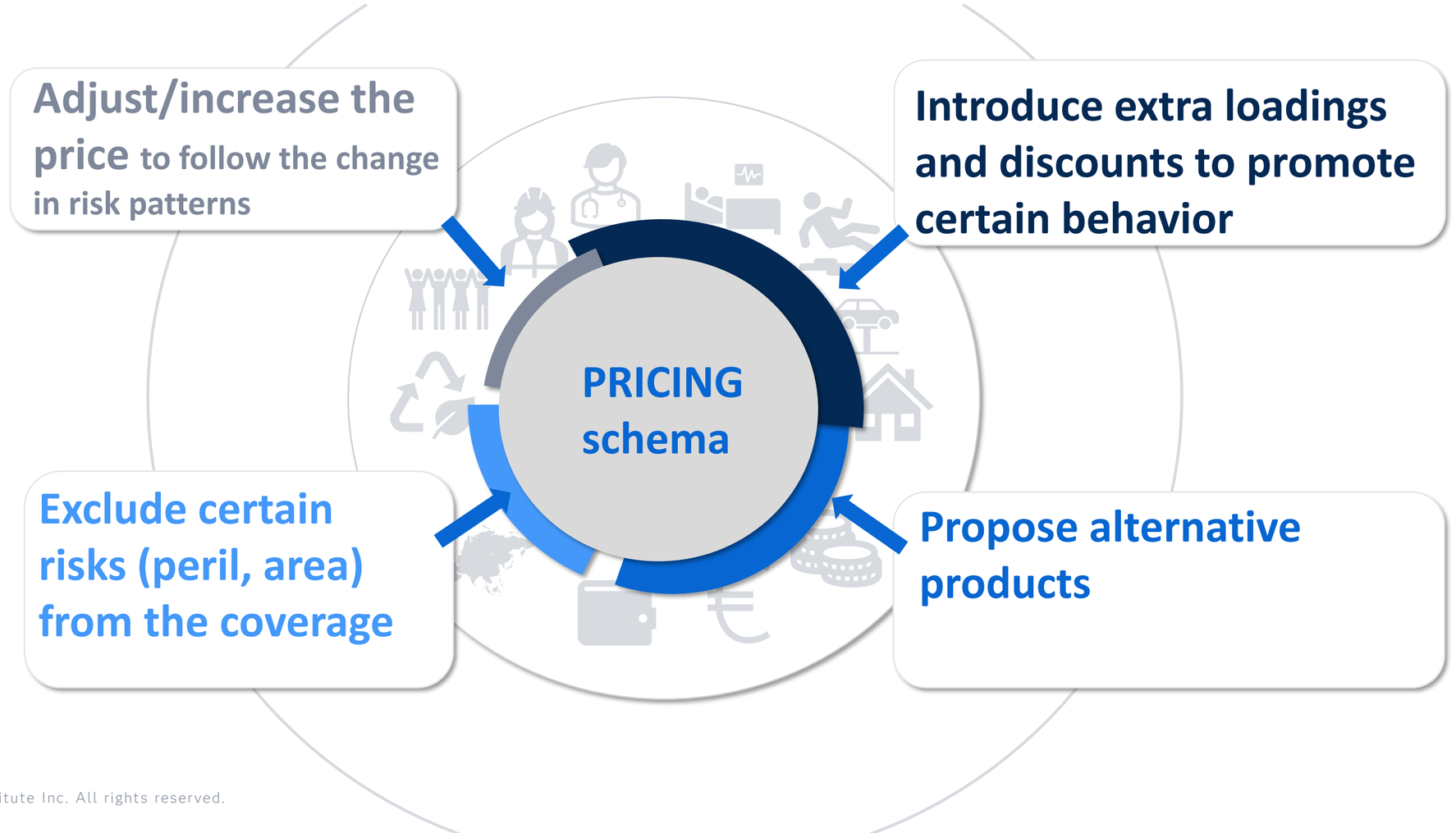
Adjusting the prices to make allowance for the climate change impacts



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Adjusting the pricing process to account for climate change risk

01 Data preparation & exploration

- Geographical and extreme events data exploration
- Use of IoT data
- Mapping on the insured portfolio
- Supplementing the information about the insured objects based on external databases, including unstructured ones
- Correlation between climate change risks
- Forecasting of the risk indicators

More data, analytics

02 Modeling/ Technical price

- Frequency and severity models based on the historical data might be not enough for estimation of future events (they are expected to become more frequent and more severe).
- Some manual adjustments might be required. They should be based on results from explorative analysis, their impact tested and the final version should be validated and approved by dedicated personas.
- Dedicated models for parametric Insurance

New variables, New models, loadings

03 Testing

- Analysis of the impact of adjustments on the portfolio and its profitability
- Scenarios run to understand how sensitive the results are to changes in frequency and severity of events (incl. manual adjustments)

Scenario based tests

04 Commercial price

- Commercial price, in addition to standard factors, may include
  - climate mitigation objectives
  - long-term sustainability considerations
- It may mean:
  - Exclusion rules
  - Discounts for adequate risk mitigation features of insured objects
  - Extra chargé for climate change risk

Definition of rules

05 Testing

- Testing the impact of the introduction of climate change related exclusion and discounting rules

Impact tests

06 Publish

- After publishing final pricing schema, the portfolio is monitored:
- Benchmarking– using metrics like loss ratio based on:
  - Technical premium,
  - individual non-subsidized premium,
  - official premium
  - Realized GWP
- Analysis of the portfolio from the perspective of formulated sustainability strategy/objectives

Benchmarking monitoring

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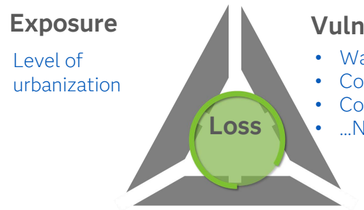
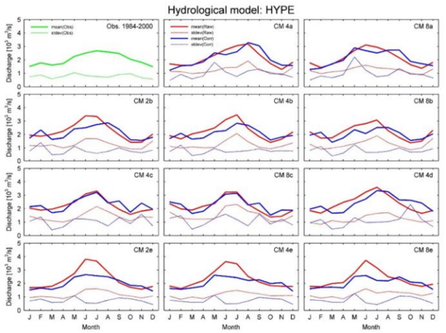
01 Data - challenges

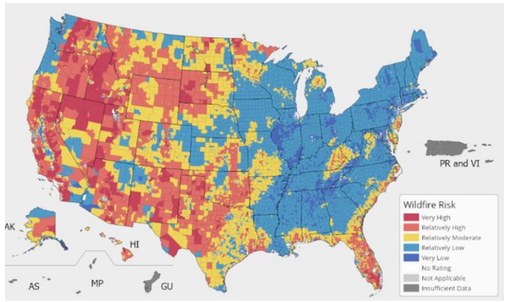
- **New data**
- **Use of IoT data**
- **Mapping on the insured portfolio**
- **Supplementing the knowledge about the insured objects based also on unstructured information**



From: Geo,ca – flood susceptibility index



From: copernicu.eu – river discharge data



From: US FEMA wildfire index

How to find useful input data?

How to extract the yet unaccounted impact?

How to incorporate them in the pricing process?

- adding new variables to the model
- separate extreme events model
- definition of manual adjustment for the segment
- individualized pricing
- additional exclusions or discounts
- input for parametric insurance

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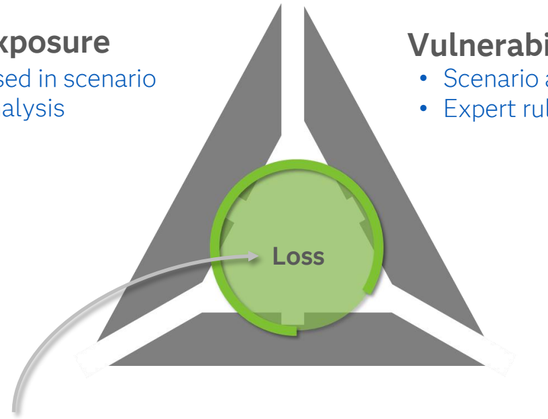
02, 04 Models - adjustments



Exposure
Used in scenario analysis

Vulnerability
- Scenario analysis
- Expert rules

Also – inflation factor/ loading on the loss estimate

Hazard
Mixture of:
- External or internal cat models (deterministic or stochastic)
- Expert judgement

Commercial price
Gross Premium

Adjustments being the result of considering:
- Adaptation to climate change
- Climate risk mitigation objectives
- Long-term sustainability

These objectives and considerations may be applied using:
- set of **exclusions rules** (negative screening)
- set of **discounts**:
- increase of **deductibles** or **decrease of limits**

Technical price
Pure Premium

To reflect higher risk of exposure to extreme events driven by climate change:
- **new** [frequency and severity] **models** may be created which include additional variables (for instance geospatial data)
- Incorporation of **adjustments** based on **external models**
- **Manual adjustment** to reflect the increased risks which are not accounted yet.

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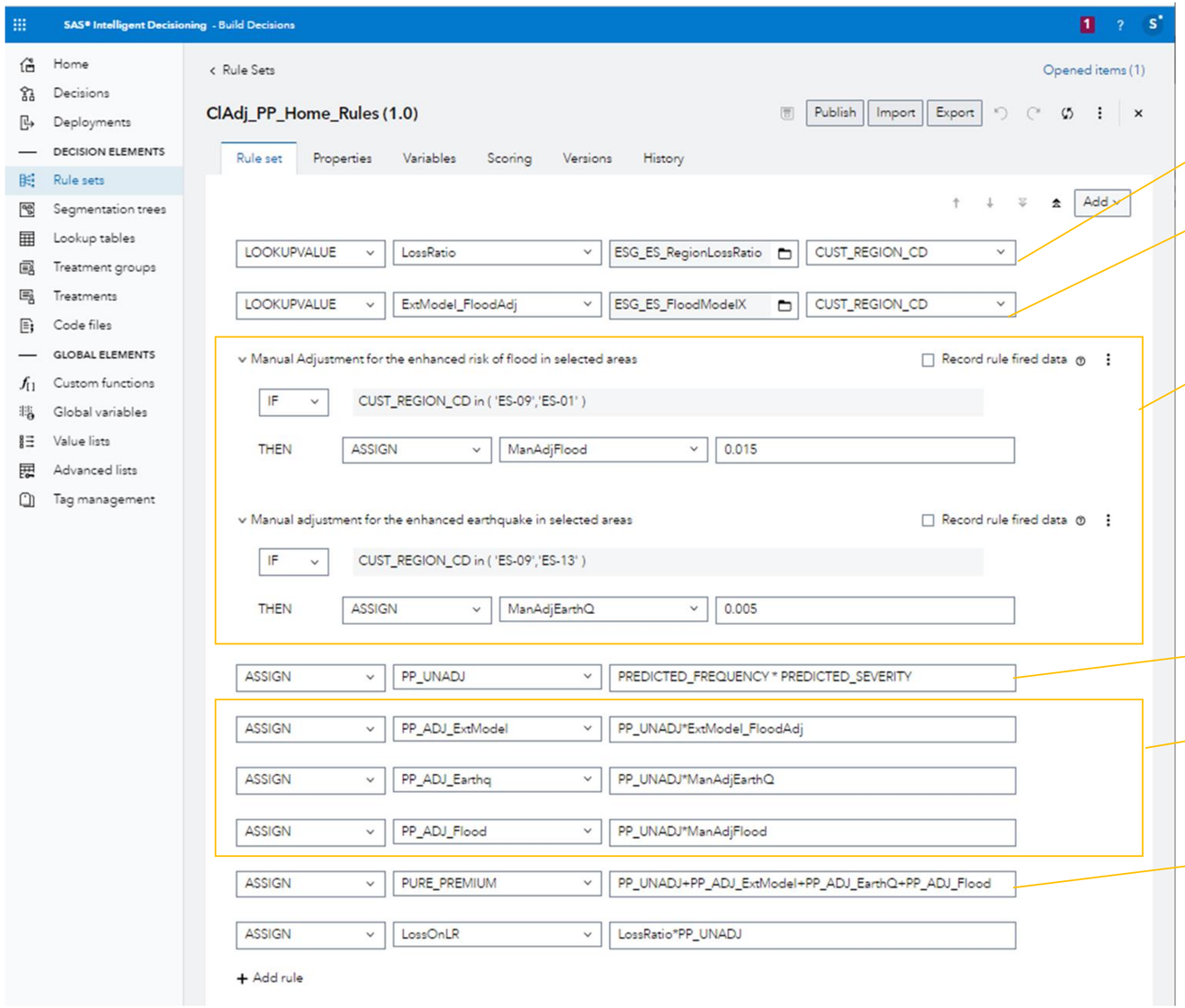
02 Technical price - adjustments



Population of Loss ratio by line of business

Population of loadings from the external model /data set being the results of external model;

In this example it is assumed that extra loading is defined for each region

Rules showing how manual adjustment loadings can be defined to capture the risks that were not sufficiently accounted in the base pricing model and in the external model

Unadjusted Pure Premium

All unit adjustments to pure premium (resulting from external model and manual adjustments)

Final Pure Premium

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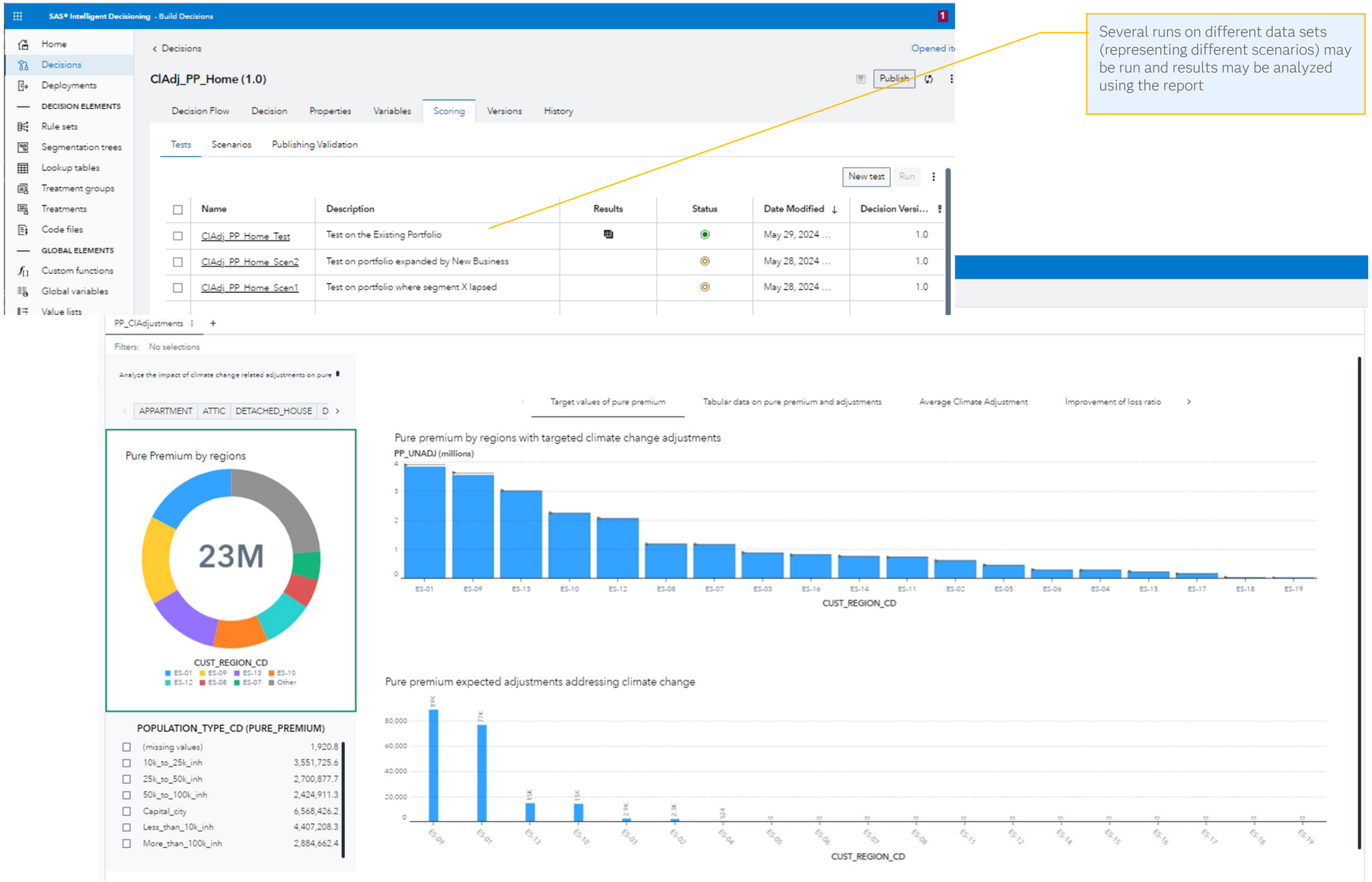
03 Testing – examples of analysis

It is recommended to do **before introducing a new pricing schema**:

- analysis of what is the **impact** of the adjustments by **basic cross sections** (lobs, channels, regions) in all **important metrics** (GWP, combined ratio..)
- Analysis could be done under different **scenarios of adjustments** (no adjustments, full adjustments starting with next year, gradual adjustments following some pattern)
- Scenarios could be further expanded to **include** specific **extreme events**
- They should also include the **impact of changes in price on the retention** of portfolio



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03 Testing – examples of analysis

Detailed information about the additional revenue from adjusting the pure premium, by type of adjustment and region

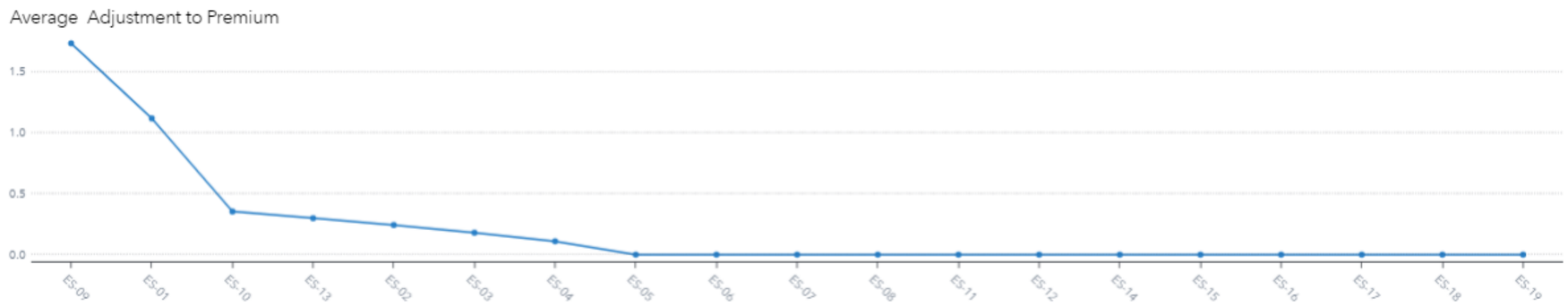
‹ Target values of pure premium | Tabular data on pure premium and adjustments | Average Climate Adjustment | Improvement of loss ratio ›

CUST_REGION_CD	PP_UNADJ	CL_Adj	PP_ADJ_ExtModel	PP_ADJ_Earthq	PP_ADJ_Flood	PURE_PREMIUM
Total	22,338,034.80	201,697.75	58,617.45	32,689.95	110,390.36	22,539,732.55
ES-09	3,537,178.34	89,136.89	18,393.33	17,685.89	53,057.68	3,626,315.23
ES-01	3,822,178.76	77,208.01	19,875.33	0.00	57,332.68	3,899,386.77
ES-13	3,000,811.77	15,004.06	0.00	15,004.06	0.00	3,015,815.83
ES-10	2,237,970.84	14,546.81	14,546.81	0.00	0.00	2,252,517.65
ES-03	889,793.81	2,936.32	2,936.32	0.00	0.00	892,730.13
ES-02	616,144.23	2,341.35	2,341.35	0.00	0.00	618,485.58
ES-04	291,283.50	524.31	524.31	0.00	0.00	291,807.81
ES-05	459,950.03	0.00	0.00	0.00	0.00	459,950.03
ES-06	296,230.46	0.00	0.00	0.00	0.00	296,230.46
ES-07	1,168,557.34	0.00	0.00	0.00	0.00	1,168,557.34

Analysis of the average premium increase on the level of policy, by region.

Might be used to analyze whether such adjustment may incline policyholders to resign from insurance
Verification against the presumed level of price affordability

‹ Target values of pure premium | Tabular data on pure premium and adjustments | Average Climate Adjustment | Improvement of loss ratio ›



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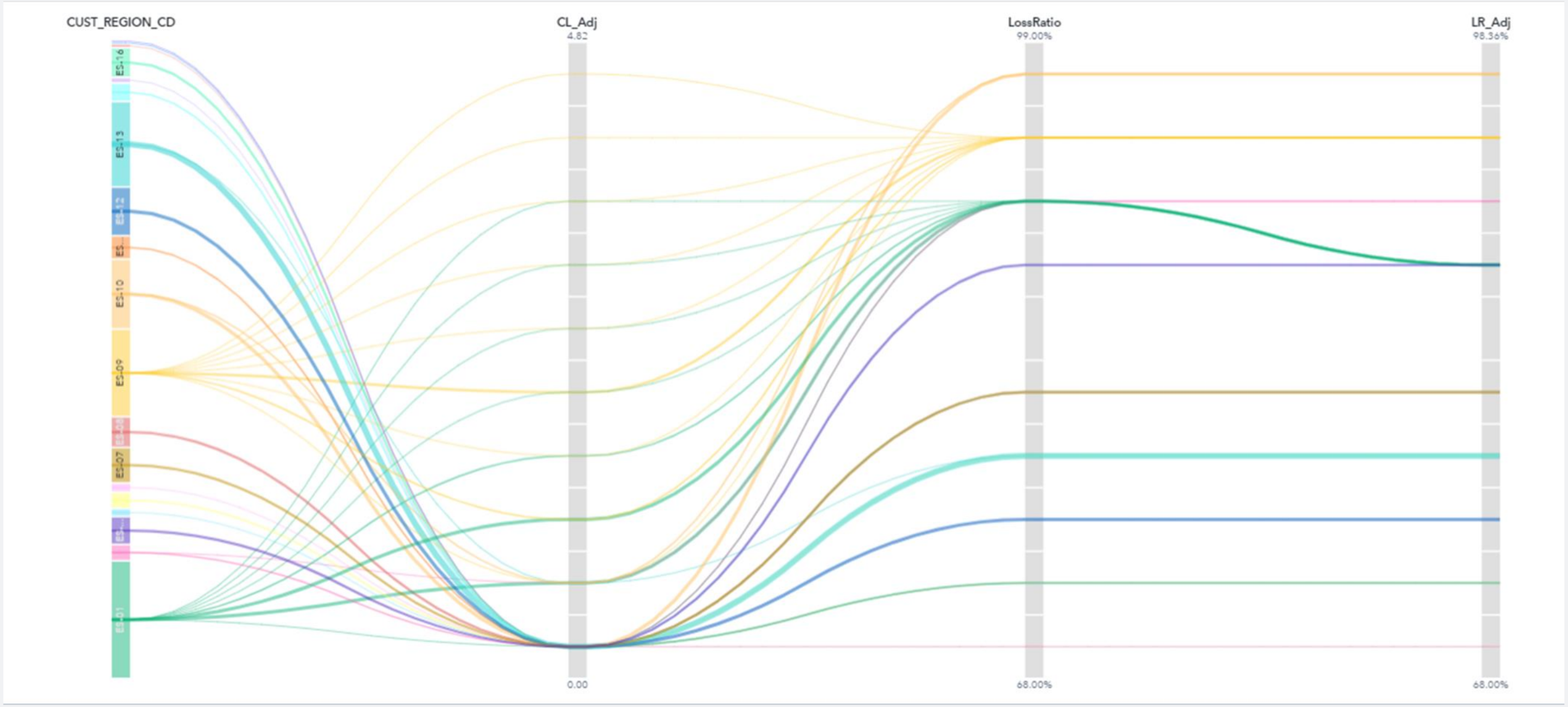
03 Testing - examples of analysis

Analysis of the impact of adjustment on the loss ratio, by region

Report shows the range of adjustments within given region and improvement of loss ratio (from “historical” LossRatio to the one calculated based on adjusted premium)



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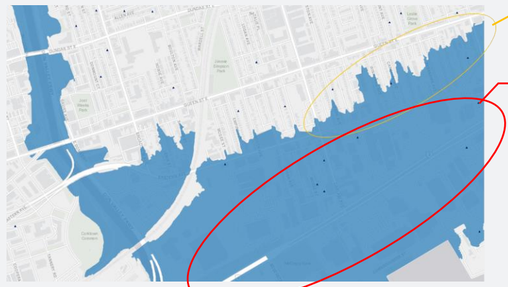
04 Exclusions, parametric insurance

Different proposals depending on the flood hazard maps



Increased risk – extra **loading** on Pure Premium

High risk – **parametric** insurance, instead of classical indemnity-based insurance.

Different approach to pricing

Traditional insurance

Commercial price

Constructed based on the Technical price, with extra [expense, risk margin..] loadings and [marketing, strategic..] discounts

Technical price

TP = Frequency x Severity

Derived by building models of **frequency** and **severity** of insured events based on historical claims data.
In most of the cases defined for segments classified by set of discriminative variables

.

Typical models are **GLM** with:
- Frequency – Poisson, binomial, negative binomial, geometric distribution
- Severity – exponential, gamma, Weibull, Pareto and the lognormal distribution

Parametric insurance

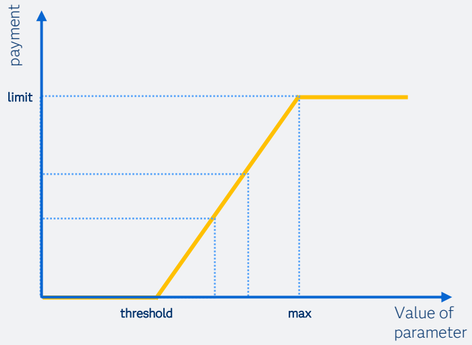
Payout structure

The payout pattern and limit is defined together with the client and the broker, taking into account historical losses and cliams as well as risk engineering rpeorts

Technical price

TP = PO (PF)
Where :
- PF - is a **Process Function**, which models the evolution and variations of the parameter underlying the Insurance; typically:
  - **Markov Chains**, including seasonality and long-term trends
  - **Poisson models** for duration-related parameters
  - **Bayesian spatial quantile regression** for earthquake, agricultural cover (crop yield)
- PO – is **Payout function**, which reflects the sensitivity of the insured against the parameter
  - It needs to be calibrated depending on the characteristic of the insured
  - Min and max of the index, together with the payment limit need to be defined

Payout function



It should reflect the sensitivity of the insured to the parameter

Examples

Example of „cat in the box" for cyclones, for 50km radius, with limit of 5M USD

Tropical cyclone category	wind speed	% of limit	payout (M USD)
1 tropical cyclone	63-88 km/h	0%	0
2 tropical cyclone	89-117 km/h	0%	0
3 severe tropical cyclone	118-159 km/h	25%	1.25
4 severe tropical cyclone	160-199km/h	50%	2.5
5 severe tropical cyclone	> 200 km/h	100%	5

Examples of „cat in the box" for earthquakes

Magnitude	Payout	Frequency
[5,6]	20%	0.1523
[6, 7]	60%	0.0229
[7, 8]	80%	0.0012
>8	100%	0

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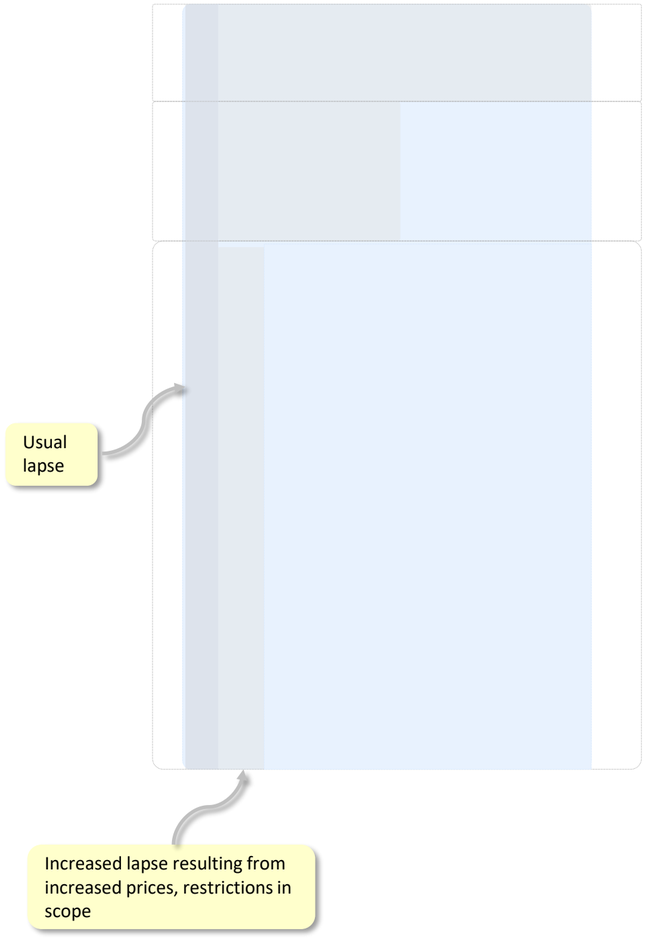
Impact of climate change adjustments on portfolio

Portfolio

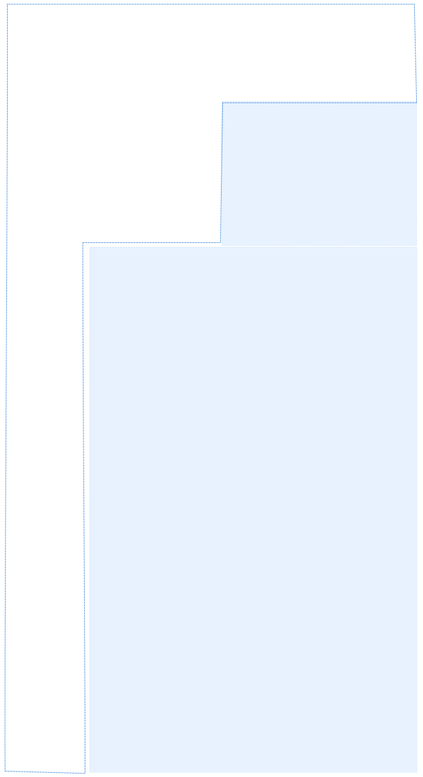


Unwanted risk
- Loss ratio exceeding the thresholds
- Exposure in high profile areas
- → Refuse to insure

Closely monitored risk
- Loss ratio near the thresholds
- Analysis of concentration risk
- Climate chng related dangerous areas
- --> Extra loadings, alternative products

Impact on remaining portfolio
- Average price increased
- Changes in the scope of coverage (restrictions, higher deductibles, lower limits..)

Portfolio impacted by adjustments



The process needs to be run in a reasonable manner to keep the portfolio a profitable and sustainable one

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THANK YOU

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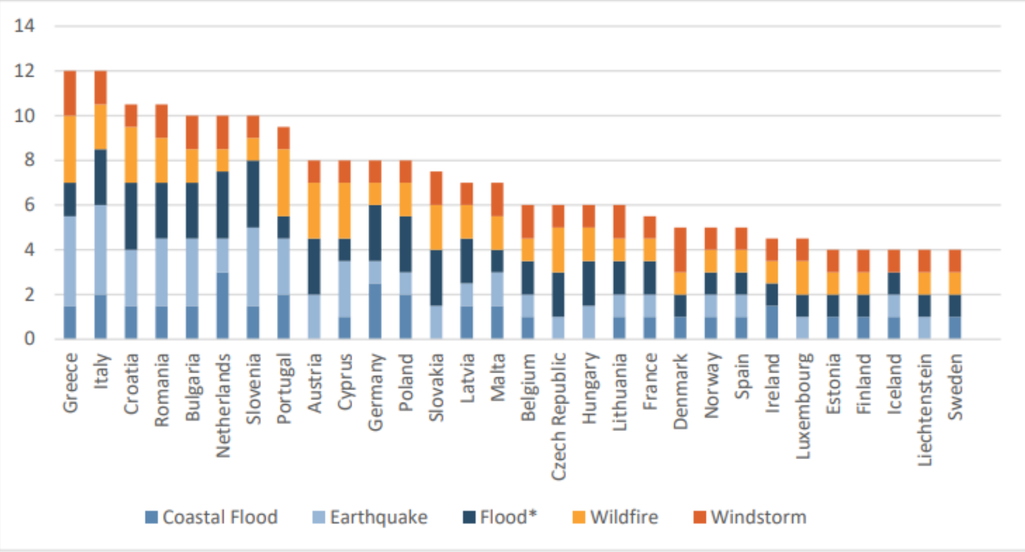
Portfolio Management

How to recover/replace the missing portfolio?

Protection gap

Current (forward looking) assessment



EU, Oct2023 - [THE DASHBOARD ON INSURANCE PROTECTION GAP FOR NATURAL CATASTROPHES IN A NUTSHELL]

New types of products

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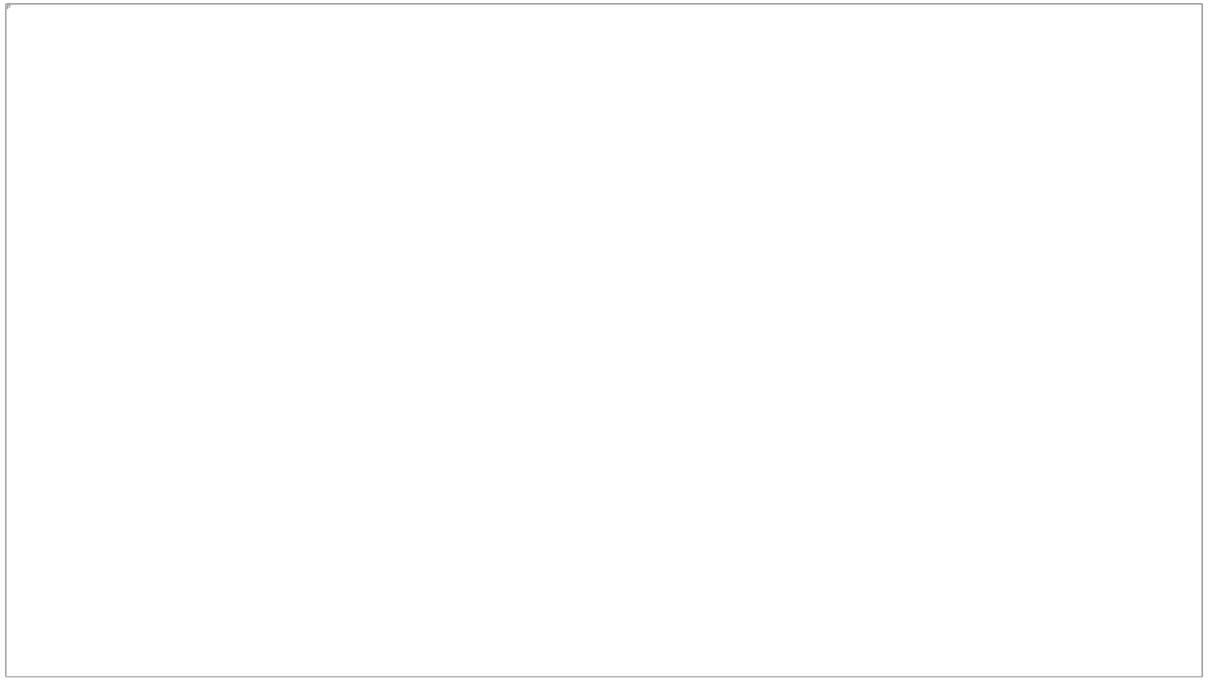
Portfolio Management

How to ensure the growth as well?

New covers

- Green buildings and equipment
- Renewables,
- Mileage-based Vehicle Insurance
- Microinsurance
- Low-emission vehicles
- Carbon offsets
- Fortified homes
- ..

Embedded insurance



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