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The European knowledge centre for actuaries

German Industry Standard for Category 4 PRIIPs

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Agenda

1. **PRIIPs: General Introduction**
2. German regulatory Framework: Existing regulatory and Industry Standards
3. The Industry Standard 1: Capital Market Model
4. The Industry Standard 2: Stochastic Simulation
5. The Industry Standard 3: Collecting PRIIP Information from Simulation Results
6. Comments and Outlook

PRIIPs: General Introduction

Quick Overview on PRIIP

- **Regulation** by the European Comission – no national law-making process
- Affects the whole **EEA**
- Regulates PRIIPs – **p**ackaged **r**etail **i**nvestment and **i**nsurance-based **p**roducts
- For our industry: IBIP - **I**nsurance **b**ased **i**nvestment **p**roducts
- Motivated by the global financial crisis of 2008
- Taking effect from **1 January 2018**

Note: The regulation does not target the insurance sector specifically, but the whole retail financial product market

PRIIPs: General Introduction

The KID

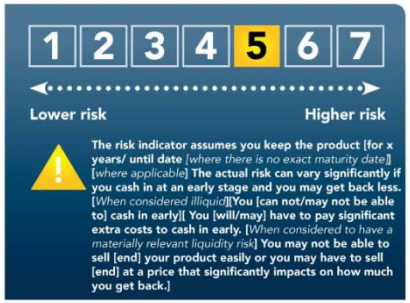
- PRIIP introduces the „Key Information Document" – the KID:
  - standardised consumer information
  - informs about **products**, not **contracts**
  - (as) **simple language** (as possible)
  - 3 pages **– short**

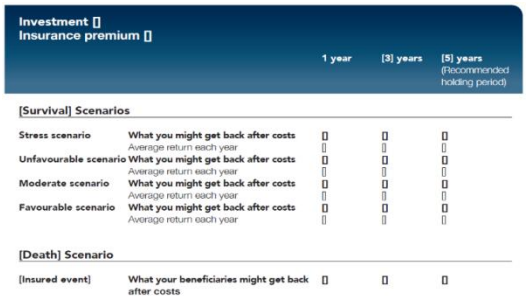
  - **investment** perspective: How does the product fare as an investment option?

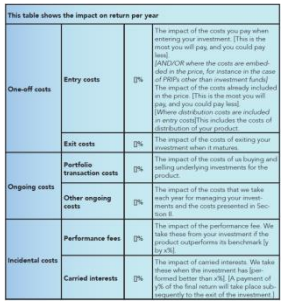
  - quantitative information about:
    - risk
    - performance
    - costs

PRIIPs: General Introduction

The scope







- The PRIIP KID introduces a universal language over several industries – and offers quantitative information in a uniform layout
- **This information will be compared.** Consumers are expected to compare between very different products when making investment choices – i.e. buying options on stock and buying an insurance product
- Given the very diverse nature of available PRIIPs, the question of how to calculate and present figures is highly non-trivial

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PRIIPs: General Introduction

Product Categories:

- **Category 1:** New PRIIPs without a proxy, products that offer leverage.
- **Category 2:** PRIIPs with a price that is calculated as a constant multiple of the price of a market-traded asset
- **Category 3:** PRIIPs with a price that based on the price of a market-traded asset, but not with a constant multiple
- **Category 4:**

> Category 4 covers PRIIPs whose values depend in part on factors not observed in the market, including insurance-based PRIIPs which distribute a portion of the PRIIP manufacturer's profits to retail investors.

PRIIPs: General Introduction

Calculation method for Category 4

In order to calculate market risk, the manufacturer must obey:

> 27. The component of the PRIIP that depends wholly or partly on a factor or factors that are unobserved in the market shall follow robust and well recognised industry and regulatory standards for determining relevant expectations as to the future contribution of these factors and the uncertainty that may exist in respect of that contribution. Where the component is not wholly dependent on a factor that is

This is not „comply or explain", rather „comply **and** explain".

Note: the german industry standard is mandated by the RTS, but it is not unique.

Remark: Even though the RTS speak of components, the german standard assumes 1 component only.

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German framework

The typical german retail IBIP client

- avoids high or medium risk
- is used to relatively high garuanteed returns
- expects profit-sharing
- is cost-sensitive
- thinks of IBIPs in terms of pension contributions

The typical german retail IBIP

- includes garuantees of capital or even profits at the end of the savings period
- is primarily a pension product
- is a very long-term product when compared to other PRIIPs
- For legal reasons always provides insurance cover – though not necessarily during the savings period

German framework

Profit sharing in Germany

Insurance clients benefit from the following minimum shares of profits:

- Capital Market gains: **At least 90 %** of total profits earned – and no less than the garuanteed annual return where applicable
- Biometric risk profits: **At least 90 %** of total profits
- Costs: **At least 50 %** of unused costs

The most important assets of retail clients pensions savings are precisely the assets of the insurance company

German framework

Existing Industry Standards and Regulatory Standards

Historically, the german insurance industry and regulators have implemented various stochastic simulation models. Notable examples include:

- **Volatium** – standard adopted by parts of the industry with the goal to bettter assess relative risk of german IBIPs
- **PIA** – standard used by regulators to simulate state-sponsored pension products
- **Private institutions** offering stochastic product testing

German framework

Why is simulation preferred?

Three main motives drive the reasoning for stochastic simulations of products

- **very long-term investment** products (30+ years savings period)
- Past performance is either **not available** or **too short** in scope
- interest-rates show **mean reversion**

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The Industry Standard 1: Capital Market Model

The capital market model of the industry standard is a two-asset model. The riskless asset is assumed to be zerobonds with yields according to a yield curve.

zero-bonds

The risky asset is a „standard stock" with a standard volatility and a standard additional return compared to zerobonds.

standard stock

Both assets are assumed to be stochastic in nature. Therefore, the future time evolution of both bonds and stocks follows stochastic processes – one for the short-rate, and one for the stock prices

The Industry Standard 1: Capital Market Model

Real assets need to be modelled as one of the two model assets

The current standard uses the following exemplary weights:

Asset class	Bond weight	Stock weight
Bonds	100.00 %	0.00 %
Stocks	0.00 %	100.00 %
Real Estate Germany	9.93 %	90.07 %
Real Estate International	55.00 %	45.00 %
Bonds Emerging Markets	33.50 %	66.50 %

The Industry Standard 1: Capital Market Model

Short-rate

The interest rate model definies a risk-neutral short-rate via a two-factor-vasicek model:

$$r^*(t) = x(t) + y(t) + \psi(t)$$

where x and y are stochastic processes given by:

$$dx(t) = -ax(t)dt + \sigma dZ_1(t),\ x(0) = 0,$$

$$dy(t) = -by(t)dt + \eta\left(\rho^* dZ_1(t) + \sqrt{1-(\rho^*)^2}\,dZ_2(t)\right),\ y(0) = 0$$

where Z_1 and Z_2 denote indepedent, one-dimensional Wiener-processes (Brownian Motion). $a, b, \sigma, \eta, \rho^*$ are model parameters. The function ψ is deterministic and given by:

$$\psi(t) = f^M(0,t) + \frac{\sigma^2}{2a^2}\left(1-e^{-at}\right)^2 + \frac{\eta^2}{2b^2}\left(1-e^{-bt}\right)^2 + \rho\frac{\sigma\eta}{ab}\left(1-e^{-at}\right)\left(1-e^{-bt}\right)$$

The Industry Standard 1: Capital Market Model

Short-rate

The risk neutral short-rate is modified by real-world drifts

$$r(t) := r^*(t) + d_X \cdot \left(1 - e^{-at}\right) + d_Y \cdot \left(1 - e^{-bt}\right)$$

which are distributed on both factors

$$\tilde{x}(t) := x(t) + d_X \cdot \left(1 - e^{-at}\right), \quad \tilde{y}(t) := y(t) + d_Y \cdot \left(1 - e^{-bt}\right)$$

The price-evolution of zerobonds $P(t,T)$ bought at t with maturity T can the be computed by

$$P(t,T) = exp\left(-\int_t^T \psi(u)du - \frac{1 - e^{-a(T-t)}}{a}\tilde{x}(t) - \frac{1 - e^{-b(T-t)}}{b}\tilde{y}(t) + \frac{1}{2}V(t,T) \right),$$

where $V(t,T)$ is also purely deterministic

$$V(t,T) = \frac{\sigma^2}{a^2}\left[T - t + \frac{2}{a}e^{-a(T-t)} - \frac{1}{2a}e^{-2a(T-t)} - \frac{3}{2a}\right] + \frac{\eta^2}{b^2}\left[T - t + \frac{2}{b}e^{-b(T-t)} - \frac{1}{2b}e^{-2b(T-t)} - \frac{3}{2b}\right] +$$
$$+2\rho^* \frac{\sigma\eta}{ab}\left[T - t + \frac{e^{-a(T-t)} - 1}{a} + \frac{e^{-b(T-t)} - 1}{b} - \frac{e^{-(a+b)(T-t)} - 1}{a+b}\right].$$

The Industry Standard 1: Capital Market Model

Stock prices

The time evolution of standard stock prices is modelled via generalised Black-Scholes:

$$S(t) = s_0 \exp\left(\int_0^t r(s)ds + \left(\lambda - 0{,}5\sigma_S{}^2\right)t + \sigma_S W(t) \right)$$

where $r(s)$ denotes the real-world short-rate and W denotes another one-dimensional Wiener-process independent to Z_1 und Z_2. The parameter λ and σ_S denote the excess return and the assumed volatility of the standard stock. General stocks with volatility σ may then be modelled via:

$$F(t) = F_0 \exp\left(\int_0^t r(s)ds + \left(\lambda \frac{\sigma}{\sigma_S} - 0{,}5\sigma^2 \right)t + \sigma W(t) \right)$$

The Industry Standard 1: Capital Market Model

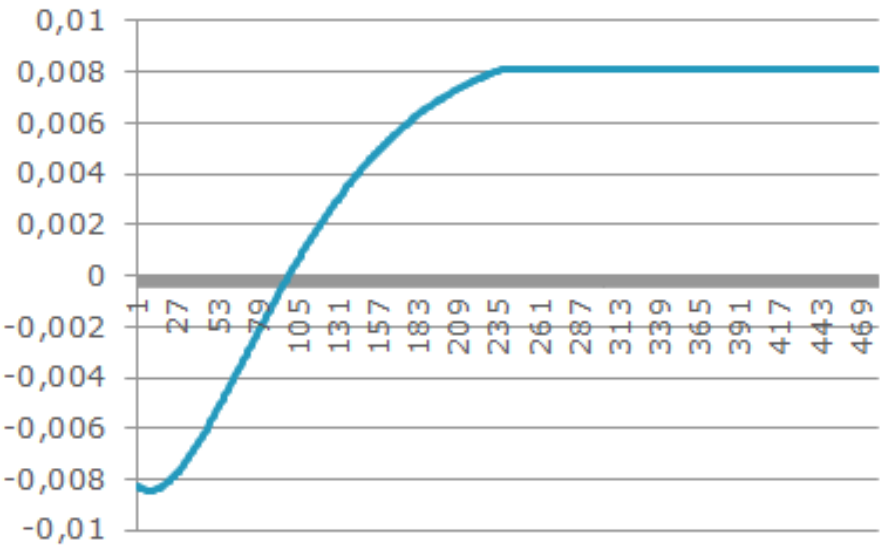
Calibration

- the model needs to be calibrated – but in a fair and principled way.
- The industry does not want to artificially inflate numbers, but tries to follow the best-estimate approach of PRIIPs
- calibration is therefore based on market data and anlysis. It uses forecasts and models made by the Bundesbank and the OECD
- i.e.: spot-rates are modelled according to the Nelsson-Siegel-Svensson parameters for german bonds which are publicised by the Bundesbank
- this approach is consistent with the calibration approach of regulators

The Industry Standard 1: Capital Market Model

Calibration

- Example: Calibrated Spot-rates for the next 40 years used by regulators for 2017



Parameter	2017 calibration
a	0.389
b	0.097
σ	0.0182
η	0.019
ρ^*	-0.924
d_x	0.016
d_y	-0.00295
λ	4 %
σ_S	20 %

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Stochastic Simulation

At it's core, the Industry Standard consists of the framework and rules to implement a specific process for PRIIP calculation. The rough process map is as follows:

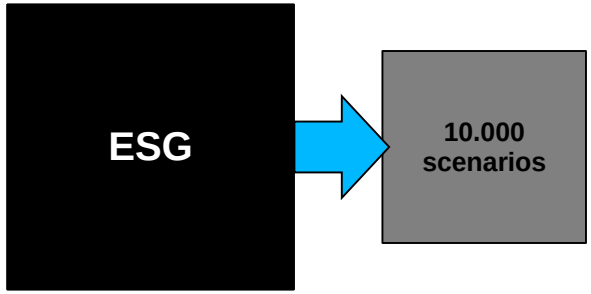
The numerical requirements are:

- generate at least 10.000 scenarios
- use at least a monthly time-step

Stochastic Simulation

In order to simulate the typical return on savings products of a german insurer, one has to model more complex assets. We will now show the example of a typical „classical" profit-sharing product.

To simulate it, we need the simulated profits the insurer will generate under the model. Therefore, we introduce a model portfolio consisting of bonds and stocks and simulate the net return of this portfolio.



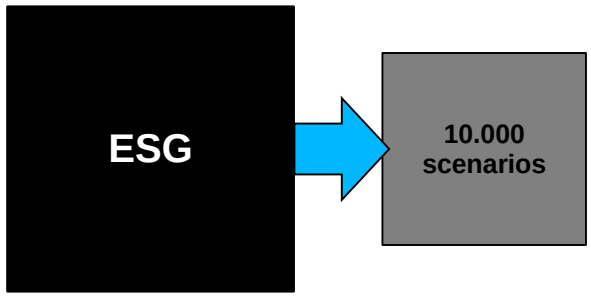
Stochastic Simulation

The model bond portfolio of an insurer is assumed to be a rolling portfolio of zerobonds with each bond running for $2d$ years. Here, d is the current Macauley duration of the real bond portfolio. The swap rates are computed via

$$K(t) = \frac{1 - P(t, t+2d)}{\sum_{j=1}^{2d} P(t, t+j)}$$

which gives a model interest-rate coupon on the bonds of

$$R_{B,d}(t) = \frac{1}{2d} \sum_{i=1}^{2d} K(t-i).$$

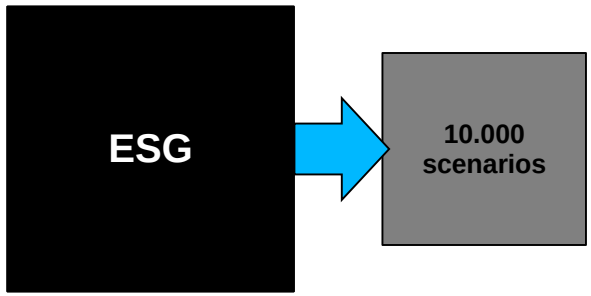


Stochastic Simulation

The model stock portfolio of an insurer is derived from the standard stock in the way already explained, together with a parameter for the modeling of costs, such as transaction costs, on the level of the portfolio.

$$F(t) = F(0) \cdot \exp\left(\int_0^t r(s)ds + \left(\lambda \frac{\sigma}{\sigma_S} - \frac{\sigma^2}{2} - K_f \right) \cdot t + \sigma W(t) \right).$$

Note that the formula also provides a model for funds investing purely in stocks



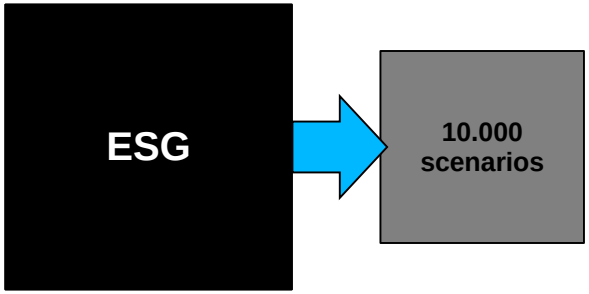
Stochastic Simulation

The return of the assets of the modelled insurer are then given by the geometric mean of the returns of the portfolio of the last 3 years

$$R(t) = \sqrt[3]{\prod_{i=0}^{2}\left(\Psi \cdot \frac{F(t-i)}{F(t-i-1)} + (1-\Psi)\cdot\left(1+R_{B,d}(t-i)\right)\right)} - 1$$

Return therefore depends on just 3 factors:

- d
- σ
- Ψ

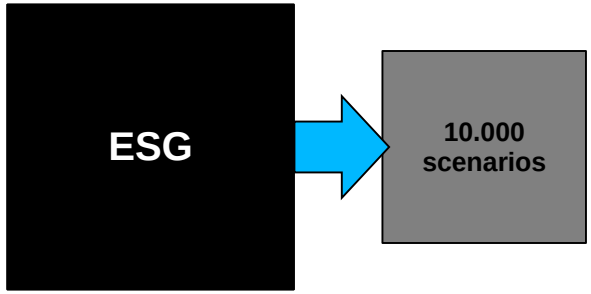


Stochastic Simulation

The return of the savings contribution is then modeled via:

$$g(t+1) = H(t) + \left((R(t) - K - K' - E) - H(t)\right)^{+} + E_{NK}(t),$$

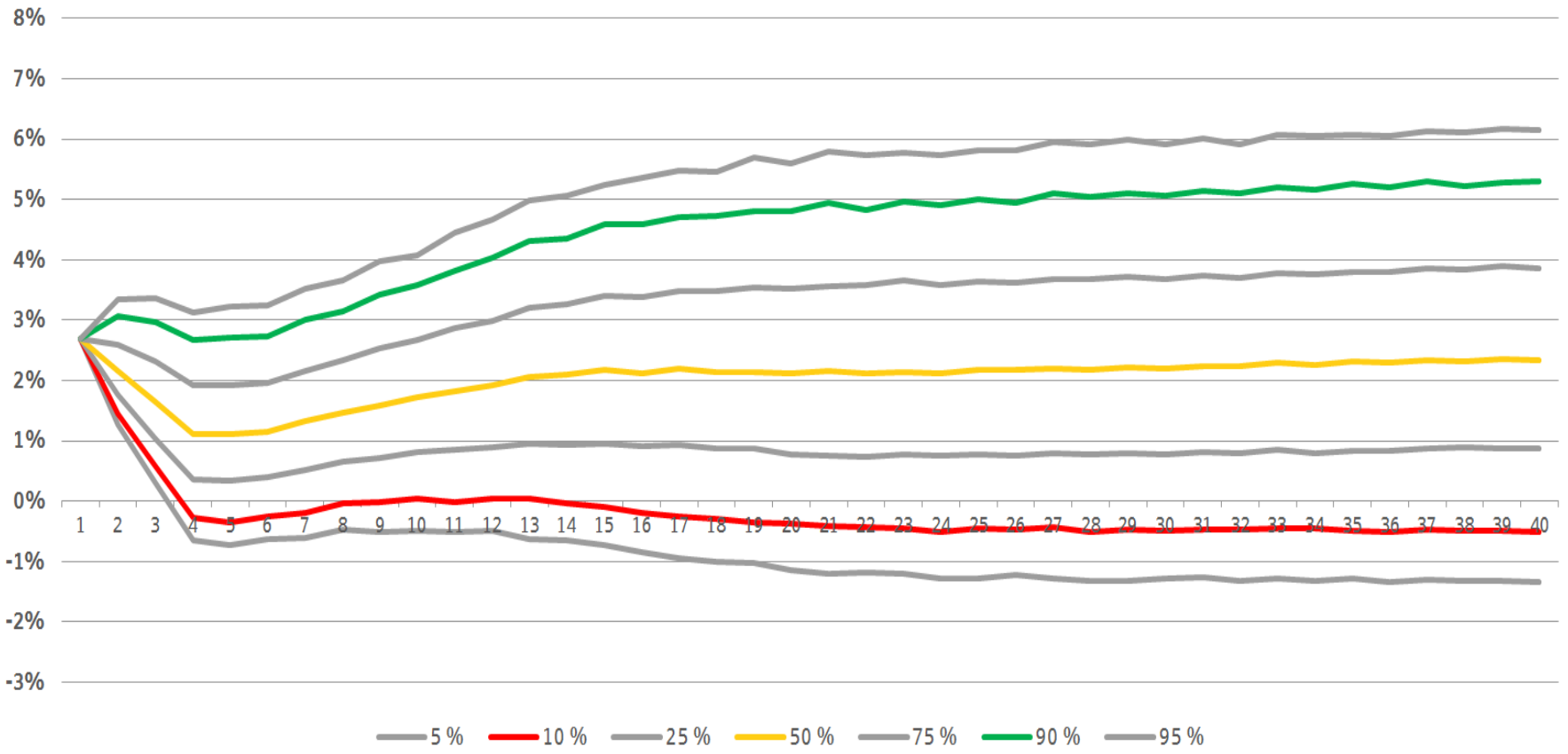
where $H(t)$ is the garuanteed minimum return of the product, K and K' are cost parameters, E is the best estimate of profits not shared with the retail client, and E_{NK} denotes a parameter for product-specific modifications.



The Industry Standard 2: Stochastic Simulation

Modelled returns on savings contributions of clients - exemplary percentiles

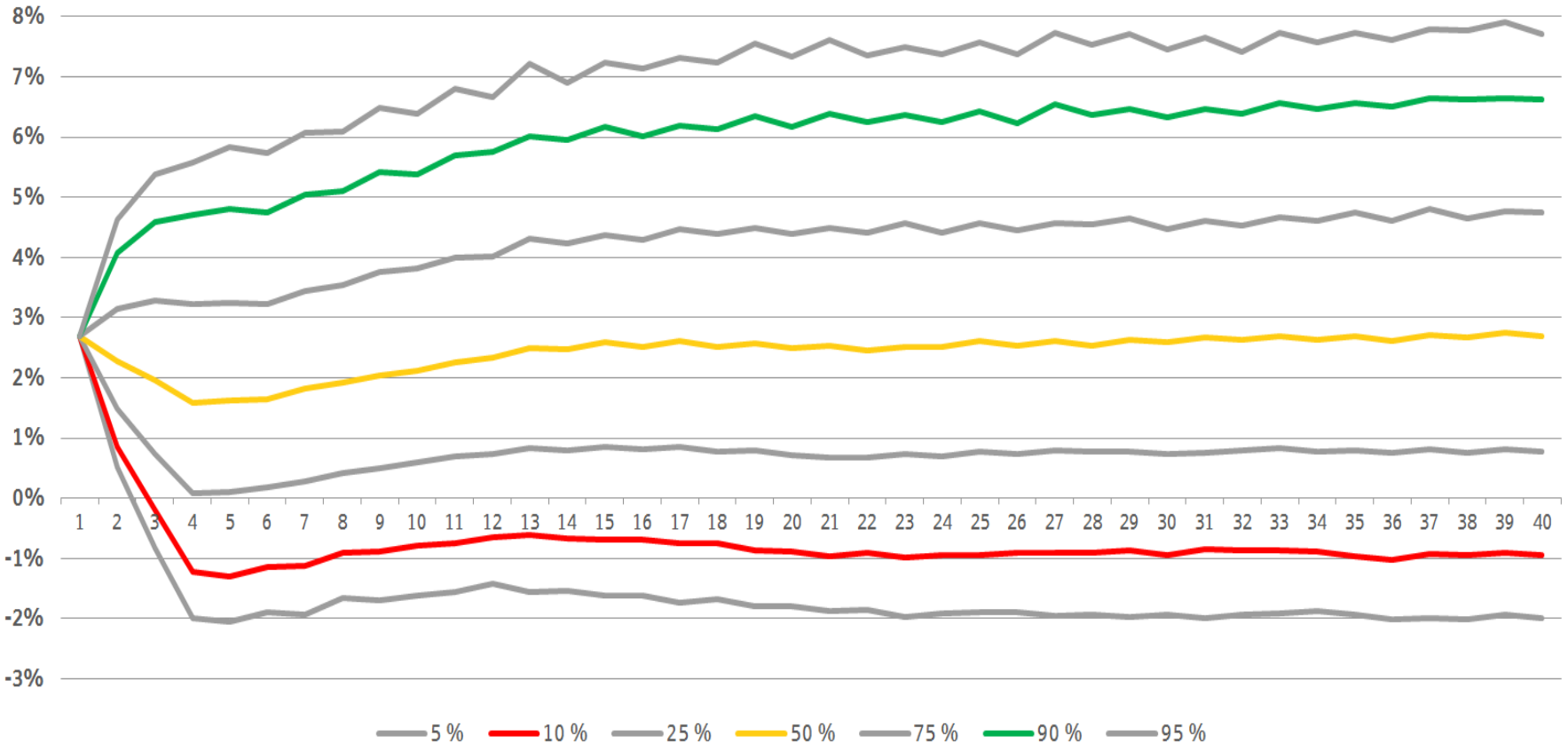
Asset distribution: 90 **%** bonds, 10**%** stocks
Asset properties: stock volatility 20 **%**, bond duration 5 years
Modelled profit share: 90**%** profit share with retail clients



The Industry Standard 2: Stochastic Simulation

Modelled returns on savings contributions of clients - exemplary percentiles

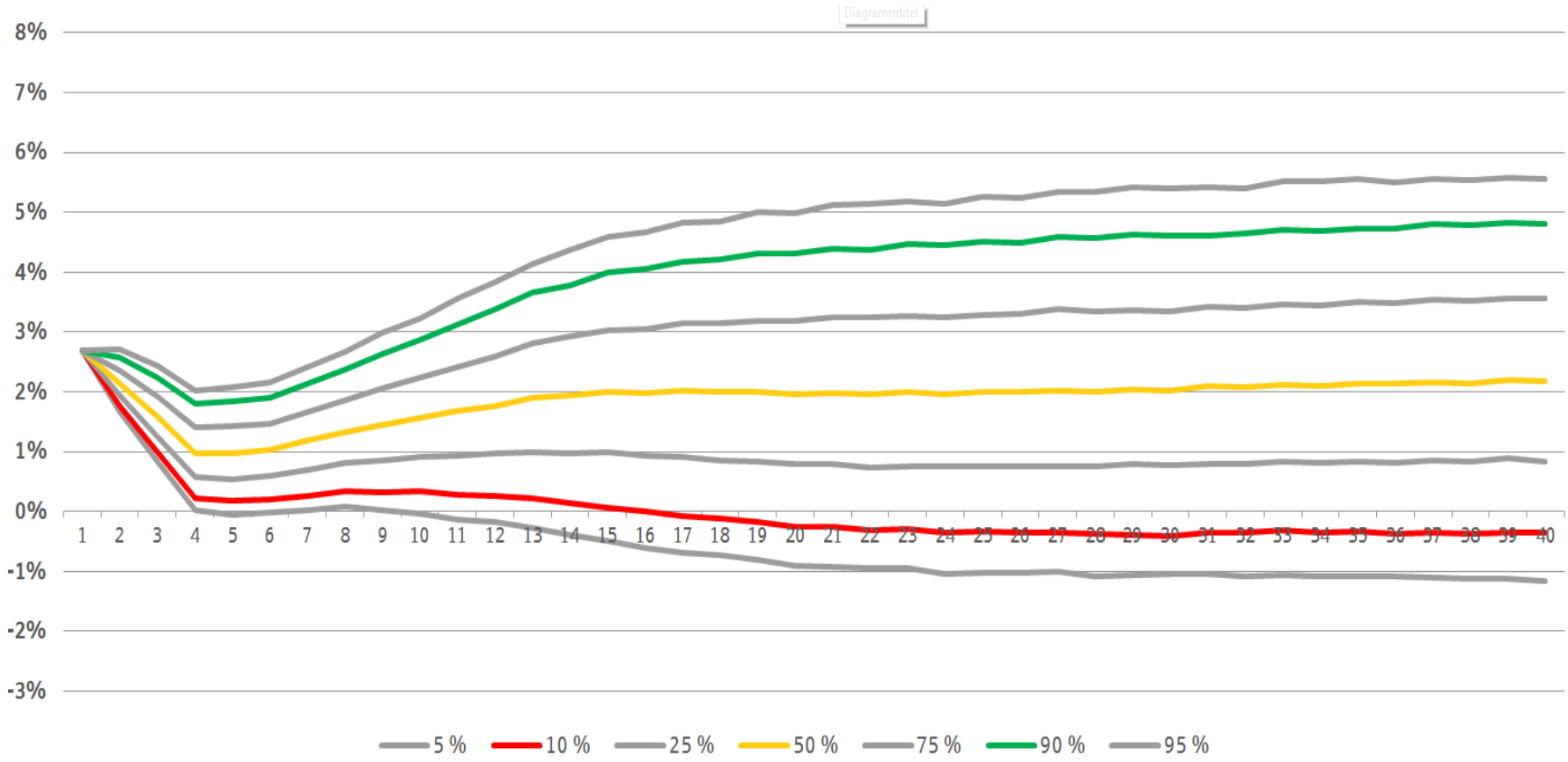
Asset distribution: **80 %** bonds, **20%** stocks !
Asset properties: stock volatility 20 **%**, bond duration 5 years
Modelled profit share: 90**%** profit share with retail clients



The Industry Standard 2: Stochastic Simulation

Modelled returns on savings contributions of clients - exemplary percentiles

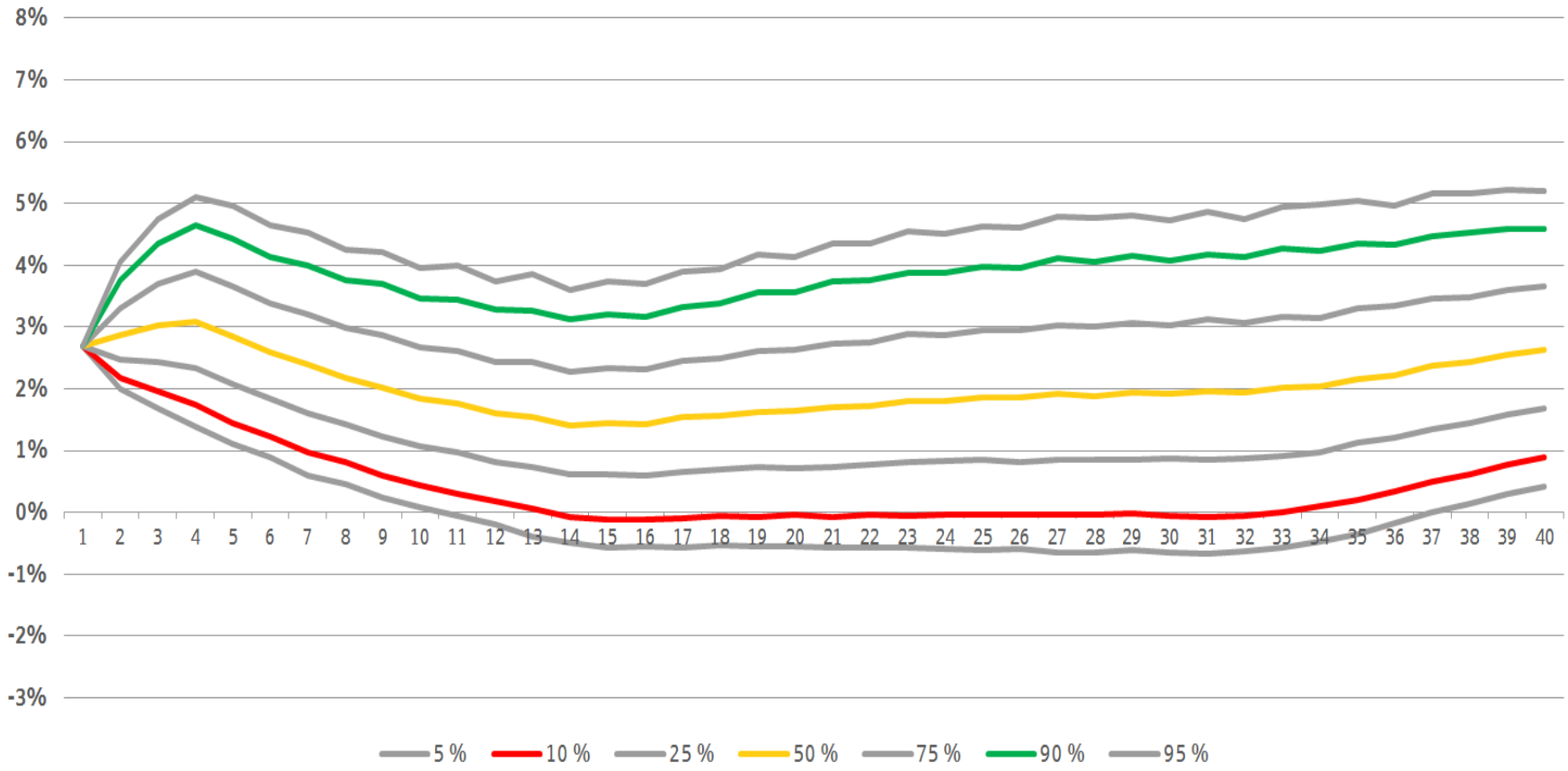
Asset distribution: 90 **%** bonds, 10**%** stocks
Asset properties: stock volatility **10 %**, bond duration 5 years
Modelled profit share: 90**%** profit share with retail clients



The Industry Standard 2: Stochastic Simulation

Modelled returns on savings contributions of clients - exemplary percentiles

Asset distribution: 90 **%** bonds, 10**%** stocks
Asset properties: stock volatility 20 **%**, bond duration **10** years
Modelled profit share: 90**%** profit share with retail clients



Modelling other assets

Depending on the product, the simulation of other assets, i.e. funds, may be necessary. We will show the modelling approach for some typical assets:

- funds investing in stocks

$$F(t) = F(0) \cdot \exp\left(\int_0^t r(s)ds + \left(\lambda \frac{\sigma}{\sigma_S} - \frac{\sigma^2}{2} - K_f \right) \cdot t + \sigma W(t) \right).$$

- funds investing in bonds

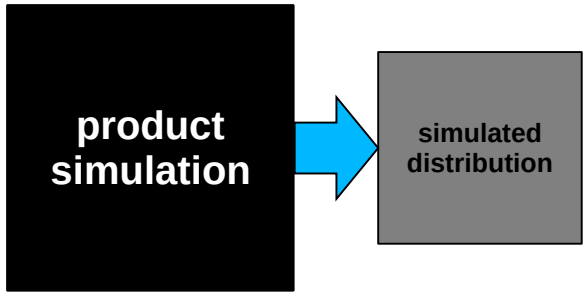
$$R(t + \Delta t) = R(t) \cdot \frac{P(t + \Delta t, t + d)}{P(t, t + d)} \exp\left(-K_f \cdot \Delta t\right),$$

  - where d is the Macauley-Duration of the fund, Δt is the timestep, and K_f is a cost parameter

Product Simulation: Guidelines

The simulation of the behaviour of products under the capital market scenarios has to be implemented and defined by the individual insurers. For legal reasons, this cannot be done in public. Therefore, the Industry Standard stipulates guidelines and principles that must be adhered:

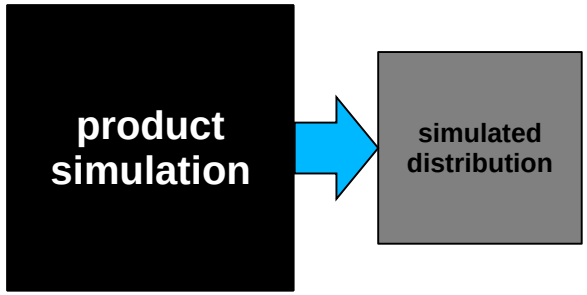
- product simulation is the responsibility of the insurer
- the product simulation is faithful to the products
- No extra returns from outside the simulation
- All profit-sharing may be included



Product Simulation: Guidelines

The simulation of the behaviour of products under the capital market scenarios has to be implemented and defined by the individual insurers. For legal reasons, this cannot be done in public. Therefore, the Industry Standard stipulates guidelines and principles that must be adhered:

- All costs according to the RTS have to be included
- Where relevant, the management rules regarding profit-sharing mechanisms are estimated to mirror the decisions today.



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The Industry Standard 3: Collecting PRIIP Information from Simulation Results

Market Risk Measure and the Industry Standard

Market Risk has to be calculated based on the concept of VEV - this is explicit in the RTS regardless of category

In turn, the industry standard has to provide VEV – even though the assumption that returns on IBIPs with garuantees are normal distributed **is wrong**

MRM class	VaR-equivalent volatility (VEV)
1	< 0,5 %
2	0,5 % - 5,0 %
3	5,0 % - 12 %
4	12 % - 20 %
5	20 % - 30 %
6	30 % - 80 %
7	>80 %

The Industry Standard 3: Collecting PRIIP Information from Simulation Results

Market Risk Measure and the Industry Standard

The Industry standard therefore takes the formula for VEV as given and plugs in the $2{,}5\%$-percentile of the simulated return distribution. More precisely, MRM is computed in the following steps

1. Simulate the 10.000 scenarios
2. Take the $2{,}5\%$-percentile of the notional saved amount at the end of the recomended holding period ($VaR_{97{,}5\%}$)
3. Compute the continuosly-compounded annualized RETURN

$$VaR_{97{,}5\%} = \sum_{t=1}^{T} Premium(t) \cdot \mathrm{e}^{RETURN \cdot (T-t+1)}$$

4. Calculate VEV via $$VEV = \frac{-1{,}96 + \sqrt{3{,}842 - 2 \cdot T \cdot RETURN}}{\sqrt{T}}$$

The Industry Standard 3: Collecting PRIIP Information from Simulation Results

Performance Scenarios and the Industry Standard

Most performance scenarios can be calculated with relative ease from the distribution of notional amounts at the end of the RHP:

- The optimistic scenario is the 90%-percentile
- The medium scenario is the 50%-percentile
- The pessimistic scenario is the 10%-percentile

The stress scenario does not have such a simple rule to follow. Instead, we have to work a little more:

2. The stress scenario shall set out significant unfavourable impacts of the product not covered in the unfavourable scenario referred to in point 1(c) of this Annex. The stress scenario shall show intermediate periods where those periods would be shown for the performance scenarios under point 1(a) to (c) of this Annex.

The Industry Standard 3: Collecting PRIIP Information from Simulation Results

Stress Scenario and the Industry Standard

In order to get the stress scenario, one has to run a second simulation based on a stressed model. The model is modified as follows:

- initial spotrates and the parameters d_x, d_y are set to 0.
- volatilties in the interest rate processes are increasd by the factor 1.5
- for the stock prices, the short rate and the additional return are set to 0. Volatility is either estimated according to 10 Annex IV RTS or increased by 1.5

$$F(t) = F(0) \cdot \exp\left(\left(-\frac{{\sigma_{Stress}}^2}{2} - K_f\right) \cdot t + \sigma_{Stress} W(t)\right)$$

The Industry Standard 3: Collecting PRIIP Information from Simulation Results

Costs and the Industry Standard

Cost calculation is only indirectly part of the industry standard. The methodology has to be implemented in such a way that all costs in the sense of the RTS can be computed. Depending on the cost type and product, this may require additional modeling.

The existing model provides plenty opportunity to include costs in an adequate way. This may be both directly:

- Calculatory costs (product simulation)

And indirectly – as costs built into the scenarios:

$$g(t+1) = H(t) + \left((R(t) - K - K' - E) - H(t)\right)^{+} + E_{NK}(t),$$

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Comments and Outlook

Review requirements demand a well-defined simulation process in order to comply with the RTS

=> The Industry Standard may pose high implementation and maintenance costs

Article 15

Review

1. PRIIP manufacturers shall review the information contained in the key information document every time there is a change that significantly affects or is likely to significantly affect the information contained in the key information document and, at least, every twelve months following the date of the initial publication of the key information document.

2. The review referred to in paragraph 1 shall verify whether the information contained in the key information document remains accurate, fair, clear, and non-misleading. In particular, it shall verify the following:

(a) whether the information contained in the key information document is compliant with the general form and content requirements under Regulation (EU) No 1286/2014, or with the specific form and content requirements laid down in this Delegated Regulation;

(b) whether the PRIIP´s market risk or credit risk measures have changed, where such a change has the combined effect that necessitates the PRIIP´s move to a different class of the summary risk indicator from that attributed in the key information document subject to review;

(c) whether the mean return for the PRIIP's moderate performance scenario, expressed as an annualised percentage return, has changed by more than five percentage points.

3. For the purposes of paragraph 1, PRIIP manufacturers shall establish and maintain adequate processes throughout the life of the PRIIP where it remains available to retail investors to identify without undue delay any circumstances which might result in a change that affects or is likely to affect the accuracy, fairness or clarity of the information contained in the key information document.

Comments and Outlook

The Industry Standard may or may not find approval in the general PRIIP review

Article 33

1. By 31 December 2018, the Commission shall review this Regulation. The review shall include, on the basis of the information received by the ESAs, a general survey of the operation of the comprehension alert, taking into account any guidance developed by competent authorities in this respect. It shall also include a survey of the practical application of the rules laid down in this Regulation, taking due account of developments in the market for retail investment products and the feasibility, costs and possible benefits of introducing a label for social and environmental investments. As part of its review, the Commission shall undertake consumer testing and an examination of non-legislative options as well as the outcomes of the review of Regulation (EU) No 346/2013 regarding points (c), (e) and (g) of Article 27(1)thereof.

As regards UCITS as defined in Article 1(2) of Directive 2009/65/EC, the review shall assess whether the transitional arrangements under Article 32 of this Regulation shall be prolonged, or whether, following the identification of any necessary adjustments, the provisions on key investor information in Directive 2009/65/EC might be replaced by or considered equivalent to the key investor document under this Regulation. The review shall also reflect on a possible extension of the scope of this Regulation to other financial products, and shall assess whether the exemption of products from the scope of this Regulation should be maintained, in view of sound standards for consumer protection including comparisons between financial products. The review shall also assess the appropriateness of introducing common rules on the need for all Member States to provide for administrative sanctions for infringements of this Regulation.

2. The Commission shall assess, by 31 December 2018, on the basis of the work undertaken by EIOPA on disclosure of product information requirements, whether to propose a new legislative act guaranteeing appropriate disclosure of product information requirements for those products or whether to include pension products referred to in point (e) of Article 2 (2) in the scope of this Regulation.

In making its assessment, the Commission shall ensure that such measures do not reduce standards of disclosure in Member States that have pre-existing disclosure regimes for such pension products.

3. After consulting the Joint Committee, the Commission shall submit a report to the European Parliament and to the Council relating to paragraphs 1 and 2, accompanied, if appropriate, by a legislative proposal.

4. By 31 December 2018, the Commission shall conduct a market survey to determine whether online calculator tools which allow the retail investor to compute the aggregate costs and fees of PRIIPs are available and whether they are free of charge. The Commission shall report on whether those tools provide for reliable and accurate calculations for all products within the scope of this Regulation.

In the event that the survey concludes that no such tools exist or that existing tools do not enable retail investors to understand the aggregate amount of costs and fees of PRIIPS, the Commission shall assess the feasibility of the ESAs, through the Joint Committee, developing draft regulatory technical standards setting out the specifications applicable to such Union-level tools.

Comments and Outlook

The German Industry Standard

- is an earnest answer of the german industry for their PRIIPs
- is principle driven
- is continously under development
- Is open to your questions and feedback

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He holds a PhD in Mathematics from the University of Bochum, Germany. Before his doctoral degree, he obtained a Diploma in Mathematics from the same university.