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FLOOD RISK

In June 2019 the International Actuarial Association (IAA) launched the Working Group Discussion Paper on Flood Risk. In a webinar on 23 October it was further discussed. With their permission The European Actuary publishes the executive summary of the paper.



Although water is an essential ingredient of life, floods can threaten life and property. The objective of this paper is to inform readers of the nature of flood risk from an actuarial perspective, including the issues and challenges associated with managing flood risk, which has financial, political, social, and indeed emotional components.

After a formal definition of flood and detailed description of the major types of floods and their consequences, this paper describes the components of flood risk, flood hazard, and flood vulnerability, and identifies the drivers of flood risk.

Losses associated with floods can be extensive. Often, those who are most vulnerable are also those who can least afford the losses. For those who are already poor, floods deepen their poverty, add misery, and strain limited available public or charitable resources.

A risk management process can be applied to flood risk. This process involves multiple steps, including feedback loops, as underlying conditions and expectations are dynamic in nature. Both qualitative and quantitative considerations are needed to address flood risk, including concentration risk, related perils, and stakeholder behaviour. Private and public stakeholders need to be involved in this process, especially as various means of mitigating risks and financing damages are likely to be required. Being prepared for and reacting to disasters in a timely manner can significantly reduce consequential damages.

Insurance, whether offered by the private sector, the government, or a public-private partnership, can address the financial effects of damages following a flood. Key considerations in the design of an insurance program are discussed, including the protection gap, pre- and post-event financing, and the

use of subsidies in insurance rating programs.

THERE ARE SEVERAL CONSTRAINTS that affect the development and maintenance of effective flood risk management. This is partly the result of the many stakeholders involved, each with differing risk perceptions influenced by their own interests. These perceptions can represent a difficult concept for individuals, businesses, and even insurers to grapple with and communicate. Recent enhancements in availability of data and advances in modelling may help overcome some of these obstacles. Flood risk is a moving target, significantly influenced by human activities and global climate trends. Its dynamic nature poses unique challenges for public policy planners and leads to many difficult social and political questions. Changes may be needed in many areas, especially in how policymakers think about ►

building codes and land-use development.

Due to their experience and skills, actuaries can develop proper analysis and provide practical and sound advice to facilitate appropriate decisions with respect to flood risk management, including the design and pricing of flood insurance products.

The acquisition of high-quality flood-related data is usually very difficult, as granular data related to many different risk factors are required to accurately estimate the expected losses and distribution of losses for a particular property or

area. In addition, conditions, data, and information are constantly changing, leading to uncertainty in the quantification of flood risk. Developing flood premiums is especially difficult given the catastrophic nature of flood losses, where large and infrequent losses, which cannot be projected with precision, tend to cause most of the loss. Currently, catastrophe models are a critical tool in the ratemaking process and will be even more so as they continue to be enhanced.

GOVERNMENTS NEED TO PLAY A CENTRAL ROLE in managing flood risk. This role involves managing critical infrastructure

and enacting building codes and land-use policies to reduce loss exposure. Governments also create the flood risk management process and flood insurance framework within which private sector and government insurance programs operate. Many countries have built unique programs to finance and manage flood losses suited to their local or regional conditions, examples of which are described in the paper. Nevertheless, they share certain similar features. Understanding the differences in private sector and government insurance programs, as well as the unique drivers for such programs, is critical to actuaries' ability to provide support to these programs. ●



PENSIONS IN FRANCE MAJOR CHANGES ARE UNDERWAY...

BY **FRANCOIS CHEYNET**

We are on the eve of major transformation of the retirement landscape in France!



The French government is in the process of reforming the state pension system, but this is not the only change under way. The government has also enacted legislation in order to modernise corporate supplementary pension plans and individual pensions.

By putting the various reforms into perspective, we are now able to discern the government's priorities and to shape the framework of the new pension system in France.

This new framework should be simpler, more equitable, and easier for everyone to understand. The government's ambition is to promote savings for retirement. Companies will continue to play a major role in retirement provision and will be able to offer more flexible and more efficient pension vehicles for their employees.

Vested and portable pension rights are encouraged in order to allow employees to change companies or countries within the European Union.

Lastly, the government aims to encourage pension investments in shares. ►



REFORM OF STATE PENSIONS

- Simplification
- Systemic reform
- A unique universal plan

REFORM OF COMPANY DEFINED CONTRIBUTION PENSIONS

LOI PACTE – ART. 71

- Simplification
- Financing the real economy
- Stimulation of competition

REFORM OF COMPANY DEFINED BENEFIT PENSIONS

LOI PACTE – ART. 197

- Vested rights
- Mobility of workers in Europe
- New pensions vehicle

BACKGROUND

Three legal texts are going to completely redesign the pension framework in France. These texts (already enacted or in preparation) concern both mandatory pension plans (basic and complementary) and corporate (supplementary) pension plans.

We look at each of these elements of the pension reform in turn.

REFORM OF STATE PENSIONS

Jean-Paul Delevoye's report to government dated 18 July 2019; Draft law expected to be tabled in parliament before summer 2020.

The state pension reform will create **a single universal plan** for all French people to replace the 42 mandatory schemes (basic and complementary schemes) that currently exist.

The objective of this structural reform is to provide greater clarity and equity.

The main provisions would be as follows:

- Pay as you go system with points
- A return ratio (*rendement*) of 5.50%; which means that a €100 contribution generates a €5.50 annual pension
- Contributions: 25.31% of wages capped at 3 times the Social Security Ceiling (around €120,000) plus 2.81% of total wages
- Split of contributions: 60% employer; 40% employee
- Accrued rights, converted into points in the universal plan, are guaranteed
- Effective date: January 1, 2025 with a 15-year transition period
- No impact for current retirees and people born in 1962 or before

In the coming months, the reform will be explained, discussed and negotiated with the French people, unions and employer representatives. For this reason, the government may yet agree some concessions or adjust the proposals depending on the balance of power and the social climate.

In particular, there is a lot of discussion going on about the age at which individuals may take an unreduced pension. While initially it was suggested that an unreduced pension would be available from age 64, the general consensus appears to be moving in favour of linking this to a minimum number of years of social security contributions (e.g. retaining the current requirement of 43 years of contributions).

REFORM OF COMPANY DEFINED CONTRIBUTION PENSION PLANS

Article 71 of the law PACTE enacted on 22 May 2019; Government order dated on 24 July 2019; Application decree dated on 30 July 2019

A new type of defined contribution (DC) pension plan is being introduced: *the Plan d'Épargne Retraite* or PER.

These new plans will be launched on 1 October 2019 and will replace all current supplementary DC plans, including the current DC pension plans (*Article 83*), PERCO, PERP, and Madelin plans. ►



The new PER will have three sections:

PLAN D'ÉPARGNE RETRAITE – PER

1. INDIVIDUEL

Contributions: Voluntary by participants

Benefits: Lump sum or annuity

2. ENTREPRISE COLLECTIF

Contributions: Profit sharing, incentive, and matching contributions by employer

Benefits: Lump sum or annuity

3. FIDELISATION

Contributions: mandatory by employer and employees (previously in Art. 83 plans)

Benefits: Annuity only

PER providers will be insurance companies and banks / asset managers. This will open up the market and require development from providers in terms of investment options – under the current system DC pension plans are provided by insurers and PERCOs are provided by banks / asset managers.

One of the objectives of the reform is to encourage plan participants to invest their pension assets more appropriately for the long term. The default investment option is to incorporate a lifecycle-type investment strategy (*gestion pilotée*), where the exposure to equity investments and risks is adjusted based on the participant's investment horizon. Currently many pension assets are still invested in government and corporate bonds via insurance company funds (*fonds en Euro*).

We have identified four major improvements:

- Participants' voluntary contributions become deductible for income tax (within certain limits) – this is not the case for the current PERCO.
- With the exception of mandatory contributions (section 3) for which the benefit at retirement must be paid in annuity, participants may now choose to take their benefits as a lump sum at retirement – this is not the case for funds built up from the voluntary contributions in the current *Article 83* DC pension plans.
- Benefits may be taken earlier in specified circumstances, which include: death, invalidity, unemployment (after the insurance benefit runs out), and, for the sections 1 and 2 only, the purchase of the employee's principal residence.
- For companies, the current tax on mandatory contributions (*forfait social*) is reduced from 20% to 16% (under certain conditions)

The PER will be commercialised by insurers or banks as from 1 October 2019. A transition period is set to allow for transferring the existing plan assets to a new PER arrangement.

With the PER, the government wants to offer French people an efficient vehicle for long-term pension investment. Through the introduction of PERs, the government also hopes to see French retirement plans play a greater role investing in the economy through public and private markets, in the same way as pension funds in other European countries. By extension, the government would also like to see some of the assets currently invested in insurance company funds (*fonds en Euro*) redirected towards funds more favourable for financing the economy. ►



REFORM OF COMPANY DEFINED BENEFIT PENSION PLANS

European directive 2014/50/UE dated on 16 April 2014, Article 197 of the law PACTE enacted dated on 22 May 2019; Government order dated on 3 July 2019

The changes for defined benefit (DB) pension plans will take effect from 1 January 2020. They implement the provisions of the EU Directive 2014/50, also known as the *Portability Directive*.

A typical supplementary DB plan in France will pay benefits to employees at retirement only if the employee is still in employment with the company at that time. This will change going forward: benefits will vest and DB plans will need meet specific conditions to benefit from favourable tax treatment.

These conditions include:

- The plan benefit is an annuity at retirement
- A maximum accrual rate of 3% of annual salary
- Pension rights must be accrued each year, it is not permitted to retrospectively grant pension rights for prior years of service
- An overall maximum benefit of 30% for the employee's whole career with all of their employers
- The accrued rights are revalued each year for both active and deferred members at a rate of up to the annual revaluation of the Social Security ceiling.
- For corporate officers and employees with annual remuneration in excess of 8 times the Social Security ceiling (approximately €325,000), benefit accrual is subject

to satisfying performance conditions

The changes apply to all new DB plans that are set up after 3 July 2019.

The effect for existing supplementary DB plans varies:

- DB plans still open to new entrants after 20 May 2014 (the publication date of the Directive), are closed to new entrants with effect from 4 July 2019 (if they were not closed earlier) and benefit accrual for existing participants stops on 1 January 2020. However, participants' accrued benefits can retain a link to future salary increases. There is no change to the vesting requirements for the accrued benefits: for a typical plan the non-vested accrued benefits would only be paid if the employee retires from active service.
- DB plans closed to new entrants before 20 May 2014 are not affected by the changes. Participants can continue to accrue future service benefits under the old rules.

CONCLUSION

In the coming months, the government will need to communicate further on the proposed state pension reforms in order to convince the French people, unions and employer representatives that the new **single universal plan** is good for the country.

Whether the government is successful in introducing the state

pension reforms depends crucially on its ability to negotiate with all stakeholders in the current difficult social climate in France.

While these reforms may result in some challenges in the short term, the new French pension system should be simpler, more equitable and easier for everyone to understand. The long-term sustainability of the state pension system should also be improved.

With all these changes, there is plenty for employers to consider in restructuring their pension plans to fit with the new framework. ●

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COST OF CAPITAL METHOD CAN STILL PROVIDE ADDITIONAL INSIGHT UNDER IFRS 17

BY **JASPER HOOGENSTRAATEN**
AND **SERVAAS HOUBEN**

EXECUTIVE SUMMARY

In the previous TEA article on the IFRS 17 risk adjustment as part of the technical provisions we have argued that the differences between Solvency II and IFRS 17 will provide insurance companies with room for their own interpretation under IFRS 17 as the risk adjustment should be a reflection of the company's risk profile and their own risk appetite.

The Cost of Capital (CoC) method and Confidence Interval

(CI) method are two common techniques for determining the risk adjustment as a buffer for non-financial risks. In this article we will look at a practical example to assess the impact on the choice of methodology.

Although IFRS 17.119 does prescribe disclosure of the CI level corresponding to the risk adjustment value, we will argue that using the CoC method to actually determine the risk adjustment will still provide

additional insights and might better align the current and future balance between risk and capital of the specific insurance company involved.

IFRS 17 OPPORTUNITIES

As mentioned in the previous article the Solvency II risk margin is based on the principle of transferring liabilities to a third party while the IFRS 17 risk adjustment is based on the principle of a going concern. ►

	Solvency II Risk Margin	IFRS 17 Risk Adjustment
Valuation perspective	Transfer to third party	Going concern own entity
Scope	All relevant SCR risks including operational risk and non-hedgeable financial risk	Contract specific non-financial risk only
Valuation method	Cost of capital	Own estimation technique
Stress level	99.5% following SCR	Dependent on company's own degree of risk aversion
CoC rate	6%	Not predefined, can be company specific or other method may apply
Shock type	Unfavourable outcomes	Assess risk aversion to favourable and unfavourable outcomes

Although IFRS 17 does not prescribe a methodology to determine the risk adjustment and allows for a more company specific interpretation, IFRS 17. B91 does list the following characteristics a risk adjustment metric would require:

- Low frequency high severity risks should be reflected in a higher risk adjustment compared to high frequency low severity risks.
- Risks with longer durations would be reflected in a higher risk adjustment. E.g. lifelong annuities would require a higher risk adjustment compared to temporary annuities;
- The wider the distribution of the risk, the higher the risk adjustment. More uncertainty around risks would require a higher buffer;
- The less information that is known about the current risk and future trends the more risk adjustment is needed. E.g. in countries with little mortality (trend) data the risk adjustment would be higher than for countries with more data;
- When emerging experience reduces uncertainty, the risk adjustment decreases. During the term of a temporary annuity portfolio, it will become clearer what the actual vs expected cash flows will be and hence the risk adjustment will decrease.

As both the CI and CoC method take into account the requirements mentioned above, they are both suitable techniques to determine a risk adjustment.

ANNUITY PRODUCT

Consider a lifelong annuity product from age 65 with annual payments of 1 and a flat discount rate of 3%. For this example the following capital costs apply:

TABEL 1: COST OF CAPITAL ASSUMPTIONS

Method	Cost of Capital
Cost equity financing	10%
Cost debt financing	6%
Allocation equity financing	40%
Allocation debt financing	60%
Weighted average cost of capital	7,6%

One of the main risks for such a product potentially resulting in the cash flows deviating from the best estimate cash flows is mortality.

We assess the impact of a mortality level down stress with the following shocks¹ and distribution assumptions:

TABLE 2: DISTRIBUTION PARAMETERS AND SHOCK ASSUMPTIONS

CI shock	70%
CoC shock	99,50%
Longevity mean	1,0
Longevity standard dev	0,1

The CI method is based on a projection of the technical provision at the chosen confidence level (i.e. 70%) and implicitly only applies a stress to the best estimate liability (BEL) which at time zero will result in the following capital requirement:

Table 3: CI capital requirement

Time	ax (BEL)	ax (down)	Capital requirement
0	15,04	15,26	0,23

¹ Confidence interval i.e. compared to the mean of 50%

The CoC method instead applies a stress for each time during the term of the contract.

Figure 1 compares the best estimate reserve to the stressed reserve, the difference between the two being the capital requirement.

Figure 1 displays a decreasing capital requirement for mortality risk during the lifetime of the policy. These future capital requirements are finally transformed to a cost of capital for each future period by determining the net present value of all future capital requirements multiplied by the WACC%. In this example this would result in a total of 2,138.

Not surprisingly, in the case of an annuity – a product with a long duration – the CoC calculation, explicitly taking into account a stress at future periods, will result

in a higher capital requirement compared to the CI method.

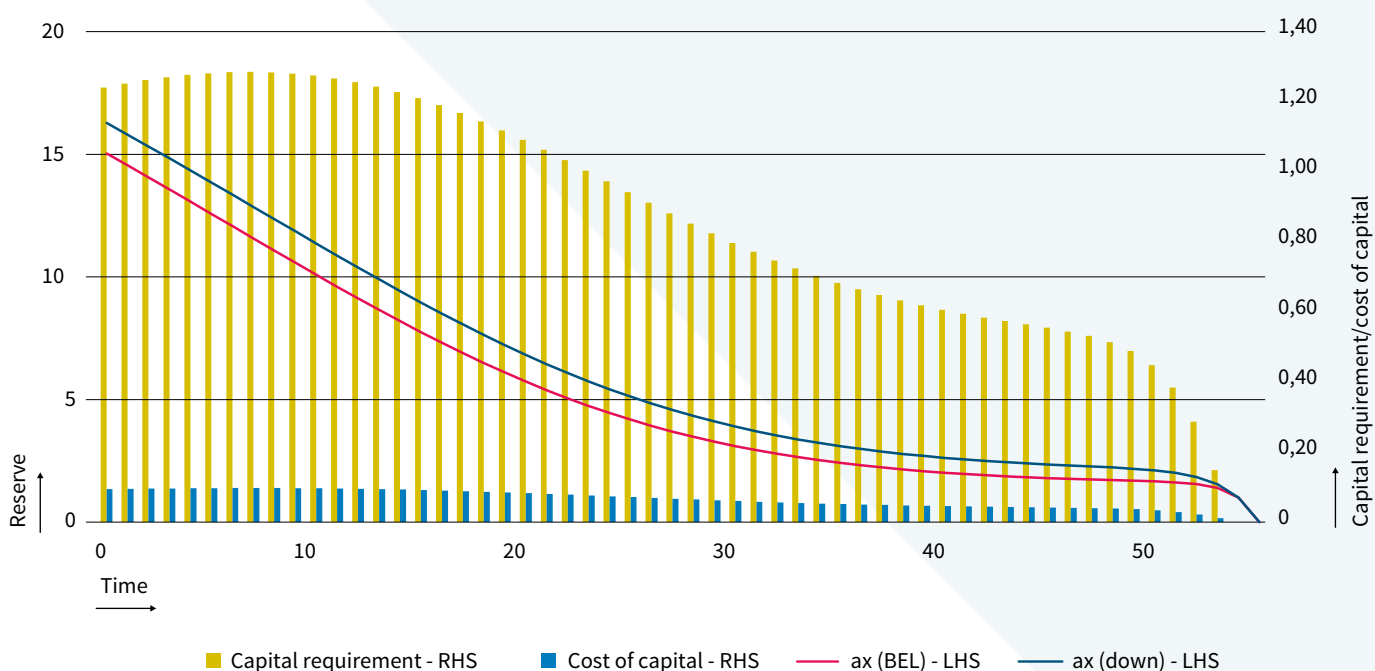
Suppose however that the insurance company's long term capital strategy is to increase its financing by means of equity from the current 40% to a level of 60% over a period of 20 years (an increase of 1%-point per year). This has an impact on the WACC since equity financing is considered to have a higher cost of capital following table 1. While the CI level will provide the same risk adjustment number (as only the CI level at time 0 is taken into account) the CoC method will result in a different risk adjustment instead (i.e. an increase to 2,274) reflecting the change in capital structure during the projection period. Therefore the CoC method seems to better reflect the changing environment of the insurance company over time.

CONCLUSION

IFRS 17 allows insurance companies to use their own risk appetite and CoC interpretation while determining the risk adjustment. This will not only allow them to let the risk adjustment be more in line with their own view on risks but will also allow them to potentially adjust their capital funding to optimize the balance between capital and risk.

The straight-forward example discussed in this article shows that with limited effort and analysis, a substantial insight can be derived in both risk assessment and capital funding. Extending the analysis with assumptions and views on different risks and diversification benefits, will further enhance the understanding of the interaction between risks and capital. ►

FIGURE 1: COC PROJECTION OF RESERVES AND CAPITAL REQUIREMENT OVER TIME



Although IFRS 17.119 prescribes companies to disclose their risk adjustment on a CI level, the CoC approach is still a valuable alternative as it takes into account the duration of the liabilities and potential changes in capital funding and can therefore be a longer term counterweight to more short term measures.

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LAST CALL FOR PARIS 2020 PAPERS: DEADLINE 15 NOVEMBER 2015!

The Institut des Actuaire is hosting in Paris from May 10th to May 14th, 2020 an actuarial colloquium on the topic “Individual Choices facing Societal Changes for the 5 following sections from the International Actuarial Association (IAA): AFIR-ERM, ASTIN, LIFE, PBSS and IACA. This colloquium will take place in a prestigious setting the *Palais Brongniart* (the former stock exchange) in Paris and will bring actuaries from all around the world.

The call for papers is open. Authors are kindly requested to send their abstract to the website <https://www.actuarialcolloquium2020.com/categorie-1428.html?lang=1> by November 15th 2019.



CDC

BY **HILARY SALT**

We were of course all expecting that we might have seen a Pensions Bill by now. I'm disappointed it has been put back as one of the items in it – the introduction of legislation allowing Collective Defined Contribution (CDC) pension schemes – is sorely needed.

That need arises from the fact that most working people want a regular income in retirement – one that arrives each month like their pay did and one they can rely on being paid until they die.

“The alternative leaves people with a real risk of under or over-spending”

Individual money purchase schemes – the scheme into which most people are being auto-enrolled - are largely not able to do this as converting a pot of money into an annuity at retirement costs a mind boggling amount. And the alternative – drawing down on the pot as it's needed, leaves people with a real risk of under or over-spending. And whilst the management of a pot might be quite an interesting pursuit for a 70 year old, we really can't expect people in their 90s to have the energy or inclination for quite complex financial management.

At the same time, defined benefit schemes are becoming less and less common – especially in the private sector and especially for anyone moving jobs who is likely

to find that the DB scheme at their new employer is closed to new entrants.

So we've ended up in a position where the pensions industry is unable to provide a pension – and we need the CDC legislation to resolve the problem.

Our current position stems from the fact that we've become unable to separate the provision of long-term income from the need to invest the backing assets in gilts and bonds. That in itself needn't be a problem. At times in history, gilts have yielded good real long-term returns. But now buying a UK gilt means locking into a negative real rate of return – so each £1 of future income in real terms you want to buy, costs more than £1 today. No wonder that doesn't look like a good deal to those considering annuities.

“Incoming contributions can be used to pay outgoing benefits”

So how does CDC solve this problem? In a CDC scheme, there are no individual money purchase accounts. Instead assets are pooled – so money regains that

great advantage of fungibility – the money you contribute doesn't have your name on it. The key advantages are first that incoming contributions can be used to pay outgoing benefits – this saves two lots of investment expenses. But it also means that assets can be invested for the long term in more volatile asset classes which we expect to produce a good real long-term return. The second bit of actuarial magic is that without individual pots, members can share longevity risk. If you save as an individual then drawdown in retirement, you may need to save 40 years worth of income to have a high probability that you won't run out of money. But if 1000 of you save, you can all just save for 20 years of income as that's what you'll need on average.

It's often assumed that CDC will only be of interest to employers trying to find a less difficult way to close a DB scheme. Certainly the first adopters Royal Mail are looking for a way to achieve a settlement with the Communication Workers Union, are from this background.

But in my view, the far more important demand for CDC ►

will come from those with individual DC pots looking to find a way to drawdown. At the moment, they can only share risk with others by going down a route (annuitisation) that forces them into investment in gilts guaranteeing negative returns. CDC allows risk sharing without having to give up on productive investment. So I'd expect the master trusts to want to provide CDC options to members.

Whilst it's possible to design CDC in lots of different ways, there is no requirement in CDC to aim to smooth investment returns. Building up a buffer in a CDC scheme means holding back assets from the current generation of pensioners to benefit future generations. In my view it's far better for CDC schemes to fund on a central neutral estimate basis – so distributing profits and sharing losses as they arise and minimising intergenerational transfers.

In the proposed Royal Mail scheme, this is done by setting a target benefit of 1/80th of pension for each year. The benefit revalues both before and after retirement at the annual rate that can be afforded by the scheme if that rate were paid to all members forever. The scheme is funded to pay an annual inflationary increase. But if its assets are insufficient to meet the benefits increasing at this rate (assessed on a market neutral basis) then the increase might be scaled back in any one year - to say inflation less 0.5%. In some years no increase might be paid. As a pension increasing each year with



inflation is worth about twice the value of a non-increasing pension, scheme funding would need to fall to below 50% before a reduction in the headline target rate would be triggered.

“So we will need to get much better at keeping in touch”

With CDC communication is key – members need to know that benefits can be reduced – or fail to increase. That can also happen

to pensioners – who we typically communicate with very little – so we will need to get much better at keeping in touch.

It's difficult to predict when it might be possible for a Pensions Bill to proceed. But I'm hoping it will be soon – so we as a pensions industry can get back to providing pensions – this time round using CDC schemes. ●

Note: this article is written based on information as of October 2019.

SOLVENCY II'S ONE-YEAR TIME HORIZON:

A REFINED APPROACH FOR NON-LIFE RISK MARGINS

BY **MARK SHAPLAND**



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European results published by EIOPA at year-end 2018 for the solo Non-Life insurance companies during financial year 2017 show that the risk margins account for 5,7% of the Technical Reserves, which is a total of over €36B.

While the standard formula is predominantly used for these calculations, 79 Non-Life entities (out of a total of 1.598) use a full or partial internal model, implying they are making their own evaluation of their reserving risk.

A COMPLEX QUANTIFICATION

Traditionally, reserving risk considers risk over the remaining lifetime of liabilities (i.e., ultimate time horizon) and early models designed to quantify this risk focused on the standard deviation of the outstanding reserves, including uncertainty for both parameter risk and process risk. Under Solvency II, reserving risk takes on a different meaning, based on the change

in the estimated ultimate loss over a 1-year time horizon, which accounts for the payments during the 1-year time horizon and the consequences for future payments (i.e., the change in reserves) after the 1-year time horizon. A number of models – most notably those developed by Mack in 1993 and later refined by Merz and Wüthrich – have provided insurers well-thought-out and documented approaches for determining reserve variability and estimating unpaid claims on an ultimate time horizon and 1-year time horizon, respectively.

A Capital Profile based on the runoff of a Mack model can be used directly for estimating an ultimate time horizon risk margin (which could also serve as the basis for a risk adjustment under IRFS 17).¹ In order to produce a Capital Profile for a 1-year time horizon risk margin as required under Solvency II, however, the runoff of the Merz and Wüthrich model requires some extra steps. ►

¹ The *Capital Profile* is defined as the runoff of required capital.

This is because a reconciliation between the two approaches used by Mack and Merz & Wüthrich shows that the full variance is not included in the unpaid claims runoff for the Merz-Wüthrich model beyond the first year. This is the intended result, but it is an outcome that, if overlooked, could lead insurers to underestimate their Solvency II risk margins.

These models focus exclusively on an accident-year perspective of claims development, which is natural given the common configuration of reserving data into accident-year triangles. Insurers however need a calendar year view to produce a capital profile for use in calculating a risk margin under Solvency II and a risk adjustment under IFRS 17.

THE STARTING POINT

Taking as a reference the main triangle studied in their paper² and comparing its runoff calculation for the Mack and Merz-Wüthrich models using the total rows from **Figures 1** and **2**, the results show the standard deviation for the 1-year time horizon is 72,7% of the standard deviation for the ultimate time horizon at valuation period 0. This makes sense since the 1-year time horizon only includes the parameter variance beyond the first diagonal.³

For the first year, the oldest accident period only contains a cell from the first diagonal (i.e., the 1-year time horizon) so the standard deviation of 75.535 is the same as for Mack. By summing all of the variances in the runoff for Merz-Wüthrich, the TOTAL column matches all of the Mack estimates (i.e., they reconcile).⁴ ►

2 The data used for all the figures is from the well know Taylor & Ashe paper.

3 The covariance adjustment (CVA) row in Figures 1, 2, and 3 is the additional variance between periods included in the total row.

4 The TOTAL column in Figure 1 is calculated as the square root of the sum of the squares for the other columns.

FIGURE 1: CALENDAR YEAR RUNOFF OF MERZ-WÜTHRICH STANDARD DEVIATIONS ON A SAMPLE TRIANGLE

Runoff of Merz-Wüthrich Model – Standard Deviations by Time Window										
Year	1	2	3	4	5	6	7	8	9	TOTAL
1	-	-	-	-	-	-	-	-	-	-
2	75.535	-	-	-	-	-	-	-	-	75.535
3	105.309	60.996	-	-	-	-	-	-	-	121.699
4	79.846	91.093	56.232	-	-	-	-	-	-	133.549
5	235.115	60.577	82.068	51.474	-	-	-	-	-	261.406
6	318.427	233.859	57.825	82.433	51.999	-	-	-	-	411.010
7	361.089	328.989	243.412	59.162	85.998	54.343	-	-	-	558.317
8	629.681	391.249	359.352	266.320	64.443	94.166	59.533	-	-	875.328
9	588.662	554.574	344.763	318.493	236.576	56.543	83.645	52.965	-	971.258
10	1.029.925	538.726	511.118	317.142	293.978	218.914	51.661	77.317	49.055	1.363.155
CVA	1.025.050	676.444	449.236	288.887	164.691	92.828	57.595	24.085	-	1.353.961
Total	1.778.968	1.177.727	885.178	607.736	428.681	267.503	128.557	96.764	49.055	2.447.095

This is the intended result for the Merz-Wüthrich model, but England, Verrall & Wüthrich suggest in their paper *On the Lifetime and One-Year View of Reserve Risk, with Application to IRFS 17 and Solvency II Risk Margins* that the runoff in **Figure 1** can be used with the cost of capital method to calculate the risk margin for Solvency II.

However, comparing the runoff of Merz-Wüthrich with the runoff for the Mack model in **Figure 2**, the 1-year time horizon standard deviations at the top of each column do not match the same values for Merz-Wüthrich. This is because the full variance is included for the first year, but beyond that year, only part of the variance is included in the runoff of the Merz-Wüthrich standard deviation.

A MODIFICATION

To address this point, an adjustment to the calendar year runoff of Merz-Wüthrich standard deviations can be made in order to arrive at runoff standard deviations for subsequent 1-year time horizons that reflect the full variability of an insurer's unpaid claims: both the process and parameter uncertainty. Stated differently, the calendar year runoff of standard deviation relevant for the risk margin calculation should include consecutive 1-year time horizon calibrations for as many years as there are development periods, each of which begins with a first projected period including process and parameter risk and remaining projected periods including parameter risk only. ►

FIGURE 2: CALENDAR YEAR RUNOFF OF MACK STANDARD DEVIATIONS

Runoff of Mack Model – Standard Deviations by Valuation Period

Year	0	1	2	3	4	5	6	7	8
1	-	-	-	-	-	-	-	-	-
2	75.535	-	-	-	-	-	-	-	-
3	121.699	74.931	-	-	-	-	-	-	-
4	133.549	120.373	74.041	-	-	-	-	-	-
5	261.406	125.695	113.131	69.186	-	-	-	-	-
6	411.010	269.797	130.224	117.306	71.982	-	-	-	-
7	558.317	437.273	287.714	139.969	126.301	78.029	-	-	-
8	875.328	623.100	489.142	323.291	159.581	144.441	90.307	-	-
9	971.258	785.070	557.224	436.400	287.117	139.643	125.999	77.826	-
10	1.363.155	903.373	729.436	516.796	404.139	265.121	127.697	114.976	70.421
CVA	1.353.961	1.039.055	773.477	556.945	384.712	263.965	170.358	79.424	-
Total	2.447.095	1.788.912	1.340.940	954.131	663.602	431.762	263.362	159.952	70.421

The method for including the full variability is developed in the paper *Cash Flow and Unpaid Claim Runoff Estimates Using Mack and Merz-Wüthrich Models (Cash Flow and Unpaid Claim Runoff)* as the “Alternative” formula.⁵

In **Figure 3**, which shows results for the alternative formula, the top row for the runoff is identical to that for Mack. The total row values are different, but this result is expected since beyond the first diagonal only the conditional reserves are calculated based on the full variance in the first diagonal.

One way to think about the differences between these models is that the full variance cannot be included in the Merz-Wüthrich model if the goal is to have the runoff reconcile with the results from Mack. However, since the time horizon concept of Solvency II requires the full variance in the first diagonal of each runoff year, then the alternative formula seems like a better solution for calculations such as risk margins. ►

5 The paper can be downloaded here: <https://www.milliman-mind.com/shapland/>. Access to a free trial app to test out the calculations can be requested at europesoftware@milliman.com.

FIGURE 3: CALENDAR YEAR RUNOFF OF ALTERNATIVE MODEL STANDARD DEVIATIONS									
Runoff of Alternative Model – 1-Year Time Horizon Standard Deviations by Valuation Period									
Year	0	1	2	3	4	5	6	7	8
1	-	-	-	-	-	-	-	-	-
2	75.535	-	-	-	-	-	-	-	-
3	105.309	74.931	-	-	-	-	-	-	-
4	79.846	100.806	74.041	-	-	-	-	-	-
5	235.115	68.535	93.353	69.186	-	-	-	-	-
6	318.427	240.563	67.590	95.673	71.982	-	-	-	-
7	361.089	336.607	255.033	70.558	102.361	78.029	-	-	-
8	629.681	400.731	374.947	284.965	79.593	116.320	90.307	-	-
9	588.662	562.933	356.774	334.233	253.564	69.171	101.939	77.826	-
10	1.029.925	544.418	521.865	329.305	308.794	234.466	62.194	92.663	70.421
CVA	1.025.050	787.105	592.464	434.573	299.857	212.772	154.021	79.424	-
Total	1.778.968	1.258.989	987.439	713.534	521.112	353.057	214.796	144.746	70.421

THE IMPACT

Drawing on calculations from *Cash Flow and Unpaid Claim Runoff*, the effect of the modification to the Merz-Wüthrich models can be seen in **Figure 4**. Starting with the runoff from the Merz-Wüthrich method and using the 99,5% Value at Risk (VaR) Capital Profile, an expected return of 6,0%, and a discount rate of 2,0%, the sum of the discounted

cost of capital is 891.587, which is 4,8% of the unpaid claims.

This figure is significantly less than the total discounted cost of capital of 1.007.157, or 5,4% of the unpaid claims, using the same assumptions noted above but calculated using the alternative model shown in **Figure 5**.

To help calibrate the potential impact on the market, an alternative proxy for required capital, such as the commonly used runoff of the projected best estimate (BE) can be added to the mix. Using the same assumptions noted above, except for using BE Runoff Capital Profile, also significantly underestimates the risk margin as shown in ►

FIGURE 4: COST OF CAPITAL FOR MERZ-WÜTHRICH MODEL USING A VAR CAPITAL PROFILE						
Valuation Period	Unpaid Claims	Standard Deviation	99.5 th Percentile	99,5% VaR	6,0% CoC	Discounted CoC
0	18.680.856	1.778.968	23.753.426	5.072.570	304.354	301.328
1	13.454.320	1.177.727	16.785.734	3.331.414	199.885	193.982
2	9.274.925	885.178	11.799.479	2.524.553	151.473	144.092
3	6.143.258	607.736	7.882.818	1.739.561	104.374	97.323
4	4.015.986	428.681	5.252.966	1.236.980	74.219	67.836
5	2.454.107	267.503	3.227.797	773.690	46.421	41.590
6	1.276.363	128.557	1.645.023	368.659	22.120	19.425
7	532.076	96.764	833.102	301.026	18.062	15.548
8	86.555	49.055	293.233	206.679	12.401	10.464
Total						891.587
Percent of Unpaid Claims:						4,8%

FIGURE 5: COST OF CAPITAL FOR ALTERNATIVE MODEL USING A VAR CAPITAL PROFILE						
Valuation Period	Unpaid Claims	Standard Deviation	99.5 th Percentile	99,5% VaR	6,0% CoC	Discounted CoC
0	18.680.856	1.778.968	23.753.426	5.072.570	304.354	301.328
1	13.454.320	1.258.989	17.038.055	3.583.735	215.024	208.674
2	9.274.925	987.439	12.123.409	2.848.484	170.909	162.580
3	6.143.258	713.534	8.222.165	2.078.907	124.734	116.308
4	4.015.986	521.112	5.555.442	1.539.456	92.367	84.424
5	2.454.107	353.057	3.512.025	1.057.918	63.475	56.868
6	1.276.363	214.796	1.935.777	659.413	39.565	34.745
7	532.076	144.746	1.021.830	489.754	29.385	25.295
8	86.555	70.421	421.013	334.458	20.067	16.933
Total						1.007.157
Percent of Unpaid Claims:						5,4%

Figure 6. More importantly, it produces a risk margin almost indistinguishable from the Merz-Wüthrich Model using a VaR Capital Profile.

A BIGGER RISK MARGIN

The example shows an additional 13% Risk Margin is required for the studied triangle, but this is just one sample. To help assess the potential impact on the market, 18 sample triangles for 2 lines of business were also tested using the same assumptions noted above.⁶

As shown in **Figure 7**, without adding any tail factors the impact on the risk margins using the alternative model compared to the Merz-Wüthrich model using a VaR Capital Profile ranged from

3,8% to 27,5% with an average of 13%, which is consistent with the example. Including tail factors (based on the data) increased the range to between a low of 6,6% and a high of 43,8% with an average of 20,9%.

While this refined approach is more likely to be used for internal models, if we assuming that the calibration of the standard formula is roughly consistent with Cost of Capital approach using either the Merz-Wüthrich VaR Capital Profile or the BE Runoff Capital Profile, we can extrapolate to the full European market as shown in **Figure 7**. The impacts shown are only on the Risk Margin, the impact on the Solvency Ratio should be much less significant. ●

6 The data includes 9 Private Motor and 9 Commercial Motor entities from the UK market PRA returns as at 31 December 2015.

FIGURE 6: COST OF CAPITAL USING A BE RUNOFF CAPITAL PROFILE						
Valuation Period	Unpaid Claims	Standard Deviation	99.5 th Percentile	99,5% VaR	6,0% CoC	Discounted CoC
0	18.680.856	100,0%	5.072.570	5.072.570	304.354,20	301.328
1	13.454.320	72,0%		3.653.365	219.202	212.729
2	9.274.925	49,6%		2.518.499	151.110	143.746
3	6.143.258	32,9%		1.668.131	100.088	93.327
4	4.015.986	21,5%		1.090.494	65.430	59.803
5	2.454.107	13,1%		666.384	39.983	35.821
6	1.276.363	6,8%		346.582	20.795	18.262
7	532.076	2,8%		144.479	8.669	7.462
8	86.555	0,5%		23.503	1.410	1.190
Total						873.668
Percent of Unpaid Claims:						4,7%

FIGURE 7: COMPARISON OF MODEL IMPACTS ON EUROPEAN RISK MARGINS						
Models Tested	Alternative vs. Merz-Wuthrich Model			European Market Risk Margin		
	Low	High	Average	Low	High	Average
No Tail Factors	3,8%	27,5%	13,0%	€ 37,4	€ 45,9	€ 40,7
Tail Factors	6,6%	43,8%	20,9%	€ 38,4	€ 51,8	€ 43,5

EUROPEAN ACTUARY

I feel honored and humbled to take on the role of Chief Executive at the Actuarial Association of Europe. I'm excited about the opportunities ahead to develop the association's already high-regarded reputation across Europe. I feel privileged to represent the interests of actuaries in Europe and to work with a first class board of directors, committee members and members of the AAE. I join the AAE from the UK's Financial Reporting Council, the UK regulator and standard-setter in the areas of audit, accounting, corporate governance and actuarial policy where I was head of international relations for the last eight years. I have worked in international affairs and EU policy for more than 16 years.

This is an exciting time to join the AAE. A new European Parliament has recently started its activities and the Commission is soon taking up its mandate in November and setting out its priorities for the next five years. This means that now is a good time to reinforce our existing relationships in order to outline our priorities in the context of the new agenda. AAE has recently published new position papers on sustainable finance, data science and ethics in insurance, costs and past performance participation products, IFRS17 and Solvency II. Please have a look, you can find them under publications on our website actuary.eu.

Equally important is to develop new relationships, especially with new MEPs that might have very little knowledge about the role of actuaries but who are going to play an important role on key EU dossiers. Many MEPs (and other stakeholders) are not technical experts so we need to ensure that we can reach them with a language they understand in the context of policy issues they care about. I recently spoke to an EP official who said that the EPs key priority in the areas of sustainable finance, the new capital markets union (CMU) and the pension/insurance dossiers is going to be consumer protection. I think that actuaries are in a strong position to play a prominent role in this, given their deep understanding of financial economics and the construction of retail financial products. By raising awareness of the constructive role AAE and its members can play in helping policy-makers and other key stakeholders with the key issues and priorities they are grappling with, we can position ourselves as a helpful, trusted partner.

I would love to hear your views about the challenges and opportunities facing the profession in the future and I look forward to meeting and discussing with many of you in Vienna at the AAE General Assembly.

Cecilia Thorn
Chief Executive Actuarial Association of Europe



COLOPHON

The European Actuary (TEA) is the triannual magazine about international actuarial developments. TEA is written for European actuaries, financial specialists and board members. It will be released primarily as e-mail newsletter.

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