A note on the quantitative requirements for risk-mitigation techniques and the “Basic PEPP” for pan-European Personal Pension Products (PEPP)[a]

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Abstract

The regulatory framework for the introduction of a Pan-European Private Pension Product (PEPP) aims on building a stable and adequate individual retirement income through the PEPP. It therefore includes, among other things, specifications on requirements for "risk-mitigation techniques", specifications for a “Basic PEPP” (standard variant) as well as specifications for calculating a risk and return indicator.

The specifications require stochastic modeling to analyze future PEPP performance. This letter summarizes the main requirements as well as the results of an analysis of the requirements for 20 different products resp. investment strategies (hybrid products as well as mixed and life-cycle fund products).

In the current capital market environment, none of the products analyzed meet the specified requirements. The interaction of absolute requirements in the PEPP regulation and a calibration of the models used to the respective current capital market environment leads to a predictable high fluctuation of the results over time.

Keywords: Pan-European Private Pension Product (PEPP), risk-mitigation technique, retirement planning

[a] This letter is based on analyses which the Institute for Finance and Actuarial Sciences (ifa) has performed in cooperation with the Austrian Insurance Association (Verband der Versicherungsunternehmen Österreichs, VVO). This letter was submitted to the European Actuarial Journal and a similar version will be published in German language in the journal “Versicherungswirtschaft”.

1 Introduction

In June 2019, the European Commission issued regulation EU 2019/1238 on a pan-European Personal Pension Product (PEPP). This regulation aims on the creation of "*a personal pension product which will […] be simple, safe, reasonably-priced, transparent, consumer-friendly and portable Union-wide and complements the existing systems in the Member States"* (cf. recital 8, European Commission, 2019). Further, this regulation introduces the notion of a so-called "risk-mitigation technique" and a "Basic PEPP". Products resp. investment strategies must obey the requirements for a risk-mitigation technique resp. a Basic PEPP to be offered within the PEPP-regime.[1] The regulatory technical standards ("RTS", cf. European Commission, 2020) further specifies the actual quantitative requirements that have to be fulfilled by the products.

This letter provides an overview as well as quantitative analyses of the requirements for risk-mitigation techniques and a Basic PEPP applying a stochastic model as proposed by European Commission (2020). The letter is organized as follows: Section 2 sketches the actual quantitative requirements. Section 3 introduces the financial model underlying our analyses and the products considered. Section 4 summarizes our main results whereas Section 5 concludes.

2 Quantitative requirements for risk-mitigation techniques and the Basic PEPP

Among others, European Commission (2020) specifies the quantitative requirements for a product resp. investment strategy to qualify as a risk-mitigation technique on the one hand and as a Basic PEPP on the other hand.[2] For doing so, a stochastic modelling approach is required (cf. European Commission, 2020, annex III (11)). Further, the derivation of so-called risk and return indicators to be disclosed in the corresponding key information document is defined.

In what follows, Section 2.1 briefly sketches these requirements whereas Section 2.2 states the actual implementation of these requirements in our study.

[1] European Commission (2019) contains among others qualitative requirements such as cross-border provision and portability of the PEPP within the EU, but also empowers the European Commission to come up with additional quantitative requirements for the respective products.

[2] Note, we do not consider any other additional requirements on the PEPP, such as e.g. the cost cap within a Basic PEPP or the required portability for a PEPP in general in our study. We solely focus on the quantitative requirements as stated by European Commission (2020) in our analyses.

2.1 Requirements as stated by European Commission (2020)

The requirements are summarized as follows:

(1) **risk-mitigation technique**: Article 14 (2) states that a risk-mitigation technique shall be designed in the following manner:

(a) *ensure that the expected loss, defined as the shortfall between the projected sum of the contributions and the projected accumulated capital at the end of the accumulation phase, is not higher than 20 % under the stressed scenario, which equals the fifth percentile of the distribution*;

(b) aim at outperforming the annual rate of inflation with a probability of at least 80 % over a 40 year accumulation phase;

(2) **Basic PEPP**: Article 14 (3) requires that:

For the Basic PEPP […] the PEPP provider shall employ an investment strategy that ensures […] recouping the capital at the start of the decumulation phase and during the decumulation phase with a probability of at least 92,5 %. However, where the remaining accumulation phase is equal to or less than 10 years when taking up the Basic PEPP, a probability of at least 80 % may be used […]

(3) **risk indicator**: Annex III (2) and annex III (4) define two different key statistics, the probability of outperforming the annual rate of inflation and an expected shortfall measure, according to which two different risk indicators shall be derived. The actual risk indicator is set as the maximum of the two.

(4) **return indicator**: Annex III (6) introduces a statistic derived from the accumulated capital and based on this figure defines the return indicator.

2.2 Implementation of the requirements

Unfortunately, although the requirements sketched in Section 2.1 at first glance seem rather clear, an actual implementation of these specifications unveils that they leave room for interpretation from a conceptional and computational point of view. For example:

- It is unclear whether the term "expected loss" in article 14 (2) induces the application of a Tail Value-at-Risk or if a Value-at-Risk given the specified level (5%) should be considered.
- It might be unclear whether "recouping the capital" in a Basic PEPP requires to recoup the contributions paid by the consumer ("gross view") or contributions after any fees within the product were deduced ("net view"). Taking the definitions of

European Commission (2019) into account, there is reason to associate the term "capital" with the "net view". Thus, the consumer's contributions less any fees were to be considered as a reference figure that should be recouped with the product. Nonetheless, we integrate both, gross and net view in our analyses.

Further, we found that the current verbal specification of the key figures required for the derivation of the risk indicator (II) and the return indicator lack conciseness and hence allow for different actual mathematical definitions of these figures. Note, for the products considered in our study the actual numerical differences of related different mathematical definitions were of rather low magnitude and hence we chose to just depict results of one alternative here.

In our numerical analysis, we consider a monthly premium payment of P which yields to an accumulated account value A_T after an investment horizon of T years by taking the financial model and the considered products introduced in Section 3 into account. Besides a stochastic modelling of equity returns and interest rates, we also model the rate of inflation stochastically and thereby obtain the consumer price index $CPI(t)$ at time t as a random variable with $CPI(0) = CPI_0$.

For deriving the required figures by the RTS, we set the total sum of premiums paid by the customer as $PP = P \cdot 12 \cdot T$ and calculate the term "*inflation-adjusted contributions*" as $IAP = \sum_{t=0}^{12 \cdot T-1} P \cdot \frac{CPI(T)}{CPI(t)}$. Additionally the contributions less any fees PP_{mod} are considered. This yields to the following derivations of the required figures:

(1) **risk-mitigation technique**:

(a) We derive the "expected loss" as

- Value-at-Risk [VaR]: $\frac{VaR_{0.05}[A_T]}{PP} - 1$
- Tail-Value-at-Risk [TVaR]: $\frac{TVaR_{0.05}[A_T]}{PP} - 1.$

This requirement is fulfilled if the considered expected loss is greater than -20%.

(b) We compute the probability of outperforming the annual rate of inflation by $\mathbb{P}(A_T \geq IAP)$. The requirement is fulfilled if $\mathbb{P}(A_T \geq IAP) \geq 0.8$ holds.

(2) **Basic PEPP**: We derive the probability of recouping the capital as

- gross view: $\mathbb{P}(A_T \geq PP)$
- net view: $\mathbb{P}(A_T \geq PP_{mod})$.

This requirement is fulfilled if the considered probability is greater than 92.5% (if a maturity of more than 10 years is considered).

(3) **risk indicator**: We set the key statistics for derivation of the risk indicators as

- risk indicator I: $\mathbb{P}(A_T < IAP)$
- risk indicator II: $\mathbb{E}\left[\frac{A_T}{IAP} - 1 \middle| A_T < IAP\right]$

(4) **return indicator**: We set the key statistic for derivation of the return indicators as $\frac{VaR_{0,5}(A_T)}{VaR_{0,5}(IAP)}$, i.e. we compare the median of the lump sum benefit with the median of the inflation-adjusted contributions.

We derive estimates for above requirements within a Monte-Carlo-setting by an application of the capital market model introduced in the following section and assuming 10.000 trajectories within our simulation exercise.

3 Financial model and considered products

This section summarizes the financial model underlying our analyses and the different products resp. investment strategies we consider.

3.1 Financial model

European Commission (2020) requires the application of a stochastic model (cf. annex III (11)). They also require the rate of inflation to follow a Vasiçek process (cf. Vasiçek, 1977) and further propose stochastic modelling of equity returns by means of a generalized Black-Scholes-model (cf. Black and Scholes, 1973), (nominal) interest rates by means of a so-called G2++-model (cf. e.g. Brigo and Mercurio, 2006) and modelling of credit spreads assuming an intensity-based model.[3]

As a basic building block, we apply a stochastic modelling approach that is for example used within the Austrian and German industry standard for products of category 4 within the PRIIPs regime (cf. AVÖ, 2018 and DAV, 2018 and summarized by Graf and Korn, 2020). This model provides stochastic modelling of (nominal) interest rates applying the G2++-model and further assumes a generalized Black-Scholes-model for equity returns but lacks modelling of inflation. Hence, we include this additional asset class by the following "cascade approach":

[3] Note, the latter proposals on the modelling assumptions are non-binding. European Commission (2020) only mandatorily requires the Vasiçek-model for modelling inflation.

Consider the inflation rate $i(t)$ equipped with stochastic dynamics

$$di(t) = a_i\big(\theta_i - i(t)\big)dt + \sigma_i dW_i(t), i(0) = i_0$$

for a $W_i(t)$ being a $\mathbb{P}$ −Wiener process. Further, in the spirit of the G2++-model, real interest rates are driven by two additional stochastic processes as follows

$$dx(t) = a\big(\lambda_x - x(t)\big)dt + \sigma dW_x(t), x(0) = 0$$

$$dy(t) = b\left(\lambda_y - y(t)\right)dt + \eta dW_y(t), y(0) = 0$$

where $W_x(t), W_y(t)$ are $\mathbb{P}$ −Wiener processes with $dW_x dW_y = \rho dt$ and $dW_x dW_i = dW_y dW_i = 0$.

Based on the inflation rate and the "real" interest rate, the nominal short rate $r(t)$ is set as

$$r(t) = x(t) + y(t) + i(t) + \psi(t)$$

where $\psi(t)$ is a deterministic function to ensure that the model replicates an initial term structure of interest rates.

Finally, the equity processes spot price $S(t)$ obeys the following dynamics

$$dS(t) = S(t) \cdot \big((r(t) + \lambda_S)dt + \sigma_S dW_S(t)\big)$$

with $W_S(t)$ denoting another $\mathbb{P}$ −Wiener process uncorrelated to $W_x(t), W_y(t)$ and $W_i(t)$.

3.2 Products resp. investment strategies

We consider different products resp. investment strategies within our analyses. All products are equipped with a very simple fee structure by account proportional fees that are deducted from the client's account value on a monthly basis.

Hybrid products

Within these products, the client's contributions are split according to a pre-specified *fund quota* (varying from 0%, 25%, …, 100% in our analyses) into an investment in a pure equity fund and in an insurance company's general assets whose modelling is given by AVÖ (2018). In our numerical analyses in Section 4 these products will be identified with the label "Hybrid x%" where x gives the corresponding fund quota applied within the product.

We additionally included a hybrid product with a fund quota chosen such that the product provides a guarantee of 70% of the premiums paid by the policyholder. This product will be identified by the label Guar 70% (x%) with x specifying the corresponding fund quota.

Investment in balanced funds

Within these products, the client's contributions are invested into a balanced fund which itself invests into a mixture of equity and fixed income investments. We assume constant rebalancing of the fund's exposure to the equity markets according to some *equity quota* (that will also vary from 0%, …, 100% in our results section). The remainder is invested in a zero-coupon bond with a duration of 10 years. In our numerical analyses in Section 4, these products will be identified with the label "Fund x%" where x gives the corresponding equity quota applied within the balanced fund.

Investment in life-cycle funds

So-called life-cycle funds are already mentioned as one potential risk-mitigation technique by European Commission (2019). Within these products, the client's contributions are invested into a life-cycle fund which itself invests into a mixture of equity and fixed income investments according to some pre-specified glide path. We introduce the so-called "duration of the life-cycle phase" which corresponds to the period in the glide path when devesting from equity to fixed income investments takes part. More concretely, if one considers a term to maturity of 40 years and a duration of the life-cycle phase of 10 years, the life-cycle fund invests into 100% equities for the first 30 years and then linearly reduces its equity exposure to 0 over the next 10 years. In our numerical analyses in Section 4 these products will be identified with the label "Life-Cycle x" where x gives the corresponding duration of the life-cycle phase applied within the fund.

4 Results

Assuming our base calibration[4], Fig 1 summarizes the results for the different products. The metrics shown in the respective columns are

- columns 1, 2: „expected loss not more than 20%"
- column 3: „outperforming the annual rate of inflation with a probability of at least 80%"
- columns 4, 5: „probability of recouping the capital at least 92.5%" (gross / net view)
- column 6: risk indicator, appendix III (2)
- column 7: risk indicator, appendix III (4)

[4] We calibrated the model on the current capital market environment: The long term expected rate of inflation is given by 2% p.a. 10-year nominal interest rates at outset are negative and in expectation increase to slightly above 2% p.a. over 40 years. The equity risk premium is set to 4% p.a.

- column 8: return indicator, appendix III (6)

The color coding shows whether certain requirements in columns 1-5 are met. If so, this is indicated by black shading.

Summary of results

	14 (2) a) [VaR]	14 (2) a) [TVaR]	14 (2) b) [Infl.]	14 (3) [Gross]	14 (3) [Net]	III (2) [Risk]	III (4) [Risk]	III (6) [Return]
Life-Cycle 0	-44%	-57%	66%	81.7%	88.0%	34% [4]	-38% [4]	145% [1]
Life-Cycle 5	-40%	-53%	64%	81.7%	88.4%	36% [4]	-36% [4]	136% [1]
Life-Cycle 10	-37%	-48%	62%	81.9%	88.9%	38% [4]	-34% [4]	127% [1]
Life-Cycle 15	-34%	-45%	60%	81.8%	89.5%	40% [4]	-32% [4]	118% [1]
Life-Cycle 20	-31%	-42%	57%	81.9%	90.1%	43% [4]	-31% [4]	112% [1]
Life-Cycle 25	-29%	-39%	54%	82.0%	90.7%	46% [4]	-30% [4]	106% [1]
Life-Cycle 30	-27%	-37%	51%	81.8%	91.4%	49% [4]	-29% [4]	101% [1]
Life-Cycle 35	-26%	-36%	47%	81.4%	91.8%	53% [4]	-28% [4]	96% [1]
Life-Cycle 40	-26%	-35%	43%	80.4%	91.9%	57% [4]	-28% [4]	92% [1]
Fund 100%	-44%	-57%	66%	81.7%	88.0%	34% [4]	-38% [4]	145% [1]
Fund 75%	-33%	-47%	64%	83.8%	90.7%	36% [4]	-32% [4]	128% [1]
Fund 50%	-26%	-37%	55%	84.3%	92.7%	45% [4]	-28% [4]	107% [1]
Fund 25%	-23%	-32%	33%	79.5%	92.7%	67% [4]	-26% [3]	86% [1]
Fund 0%	-32%	-38%	6%	52.6%	81.0%	94% [4]	-34% [4]	66% [1]
Hybrid 100%	-44%	-57%	66%	81.7%	88.0%	34% [4]	-38% [4]	145% [1]
Hybrid 75%	-34%	-44%	62%	81.9%	89.8%	38% [4]	-33% [4]	127% [1]
Hybrid 50%	-24%	-32%	56%	82.2%	92.5%	44% [4]	-29% [4]	109% [1]
Hybrid 25%	-16%	-21%	43%	82.6%	96.5%	57% [4]	-26% [3]	92% [1]
Hybrid 0%	-11%	-13%	5%	74.3%	100.0%	95% [4]	-27% [4]	72% [1]
Guar 70% (15%)	-13%	-17%	34%	82.1%	98.4%	66% [4]	-25% [3]	84% [1]

Fig 1 Summary of results with $c = 1\%$ p.a. assuming the base case calibration

In the current capital market environment, no product meets all the requirements of a risk-mitigation technique or the Basic PEPP. The expected loss is only small enough for the conservative insurance products. All other products show an expected loss higher than 20% for both interpretations. The probability of outperforming the annual rate of inflation is not sufficient for any product considered. Only for products with rather high equity ratios, we find some chance of outperforming the annual rate of inflation. Still, all products are far off from a required probability of 80%. The probability of recouping the capital is only sufficiently high for a net view and conservative products.

In addition, all products show the highest risk indicator (4) and the lowest return indicator (1).

Sensitivity without fees

Even without any fees, no product would meet all the requirements of a risk-mitigation technique in the current capital market environment. Even though the expected loss is small enough and the probability of recouping the capital is sufficient for some conservative products, the probability of outperforming the annual rate of inflation is not sufficient for any product,

Sensitivity on capital market environment resp. assumptions

Even with a 200 bp higher interest rate level, only a few products narrowly meet the requirements for a risk-mitigation technique. With a 200 bp higher risk premium for equities, no product meets all the requirements. With a 200 bp higher interest rate level and at the same time a 200 bp higher risk premium for equities, however, almost all products meet the requirements. For this sensitivity, the expected loss is small enough and the probability of recouping the capital is sufficient for all products. The probability of outperforming the annual rate of inflation is sufficient for almost all products.

5 Conclusion

The results clearly show shortcomings with respect to the definition of the quantitative requirements for risk-mitigation techniques and the Basic PEPP. In the current capital market environment, no product meets all the requirements for a risk-mitigation technique or the Basic PEPP. In particular, the probability of outperforming the annual rate of inflation is not sufficient for any product. Even with a benevolent interpretation of the RTS and for products without any fees, these findings would remain. At the same time, all products show the highest risk indicator (4) and the lowest return indicator (1).

This shows that the interplay of absolute specifications in the RTS and a calibration of the models to the respective current capital market environment leads to a predictable high fluctuation of the results over time: Depending on the calibration, all or none of the products meet the requirements. Therefore, the current rules do not provide any meaningful differentiation between the products.

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