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ISSUES OF RISK MARGIN COMPUTATION UNDER SOLVENCY II REGULATORY REGIME

SCIENTIFIC PAPER

Abstract

The paper deals with the issues of risk margin computation as an element of technical provisions of Insurers under the Solvency II regulatory regime. Due to a lack of regulatory method for the capital cost, in combination with the low interest rates, the risk margin is set too high and variable, which primarily affects life insurance companies. The paper includes particular proposals for overcoming or mitigating the problem of too high and rate-sensitive risk margin. The proposed solutions include both modifications to the existing capital cost method and abandonment and the replacement of this method by other risk margin computation methods.

Key words: *risk margin, Solvency II, capital cost rate, technical provisions*

I. Introduction

Establishment of a stable and single insurance market to protect the interests of insurance beneficiaries based on legislation governing the insurance industry represents an important task of the regulatory authorities in the member states of the European Union (EU). A single regulatory framework for determining solvency of insurance companies in the named countries was formally established in the 1970s. In order to allow for the inflationary effect, minor amendments to the previous regime were made in 2002, when the Solvency I regime came into effect. In the meantime, the new and stronger effects occurred of the existing risks jeopardizing

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the Insurers, but significant progress has been made in the area of knowledge and instruments required to measure and manage the risks. The modern business environment is characterized by more complex insurance services and Insurers investment strategies, intensive consolidation and expansion of business to new markets and activities, which represents a kind of challenge for supervisors. In the significantly changed business circumstances at the beginning of the 21st century, the structural shortcomings of the Solvency I concept came to light and the need was observed for a risk-based approach to Insurers' solvency valuation.[3] After 15 years of development, starting from January 1, 2016, a new regulatory framework was established for Insurers and Reinsurers in the European Union - the Solvency II.

At the moment, Solvency II represents one of the most complex global insurance industry regulatory regimes. It is often referred to as the "golden standard" of insurance regulation, aimed at by other countries outside the EU.[4] The key novelties introduced by this regulatory regime comprise the explicit consideration of a larger number of risks in the computation of capital requirements of insurance companies, high standards of capital adequacy and risk management, prudential regulation instead of quantitative investment constraints, possible implementation of the in-house models of the Insurers for calculation of capital requirements and a switch from the *rules-based* supervision to the principles-based supervision.[5] Despite the obvious advantages, the new regulatory regime appeared to have some shortcomings as well, in the first years of implementation.

The subject-matter of the paper comprises the computation problems of risk-margin as an element of technical provisions of Insurers under the Solvency II regime. In addition to the fact that the computation of the risk margin using the capital cost method represents a kind of challenge for Insurers, it was noticed that, in the actual environment of low interest rates, the risk margin is too high and variable. The aim of this paper is to present particular proposals for resolving the problem of excessive risk margin sensitive to interest rates. The paper also includes a hypothetical example how to simplify the computation of the risk margin via the so-called proportional approach.

II. Risk Margin as an Element of Technical Provisions in Solvency II Concept

Unlike the Solvency I regime, based on the book values of balance sheet items and, as such, insensitive to risks, the new regulatory regime for Insurers in

[3] Jelena Kočović, Dejan Trifunović, Marija Jovović, „Risk Treatment in Solvency II and Basel III Concepts", *Risk management in the Financial Services Sector* (editors: Jelena Kočović, Biljana Jovanović Gavrilović, Dejan Trifunović), Belgrade, 2016, pp. 5.

[4] Jean-Christophe Graz, *The Power of Standards,* Cambridge University Press, 2019, pp. 138.

[5] Jelena Kočović, Marija Koprivica, Blagoje Paunović, „Initial Effects of Solvency II Implementation in the European Union", *Ekonomika preduzeća* No. 7–8, 2017, pp. 450.

the EU, introduces prospective valuation of assets and liabilities following the market principles and applying the fair value technique. The fair value of the Insurer's liabilities represents the price that would have to be paid to a third party who is willing to commit to settle the given liabilities.[6] However, the absence of a liquid secondary market of liabilities under insurance contracts complicates the problem of the economic valuation.[7]

Article 77 of the Solvency II Directive provides for two ways of valuation of the insurance liabilities. Provisions for liabilities where the cash outflows can be precisely replicated (hedged) by cash inflows from adequate financial instruments (as in the case of unit-linked products) are estimated based on the market value of the instruments. The fair value of liabilities that cannot be replicated by the investment portfolio equals the sum of the best valuation and the risk margin. This approach is based on the idea that insurance liabilities, with their value, should reflect both the expected value of future payments to the insured and the uncertainty associated therewith. The two key elements of technical reserves in the Solvency II regime stem therefrom.[8]

The best valuation corresponds to a weighted average present value of future cash flows required to settle insurance liabilities, where the probabilities of realization of the cash flows are used as weighting factors. In discounting, we use the adequate risk-free interest rate curve, as per maturity of each projected annual net cash flow. The best estimate is declared on a gross basis, and the corresponding reinsurance receivables should be declared separately, on the assets side of the Insurer's balance sheet and adjusted for expected losses by way of risk of uncollectibility.

Complying with the concept of the time value of money, we eliminate the implicit solvency margin that was contained in the technical provisions expressed by nominal value. At the same time, fair valuation increases the volatility of technical reserves. Thus, through the level of the best estimate, a risk margin is formed as an additional measure to secure the fulfilment of Insurers' obligations.

The risk margin corresponds to the amount for which we should increase the technical provisions up to such theoretical level (i.e. the fair value) that another, hypothetical ("reference") Insurer would require as compensation for the immediate assumption of liabilities under the given Insurer's portfolio.[9] For the reference insurer,

[6] International Actuarial Association, *Measurement of Liabilities for Insurance Contracts: Current Estimates and Risk Margins,* Ottawa, 2009, pp. 8.

[7] Jelena Kočović, Marija Koprivica, Blagoje Paunović, „New Challenges for Insurance Companies – Solvency II and IFRS 17", *Insurance in the Post-Crisis Er*a (editors Jelena Kočović, Biljana Jovanović Gavrilović, Branislav Boričić, Mirjana Radović Marković), Belgrade, 2018, pp. 7.

[8] Danica Jović, Jelena Kočović, Marija Koprivica, „Valuation of Insurance Liabilities under Solvency II and IFRS 17", *Quantitative Models in Economics* (editors Jelena Kočović, Jasmina Selimović, Branislav Boričić, Vladimir Kašćelan, Vesna Rajić), Belgrade, 2018, pp. 225.

[9] Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the Taking-up and Pursuit of the Business of Insurance and Reinsurance (Solvency II), *Official Journal of the European Communities,* 2009/138/EC, Art. 77.

the risk margin represents the "reward" for exposure to the risk of less favourable actual cash flows compared to the expected cash flows according to which one has defined the best valuation of technical provisions.[10]

In Solvency II regime, the risk margin is calculated using the capital cost method. According to this method, the risk margin is observed as the present value of the costs of holding capital to the amount equal to the Solvency Capital Requirement (SCR) for the reference Insurer during the entire period until the relevant insurance liabilities are settled. In this aspect, the capital requirements are defined in relation to the risks insured (among which the longevity risk dominates the life insurance), market risks that are not subject to hedging, credit risks and operational risk. Therefore, market risks with hedgable effects are excluded from the computation.

When calculating the risk margin, it is first required to project the amounts of the solvency capital requirement for all future years of the portfolio period. A uniform annual capital cost rate of 6% applies to any one of them. The costs of holding capital calculated in this way are discounted at the relevant risk-free interest rate, with regard to their maturity. The sum of discounted values for all covered years represents the risk margin of the insurance company:[11]

$$RM = \sum_{t \geq 0} CoC \cdot \frac{SCR_t}{\left(1 + p_{t+1}\right)^{t+1}} \tag{1}$$

where CoC represents the rate of capital costs, SCR_t is the projected solvency capital requirement at the year end t and p_{t+1} is the risk-free interest rate for maturity $t+1$ years. The obtained amount of risk margin should be allocated by individual lines of business, according to their relative contribution to the total solvency capital requirement of the Insurer.

The computation of the risk margin relies on the assumption that the reference insurer has had neither proprietary funds nor previous insurance liabilities.[12] At the portfolio assignment moment $t=0$, he provides for the eligible own funds to the amount of solvency capital requirement SCR_0 that will suffice to support the settlement of assumed liabilities. Available funds are invested at risk-free interest

[10] Marija Jovović, *Merenje rizika pri utvrđivanju solventnosti neživotnih osiguravača,* Doctoral Dissertation, Faculty of Economics, Belgrade, 2015, pp. 244.

[11] Commission Delegated Regulation (EU) 2015/35 Suppplementing Directive 2009/138/EC of the European Parliament and of the Council on the Taking-up and Pursuit of the Business of Insurance and Reinsurance (Solvency II), *Official Journal of the European Union,* 2015/35, Art. 37.

[12] Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS), Final CEIOPS' Advice for Level 2 Implementing Measures on Solvency II: Technical Provisions – Article 86(d) – Calculation of the Risk Margin, 2009, *https://register.eiopa.europa.eu/CEIOPS-Archive/Documents/Advices/CEIOPS-L2-Final-Advice-on-TP-Risk-Margin.pdf,* accessed on 5. 2. 2021, pp. 14.

rate, whereat the reference insurer requires an additional return on their investment to the amount of the annual rate of cost of capital CoC. In this way, at the end of the first year, $t=1$, his funds will increase to the level of $SCR_0(1+p_1+CoC)$. Then, the available capital must equal the capital requirement SCR_1, so that it would, in the next year i.e. in the moment $t=2$, grow to the amount of $SCR_1(1+p_2+CoC)$. The named procedure repeats during all the years until the expiration of liabilities under the acquired insurance portfolio. The cost of capital CoC rate serves as compensation to the reference insurer for the risk that they will not return the invested capital together with the interest defined at the risk-free interest rate.[13]

The most significant challenge in terms of the risk-margin computation itself is the forecast of the SCR amount for any one future year, $t=1,2,...$ from the aspect of the moment $t=0$. Accurate computation would involve stochastic simulation of the portfolio until the expiry of its period, followed up by computation and discounting of the capital requirement for each simulation and at any moment t. In order to facilitate the definition of risk margin, simplifications are allowed when projecting future SCR amounts.[14] The proportional approach is most commonly applied in practice, and such approach approximates a solvency capital requirement at the end of the year $t=1,2,...$ based on the best valuation of liabilities at the end of the very same year (BE_t), pro rata the relation between two values at the moment $t=0$:

$$SCR_t = BE_t \cdot \frac{SCR_0}{BE_0}, t = 1, 2, ... \tag{2}$$

In this way, it is ensured that the projected amount of SCR shall decrease over time in accordance with the expected run-off dynamics of liabilities under a given portfolio. The application of the proportional approach to the projection of future capital requirements in the computation of the risk margin can be illustrated by a hypothetical example of a portfolio with assumed period of four years. Let us take that the $SCR_0=80$ of monetary units, and the best estimate of liabilities $BE_0=500$ monetary units. We know the cumulative percentages of claims settled by individual years of the portfolio as well as the risk-free interest rates for given maturities (Table 1). We determine the value of SCR_t for $t=1,...,4$ based on formula (2) and discount it to the time of computation of the risk margin $t=0$.

[13] Hans Waszink, "Considerations on the Discount Rate in the Cost-of-Capital Method for the Risk Margin", *ASTIN Colloquium*, Hague, 2013, pp. 3.

[14] European Insurance and Occupational Pensions Authority (EIOPA), Guidelines on the Valuation of Technical Provisions, 2014, *https://www.eiopa.europa.eu/content/guidelines-valuation-technical-provisions_en*, accessed on 15. 1. 2021, pp. 21.

Table 1. Proportional approach to projecting future SCR amounts

Year t	Cumulative percentage of claims settled	Best valuation BE_t	Solvency capital requirement SCR_t	Risk-free interest rate p_t	Discounted solvency capital requirement $\frac{SCR_t}{(1+p_{t+1})^{t+1}}$
0	0%	500	80	0.75%	79.21
1	40%	300	48	1.00%	47.05
2	60%	200	32	1.00%	30.83
3	80%	100	16	1.25%	15.07
4	100%	0	0	1.50%	0
				Total	172.16

Source: Adapted from Arthur J. Zaremba, How to Estimate Risk Margins under Solvency II, 2012, *https://www.casact.org/education/spring/2012/handouts%5CSession_4857_handout_407_0.pdf,* accessed on 20. 1. 2021.

By applying formula (1) with the prescribed rate of costs of capital $CoC=6\%$, we arrive at the amount of risk margin in the below presented example:

$$RM=0,06 \cdot 172,16=10,33$$

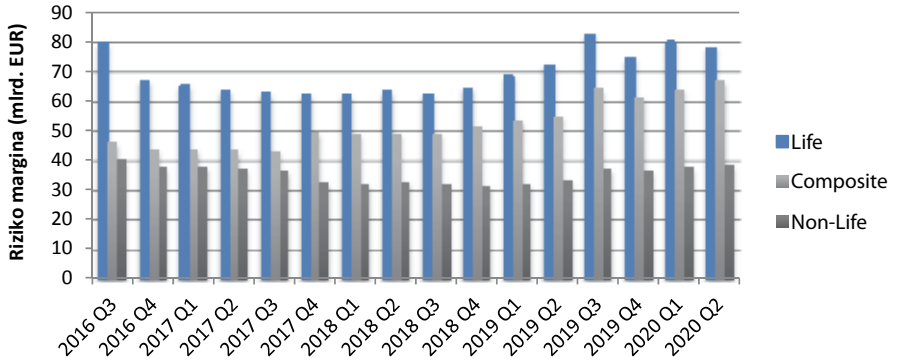
However, it is important to note that the existence of a multitude of simplified approaches to determining the risk margin opens up space for subjective reasoning. Thus, the problem of inconsistency in the valuation of technical reserves amongst insurers, which was already present in the Solvency I regime, has been maintained in the current regulatory regime of Solvency II.

III. Problem of Too High Risk Margin

Risk margin is a theoretical concept that should enable an insolvent Insurer to assign their portfolio to another Insurer. Thus, it is not intended to cover expected claims (which are covered by the best estimate), nor the surplus of actual as opposed to the expected claims (which should cover the solvency capital requirement). Therefore, the intention of the developers of the Solvency II regime was not to make the risk margin significantly affect the balance sheet of insurers. However, it turned out that the risk margin was significantly higher than expected. According to the data from the second quarter of 2020, the total risk-margin of insurers operating in the European Economic Area (EEA) exceeds 200 billion euros.[15] About 79% of this amount relates to life and composite insurers, whereby the share increases over time (Figure 1).

[15] European Insurance and Occupational Pensions Authority (EIOPA), Insurance Statistics, *https://www.eiopa.europa.eu/tools-and-data/insurance-statistics_en#Balancesheet,* accessed on 20. 1. 2021.

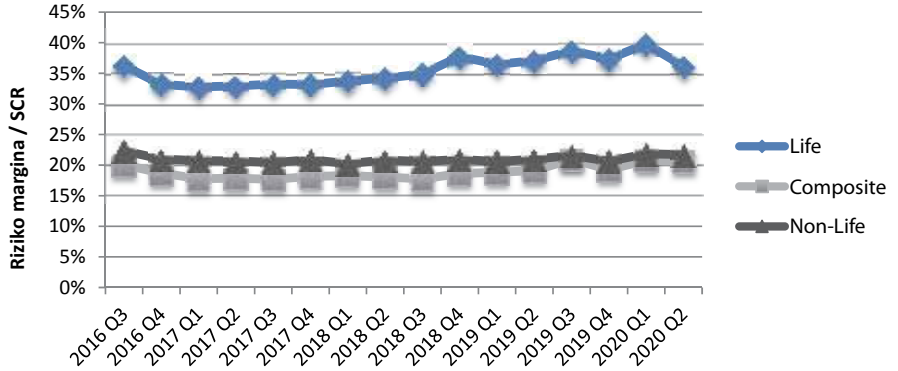
Figure 1 Risk margin of Insurers at EEA level



Source: Prepared on the basis of European Insurance and Occupational Pensions Authority (EIOPA), Insurance Statistics, *https://www.eiopa.europa.eu/tools-and-data/insurance-statistics_en#Balancesheet*

The risk margin of European life insurers on average reaches 40% of their solvency capital requirement (Figure 2). In four countries (Germany, the Czech Republic, the Netherlands and Norway), the risk margin of life insurers exceeds the 50% of SCR and in ten countries (Estonia, Greece, Ireland, Liechtenstein, Lithuania, Poland, Slovakia, Spain and the Great Britain) it ranges between 40% and 50% of the SCR.[16]

Figure 2: Ratio between the risk margin and SCR of insurers at the EEA level



Source: Prepared on the basis of the European Insurance and Occupational Pensions Authority (EIOPA), Insurance Statistics, *https://www.eiopa.europa.eu/tools-and-data/insurance-statistics_en#Balancesheet*

[16] Insurance Europe, Insurance Europe comments on the review of the Solvency II risk margin, 2017, *https://www.verzekeraars.nl/media/3673/insurance-europe-positionpaper-on-solvency-ii.pdf*, accessed on 12. 1. 2021, pp. 1.

The average share of the risk margin in the SCR for insurance groups at the EEA level amounts to 35%. In the case of particular insurance groups, the risk margin reaches or even exceeds the amount of the solvency capital requirement (Table 2).

Table 2: Risk margin of selected European insurance groups in 2019

	Risk margin (in bld.Eur)	Percentage share of risk margins in SCR
AXA	13.6	45.4%
BNP Paribas Cardif	41.3	70.9%
HDI	5.7	61.8%
KLP Group	12.9	91.1%
Munich Re Group	20.1	115.1%
NN Leaven	6.6	112.8%
Vienna Insurance Group	1.6	44.4%
Zurich	6.0	38.3%

Source: Prepared on the basis of the 2019 Report on Solvency and Financial Position for the mentioned insurance groups.

There are three possible reasons for high risk margin. First, the 6% rate of the costs of capital is relatively high. The Insurer with eligible own funds equalling the SCR and /or with a solvency ratio of 100%, as in the case of the reference insurer, has a corresponding credit rating of BBB.[17] Historically speaking, the credit spread of bonds with such rating ranged from 2 to 3%, which is significantly below 6%.[18] Of course, the assumption that one rate of costs of capital applies to the entire European insurance market is debatable, since this rate fluctuates between particular countries, lines of insurance [19] and the insurers themselves. Floreani (2011) marks that the very idea of the cost of capital of an insurer not being dependent upon their financial structure represents an interpretation of Modigliani and Miller's hypothesis on the irrelevance of the structure of capital that is based on unrealistic assumptions. Moreover, it is not logical for the rate of the costs of capital be fixed and not subject to revision under the fluctuating market conditions.

Second, at the time of defining the methodology for calculating the risk margin, valid macroeconomic conditions different from the present ones. After the

[17] Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS), Final CEIOPS' Advice for Level 2 Implementing Measures on Solvency II: Technical Provisions – Article 86(d) – Calculation of the Risk Margin, 2009, pp. 25.

[18] Insurance Europe, Insurance Europe Comments on the Review of the Solvency II Risk Margin, 2017, pp. 6.

[19] David J. Cummins, Richard D. Phillips, „Estimating the Cost of Equity Capital for Property-Liability Insurers", *Journal of Risk and Insurance*, 72(3), 2005, pp. 441–478.

2008 global economic crisis, there is a globally expressed phenomenon of dropping interest rates under the impact of monetary policy measures taken by leading central banks. Today, the interest rates are at a historically low level - close to zero, or even negative, depending on maturity and the country. When the interest rates are dropping, the present value of expected future cash flows from insurance liabilities increases. In other words, with a growing best valuation of liabilities, the solvency capital requirement based thereon and forming part of the computation of the risk margin, also grow. At the same time, the present value of projected capital costs is growing, since they are discounted at lower interest rates. Thus, record low interest rates affect the increasing risk margin on two grounds.

Third, the projected SCR is dominated by the capital requirement to cover the risk of longevity (because market risks are mostly not included in the computation), and this risk is projected for a huge number of years in the future, to which the risk extends. Therefore, high risk margin primarily affects insurers that offer multiannual services covered by guarantees.

The higher the amount of technical provisions, the greater the degree of certainty that insurance liabilities will be settled in full and within maturity dates. However, when the risk margin is too high, the insurers are forced to maintain financial assets that significantly exceed the expected costs of settling liabilities to the insured. This reduces the return for shareholders and increases the costs of capital for insurers, the burden of which is ultimately borne by the insured via higher insurance premiums.

IV. Problem of Risk Margin Sensitive to Interest Rate

Another problem related to the risk margin is that its level is sensitive to interest rate fluctuations to a much greater extent than is the best estimate of liabilities of the same portfolio. By introducing volatility to the balance sheet, the risk margin becomes a source of risk for insurers. Due to the method of its computation, the movement of the risk margin is inversely proportional to the movement of interest rates. In periods when interest rates are decreasing, the risk margin increases, and vice versa, in periods when the rates are increasing, the risk margin decreases.

However, it was noticed that the risk margin is more sensitive to the decline than to the growth of the interest rates. According to estimates of the Bank of England, a downfall in interest rates by 100 basis points increases the risk margin by 27%. If the interest rates were to rise to the same extent, the risk margin would be reduced by 20%.[20] A study conducted by the Association of British Insurers shows that, at the present 6% rate of cost of capital, a downfall in the interest rates by 200 basic points would lead to

[20] David Rule, Solvency II one year in, 2017, *https://www.bankofengland.co.uk/speech/2017/solvency-2-one-year-in*, accessed on 5. 2. 2021.

doubling of the risk margin. At the same time, the higher the level of the rate of costs of capital, the higher the sensitivity of the risk margin to changes in interest rates.[21]

Combined with low interest rates, the high and variable risk-margin primarily affects life insurers. Consequentially, changes appear in the scope and structure of the insurance proposals. Simultaneously with the reduced scope of guarantees in traditionally provided services, life insurers are gradually turning to services that are less sensitive to interest rates. First, they are increasingly promoting risk insurance over insurance with a savings component. Second, there is a growing importance of unit-linked products that allow insurers to assign the interest rate risk to the insured. In the past decade, the share of unit-linked services in total life insurance premium in the EEA increased by 5 percentage points.[22] This tendency is especially prominent in certain countries. In the UK, for example, the share of unit-linked services in life insurance premiums increased from 37% in 1985 to 82% in 2018. In the same period, unit-linked insurance premiums in Germany grew by as much as 300%.[23] However, the issue has arisen of protecting the interest of the insured, because it is not logical to expect the insured to be able to assume the investment risks and adequately manage them in the long run, as do the professional insurers.[24] It has also been observed that the European insurers, trying to reduce the risk margin, assign an increasing part of the portfolio through reinsurance into those jurisdictions where the Solvency II rules do not apply (which especially refers to the risk of longevity).[25]

As a final result, market competition decreases, the price of insurance grows, consumer choice options for the insured narrow down, the insurers are encouraged to regulatory arbitrage and the risk of longevity is largely transferred to the government.

V. Possible Solutions to the Problem of Too High Risk Margins Sensitive to Interest Rates

The conducted analysis shows that the problem of too high and interest-rate sensitive risk margin arises both from the method of its computation and from the

[21] Association of British Insurers, Comments Template on Consultation Paper on EIOPA's second set of advice to the European Commission on specific items in the Solvency II Delegated Regulation, 2018, *https://register.eiopa.europa.eu/Publications/Comments/Association%20of%20British%20Insurers_01_03_18.pdf*, accessed on 8. 2. 2021, pp. 54.

[22] European Insurance and Occupational Pensions Authority (EIOPA), Financial Stability Report, 2013–2020, *https://www.eiopa.europa.eu/type-content-document/ financial-stability-report_en,* accessed on 12. 2. 2021.

[23] International Association of Insurance Supervisors, *Global Insurance Market Report 2019*, Basel, 2020, pp. 34.

[24] Marija Koprivica, Martin Balleer, „Prospects of the Insurance Sector in a Low Interest Rate Environment", *Insurance Market After COVID-19* (editors Jelena Kočović, Tatjana Rakonjac-Antić, Biljana Jovanović Gavrilović, Branislav Boričić), Belgrade, 2020, pp. 156.

[25] Andrew Bulley, The new Solvency II landscape, 2016, *https://www.bankofengland.co.uk/speech/2016/the-new-solvency-ii-landscape,* accessed on 8. 2. 2021.

conditions in which the method has been applied. Therefore, possible solutions to solve or mitigate this problem include both the replacement of the existing method of computation with alternative methods, and its adaptation to current circumstances.

Having in mind that the prescribed rate of cost of capital is relatively high, it is only logical to propose to lower the rate to a level that is realistic for the insurance sector. The key argument in favour of such a solution is the fact that interest rates today are at a much lower level than at the time when the parameters of the risk-margin computation methodology had been defined. The 6% rate of capital cost was defined on the basis of the CAPM - Capital Asset Pricing Model, as a product of beta coefficient (a measure of systematic risk of the insurance sector) and market premium for the risk. Thereat, the assumed value of the beta coefficient is 1.20 and the market premium for the risk is 5%, with zero debt shares in the financial structure of the reference insurer.[26] However, recent empirical research shows that the beta coefficient without financial leverage (unlevered beta) of 0.5. is suitable for the insurance sector.[27]Consequently, an adequate rate of the cost of capital when calculating the risk margin would be 0,5·5=2,5%. With a somewhat more conservative valuation, it would be reasonable to assume that this rate should amount to 3%. Similarly, the capital expenditure rate proposals formulated so far range from 2% [28] to 4.5%.[29] Lowering the rate of cost of capital may contribute to resolving the problem of too high risk margin, but not its relative sensitivity to fluctuations in interest rates.

Another possibility is to replace fixed rate of costs of capital with a variable one. Thus, for example, the rate of the costs of capital may vary according to the fluctuations of risk free interest rates used for discounting the projected costs of capital. This would reduce the problem of risk margin volatility in multiannual lines of insurance business, because the changes in the rate of costs of capital would compensate for fluctuations in the discount factors. However, it should be borne in mind that such a solution may lead to an increase in the volatility of the risk margin in short-term lines of business, where it is significantly more sensitive to the rate of capital costs than to discount factors.[30] Therefore, the rate of the costs of capital

[26] Actuarial Association of Europe, A review of the design of the Solvency II risk margin, 2019, *https://www.actuary.eu/wp-content/uploads/2019/12/Solvency-II-Risk-Margin-FINAL-1.pdf,* accessed on 9. 2. 2021, pp. 30.

[27] Aswath Damodaran, Betas by Sector, 2021, *http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ Betas.html,* accessed on 9. 2. 2021.

[28] CRO Forum & CFO Forum, Comments Template on Consultation Paper on EIOPA's second set of advice to the European Commission on specific items in the Solvency II Delegated Regulation, 2018, *https://register.eiopa.europa.eu/Publications/Comments/CRO%20Forum%20and%20CFO%20Forum_01_03_18.pdf*, accessed on 12. 2. 2021, pp. 53.

[29] Institute and Faculty of Actuaries, Solvency II Practical Review, 2019, *https://www.actuaries.org.uk/practice-areas/general-insurance/research-working-parties/solvency-ii-practical-review,* accessed on 12. 2. 2021, pp. 11.

[30] Andy Pelkiewicz, Waqar Ahmed, Paul Fulcher, Katie Johnson, Stuart Reynolds, Richard Schneider, Andy Scott, *A review of the risk margin – Solvency II and beyond,* Institute and Faculty of Actuaries, London, 2019, pp. 14.

may vary depending on the line of business, as well. Alternatively, the rate of costs of capital may decrease with increasing maturity of the cash flow to which it relates.

The subject-matter of modification within the existing method of costs of capital may also comprise the risk-free interest rates at which costs of capital are discounted. Their increase through adjustment mechanisms that are already applied for the purposes of calculating the best estimate would contribute to lowering the risk margin and its sensitivity to interest rates. The adjustments to the risk-free interest rate curve are an integral part of the package of measures for services with long-term guarantees, introduced by the 2014 Omnibus II Directive. Due to reaching compliance between the long-term liabilities with long-term investments, short-term fluctuations in asset prices do not reflect real changes in the financial position and risk exposure of insurers. Therefore, such measures should mitigate the "artificial" volatility in the balance sheet of insurers, so that when evaluating the liabilities, only partial market trends shall be taken into account. Adjustment of risk-free interest rates is realized in the form of a fixed addition to the liquid part of the yield curve, which is then extrapolated (*Volatility Adjustment*) or in the form of a parallel shift of the entire yield curves upwards (*Matching Adjustment*).[31] Under the valid regulations, these measures are applied only when calculating the best estimate for services with long-term guarantees. A rational solution would be to expand their application to the computation of the risk margin, in order to affect the reduction of the overall technical reserves and their volatility in the same group of services. As an alternative solution, Waszink (2013) suggests that risk-free interest rates be replaced by higher rates, which would be equal to the capital cost rate.

More radical solutions imply the introduction of the upper limit of risk-margin (e.g. as a defined percentage of the solvency capital requirement)[32] and/or that, instead of the capital costs method, another method of calculating the risk-margin be applied. According to the classification of the International Association of Actuaries, all defined methods of calculating the risk margin are classified into one of four categories: quantile methods, capital cost methods, methods based on conservative assumptions or on discounting future cash flows.[33]

Under quantile methods, the risk margin is determined as the balance between the corresponding percentile of the probability allocation of insurance

[31] Directive 2014/51/EU of the European Parliament and of the Council of 16 April 2014 amending Directives 2003/71/EC and 2009/138/EC and Regulations (EC) No 1060/2009, (EU) No 1094/2010 and (EU) No 1095/2010 in respect of the powers of the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority), *Official Journal of the European Communities,* 2014/51/EU, Art. 77b, 77d.

[32] Dick Rae, Aisling Barrett, Dylan Brooks, Meshali Chotai, Andy Pelkiewicz, Chen Wang, „A review of Solvency II: Has it met its objectives?", *British Actuarial Journal, 23*(4), 2017, pp. 17.

[33] International Actuarial Association, *Measurement of Liabilities for Insurance Contracts: Current Estimates and Risk Margins,* Ottawa, 2009, pp. 71.

liabilities and the best estimate, as the expected values of such allocation. For this purpose, the 75th percentile of the allocation of insurance liabilities is usually taken.[34] In this way, we acheive that the total technical reserves equal the value at risk (*VaR*) of the given allocation at the selected level of confidence (e.g. 75%). Such an approach is justified if the probability allocation of insurance liabilities is relatively symmetrical. Otherwise, with very asymmetric allocations, it can lead to underestimation of technical provisions. In such situations, it is more appropriate to apply Conditional Value at Risk (*CVaR*), which reflects the average of all values of liabilities that exceed VaR.

Moreover, there are such methods by which the risk margin is reached implicitly, based on conservative assumptions that should ensure that the amount of technical provisions exceed the best estimate of insurance liabilities. Such is the case, for example, with the choice of maximum development factors when applying the *chain ladder* provisioning method. A similar effect is achieved by lowering interest rates at which the expected future cash flows are discounted by way of insurance liabilities. In this case, the methods base on discounting future cash flows, as a special case of methods based on conservative assumptions. With such a way of valuation of insurance liabilities, there would be no need for explicit computation of the risk margin because it would already be included in the total value of technical reserves of the insurers.

VI. Conclusion

In the past implementation of Solvency II, several areas have been singled out that call for the improvement in order to make the new regulatory regime for European (re)insurers effective and justify high investments in its long-term development. One of the most controversial segments of the regime is the risk margin as an element of the technical provisions of insurers. As a consequence of inadequate prescribed values of the parameters of the capital cost method, but also of the actual low interest rates environment, the risk margin is set too high and is variable. This generates high costs for insurers, increases the volatility of their balance sheet and triggers the regulatory arbitrage. The final effect is a reduction in market competition, an increase in insurance prices and narrowing down of consumer choice for the insured.

The paper presents particular proposals for overcoming or mitigating the problem of risk margins which are set too high and are sensitive to interest rates. The proposed solutions include modifications to the current capital cost method (lowering and varying the capital cost rate, that is, increasing the risk-free interest

[34] Anthony Brown, Demystifying the Risk Margin: Theory, Practice and Regulation, 2012, *https://sias.org.uk/media/1191/demystifying-the-risk-margin-theory-practice-and-regulation.pdf*, accessed on 29. 1. 2021, pp. 7.

rates at which capital costs are discounted), as well as abandoning this method and replacing it with other risk margin computation methods (quantile methods, methods based on conservative assumptions or on discounting future cash flows).

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