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VM-20 Game Changer: Mortality Aggregation

By Tim Cardinal

Mortality is a key risk factor receiving considerable attention and effort for companies that have or are about to implement VM-20. The 2020 edition[1] of the Valuation Manual incorporates APF 2018-17 which addresses mortality data aggregation and calculation of company experience rates. It is possible that a company that satisfied requirements in the 2017 through 2019 editions will need to reconsider the 2020 edition requirements.

The most memorable aspect is that VM-20 permits data aggregation to enhance credibility. For example, blocks considered for aggregation might include:

- different underwriting eras, such as thresholds associated with risk characteristics or risk class structures (e.g., 5-class with 6-class);
- different products;
- different distribution channels;
- accelerated underwriting with traditional underwriting; and
- internal data with external data.

In the absence of aggregation, lower credibility means larger margins, which means larger reserves.

The accompanying requirements have perhaps not received as much attention. If the Dire Straits 1980s classic "Money for Nothing" were about VM-20 mortality aggregation rather than about MTV, the lyric would be, "credibility for nothing and your margins for free." However, credibility through data aggregation is not "free." Permission to aggregate hinges on "if similar"—there needs to be similar underwriting processes and similar mortality.

In particular, a current hot topic is aggregating accelerated underwriting with traditional underwriting. Adequately addressing similarity requirements is not free. Does an accelerated underwriting program produce similar outcomes? What is similar? *A/E*s within five percent? Seven percent?

Actuaries are accustomed to establishing and supporting that models, methods and assumptions are reasonable in the context of materiality. Reasonable does not imply similar. Once a company determines "what" is aggregated, a company must demonstrate "why" they can aggregate the "what." I make no attempt to evaluate whether or not it is desirable or permissible to aggregate various blocks of business. This article focuses on similarity requirements but does not advocate specifications.

First, I cite pertinent VM-20 language permitting data aggregation, adding bold for emphasis. I recommend you read the original in its entirety, especially all of 9.C.

Second, I discuss considerations per the necessary "if" condition. These considerations are entirely my opinions. Third, I discuss the requirements for setting aggregate company mortality experience rates per 9.C.2.d.vi.

MORTALITY DATA AGGREGATION: VM-20 LANGUAGE

Previous editions of the valuation manual permitted data aggregation. VM-20 Section 9.A.6.a states: "For risk factors (such as mortality) to which statistical credibility theory may be appropriately applied, the company shall establish anticipated experience assumptions for the risk factor by combining relevant company experience with industry experience data, tables or other applicable data in a manner that is consistent with credibility theory and accepted actuarial practice."

The takeaway is that company rates are not simply the aggregate company experience rates. Rather, company experience is combined and weighted with other data using credibility techniques.

The 2020 edition clarifies and strengthens the conditions to combine data. First, 9.C.2.b defines company experience data as being derived from three sources.

"Company experience data shall be based on experience from the following sources:

i. Actual company experience for books of business within the mortality segment.

ii. Experience from other books of business within the company **with similar underwriting.**

iii. Experience data from other sources, … Data from other sources is appropriate **if the source has underwriting and expected mortality experience characteristics that are similar to policies in the mortality segment.** …"

Data belonging to the mortality segment does not have additional requirements. Data internal to the company requires **similar** underwriting. Data external to the company requires **similar** underwriting and similar expected mortality experience characteristics.

Section 9.C.2.d. reaffirms the permission and adds further to the similarity requirements. It states: "The company may base mortality on the aggregate company experience for a group of mortality segments when determining the company experience mortality rates for each of the individual mortality segments in the group **if the mortality segments were subject to the same or similar underwriting processes. …"**

Sections 9.C.d.i and 9.C.d.ii define underwriting processes as processes by which the company "determines which risks to accept and to which risk class each policy is assigned, including any impacts on these determinations due to distribution systems and target markets." Sections 9.C.d.iii and 9.C.d.iv address a process that is expected (d.iii) or has been shown (d.iv) **"to produce similar mortality"** to that of a previously established underwriting process. Section 9.C.d.iii further states: "… may be treated as similar to the previously established underwriting process if these expectations regarding mortality are supported by relevant, pursuant to Section 9.A.6, third-party proprietary experience studies (such as those of reinsurers or consulting firms. …" Meanwhile 9.C.d.iv requires a retrospective demonstration using statistical analyses, predictive model back testing, or other modeling methods. The common requirement in the two subsections is similar mortality.

SIMILARITY

Consider internal and external blocks of business *A*, *B*, *C*, *D* and so on. There are three separate similarity requirements:

a. Mortality experience characteristics (e.g., demographics, markets, products);
b. underwriting processes; and
c. mortality experience (i.e., outcomes).

How do we demonstrate that the key conditions of "if similar" are satisfied?

We start with some definitions of similar: having traits or characteristics in common, like in form, appearance, size, qualities, relations, etc.; having a resemblance in appearance or nature as to something implied or specified; alike in some respects though not identical.[2]

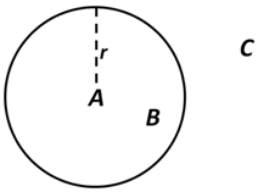
To a large degree, similarity is subjective and a matter of perspective. Perspective determines which traits to consider. From a 30,000-foot view, a cat is similar to a dog and to a fish—they are all animals. From a 10,000-foot view, a cat is similar to a dog but not to a fish. From a 1,000-foot view, a German shepherd is similar to a Labrador retriever but not to a poodle nor to a Bombay cat. How do we demonstrate our assertions? How do we reconcile that one assertion implies a dog is similar to a cat whereas another assertion implies a dog is not similar to a cat?

Is A similar to B (i.e., $A \sim B$)? To ascertain similarity, a list including subjective (qualitative) and objective (quantitative) criteria can be enumerated and evaluated. Subjective criteria could appeal to intuition or be based on a list of traits that are common to A and B and traits that are different. We could first develop a list of pre-defined traits—such as size, color, shape, weight, age, mammal, number of legs—and then given any two objects evaluate each trait on the list.

To a degree, similarity is transitive, but there is a slippery slope. We can start with an object A_1 and select five to 10 traits and by making one small change to one trait, derive similar object $A_2 \sim A_1$. With each successive change, we assert similarity: $A_k \sim A_{k-1}$. But through a series of 10+ changes, we end up with an object considered entirely different: $A_1 \sim A_2$, $A_2 \sim A_3$, …, $A_{99} \sim A_{100}$. Is $A_1 \sim A_{100}$?

We can specify a criterion by defining a "distance" function and stating that if the distance between X and Y is less than *r*, then *X~Y*. In Figure 1, we can visually see that *A~B*, but A and *C* are not similar.

Figure 1
Comparing Objects by Distance



We can make the criteria for dogs, cats and fish objective. In topology, one defines a distance function based on DNA—the differences between sequences of nucleotide bases *A*, *C*, *G* and *T*. Then based on our perspective, we choose an *r* to assert *X~Y*.

A Company Wishing to Aggregate Blocks of Business Should Specify What Similar Means. A Company Can Then Assert *A~B* by Demonstrating the Specified Criteria Are Met.

Ideally, we could use a perfect existing set of criteria with off-the-shelf distance functions for each of the three similarity requirements. However, each requirement has different challenges in choosing criteria and defining distance functions. Although we can quantify qualitative criteria, underlying subjectivity remains present.

My opinion is that similarity requirements a) and b) have more subjectivity that allows a less stringent, less precise, more qualitative set of criteria, thus providing more wiggle room to demonstrate similarity. Meanwhile requirement c) is more quantitative, resulting in a more precise requirement. I also believe requirements a) and b) will have larger "*r*"—perhaps requirements a), b) and c) could be associated with 10,000-, 20,000- and 1,000-foot perspectives, respectively.

Requirements a) and b) are ex-ante while requirement c) is ex-post. It is necessary, but not sufficient, that ex-ante requirements are similar. No matter how liberal the ex-ante similarity criteria are, there is no escaping the ex-post requirement that outcomes are similar. A company might assert via weak criteria that a) and b) are similar but the real proof is when experience comes through and the outcomes are close.

Section 9.C.2.d (d.iii and d.iv in particular) suggests that the effort to demonstrate similarity should be proportional and reasonable. Qualitative and quantitative criteria for similarity should make sense and be defendable. The bar to clear this might range from little more than asserting "similarity is obvious" to well-thought-out criteria for similarity accompanied by qualitative and quantitative analyses of underwriting processes and experience such as retrospective analyses. For example, process changes such as 1) adding one threshold, 2) changing the risk class structure by splitting a class (e.g., super-preferred), and 3) introducing accelerated underwriting represent a wide spectrum to assess similarity requirements.

Let's briefly consider each similarity requirement. First, we can form a profile of mortality experience characteristics such as:

- Sales mix across various attributes such as sex, face amount, risk class, issue age;
- distribution channels and target markets; and
- product design features that might affect behavior such as conversions and guarantees.

Sales mix by attribute is readily quantifiable, but the issue is suitable "*r*." For example, is a 60 percent/40 percent male/female mix similar to a 45 percent/55 percent mix or to a 30 percent/70 percent mix?

Second, underwriting processes can be complex and challenging to compare. A process is a series of operations, actions, changes or functions. Underwriting processes are distinct and separate from the result, that is, risk classifications. Underwriting guidelines and practices are more readily compared qualitatively but can be compared quantitatively. Similarity criteria might include the length and nature of questions, use of medical exams, and so forth, for dozens of other underwriting process "traits."

Third, mortality experience can be quantified as A/Es. Provided the Es are based on the same tables, then all that remains is defining a suitable "*r*." For example, is an 80 percent A/E similar to an 85 percent A/E or to a 90 percent A/E? Additional considerations arise when different tables or various sets of adjustment factors are used.

COMPANY EXPERIENCE MORTALITY RATES

VM-20 sections 9.A.6.a and 9.C.2.d.vi require that company experience mortality rates are "informed" by the aggregate experience using credibility or other techniques. Mortality segment rates are a blend and not simply the aggregate rates or individual segment rates. The essential concept underlying methods such as credibility and meta-analysis is that we can better understand, estimate and predict one group by aggregating many groups.

Section 9.C.2.d.vi.a is called the "top-down" approach, and section 9.C.2.d.vi.b is called the "bottom-up" approach. There has been enough confusion that the NAIC published examples of both approaches at *https://www.naic.org/documents/pbr_data_*

mortality_aggregation.xlsx. I do not go into detail here and refer the reader to the spreadsheet for basic examples.

The top-down approach uses predefined expected relativities between mortality segments determined from a reliable and applicable external source to subdivide the aggregate experience into mortality segments. The bottom-up approach adjusts the experience of each mortality segment by credibility weighting the individual mortality segment experience with the aggregate company experience for the group. More complex contexts might use a hybrid-approach that is a combination of steps consisting of top-down and bottom-up approaches.

Once techniques have been applied, section 9.C.2.d.vi requires company experience mortality rates to be increased if necessary to conserve deaths. It states that "the company must ensure that when the mortality segments are weighted together, the total amount of expected claims is not less than the aggregate company experience data for the group."

In general, VM-20 requires additional margins where there is greater uncertainty. Section 9.C.6.d.v makes this explicit in regard to mortality aggregation. It states: "To the extent that, when treating an underwriting process as similar, the judgment of the similarity of expected mortality or the estimate of the expected difference in mortality increases uncertainty in the mortality assumption, the margin applicable to the mortality assumption should be increased pursuant to Section 9.C.6.d."

CONCLUSION

To aggregate one or more blocks, a company must demonstrate three similarity requirements: Mortality experience characteristics, underwriting processes, and mortality experience. While we might each have our opinions, similarity is not only in the eye of the beholder (company); the final verdict is by the regulators. ■

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ENDNOTES

1 National Association of Insurance Commissioners. Valuation Manual Jan. 1, 2020 Edition. August 2019. Accessed online: *https://www.naic.org/documents/pbr_data_val_2020_edition_redline.pdf*

2 Used Wiktionary as starting point for definitions of "similar" and "process." Accessed online: *https://www.wiktionary.org*

VM-22: Statutory Maximum Valuation Interest Rates for Income Annuities

By Tom Mao, Mary Wu and Hannah Zhu

VM-22 was first introduced into the Valuation Manual in 2018. A number of changes have been made since its introduction, with more expected on the way.

In its current state, VM-22 defines the statutory maximum valuation interest rate used in conjunction with CARVM for immediate, payout annuities and other similar contracts issued after Dec. 31, 2017.

The maximum valuation interest rates under VM-22 supersede those prescribed in Actuarial Guideline IX (AG 9) for products under the scope of VM-22.

Key differences between pre- and post-VM-22 requirements are summarized in Figure 1.

Figure 1
Differences Between Pre- and Post-VM-22 Requirements

	Pre-VM-22	Post-VM-22
Scope	Issued prior to Jan. 1, 2018	Issued on or after Jan. 1, 2018
By duration	Guarantee duration and plan types (A, B and C)	Reference period and rate buckets (A, B, C and D)
Update frequency	Annual	Jumbo: daily Non-jumbo: quarterly
Rounding	Nearest 25 basis points (bps)	Jumbo: nearest 1 bp Non-jumbo: nearest 25 bps
Reference rate	Moody's seasoned corporate bond index	Treasury rates
Valuation rate derivation	Does not vary by jumbo vs non-jumbo contracts; based on the reference rate and pre-defined weighting factor	Varies by jumbo vs non-jumbo; based on reference rate and prescribed spreads, defaults and portfolio credit quality distribution

TECHNICAL AND IMPLEMENTATION IMPLICATIONS

Valuation Rate Buckets: A, B, C and D

Contracts in scope for VM-22 are assigned to one of four valuation rate buckets—as shown in Figure 2—based on the following criteria:

1. Whether the contract is life contingent
2. The length of the reference period (RP)
3. Initial age of the annuitant

Figure 2
Determination of Valuation Rate Buckets

		Length of RP (in years)			
Contracts without life contingencies					
		0 - 5	6 - 10	11 - 15	16 +
	Buckets	A	B	C	D
Contracts with life contingencies					
	Initial Age	0 - 5	6 - 10	11 - 15	16 +
Buckets	90+	A	B	C	D
	80-89	B	B	C	D
	70-79	C	C	C	D
	<70	D	D	D	D

The increase in granularity with respect to length of reference period and initial age of annuitant allows for more robust duration matching. However, some implementation effort is expected in order to set up the above bucket assignment in the models. After the initial model implementation, no recurring efforts are needed other than the periodic updates of valuation interest rates.

Jumbo Vs. Non-jumbo Contracts

A new distinction introduced by VM-22 is the size of the initial consideration. A contract with initial consideration equal to or greater than $250 million is referred to as a jumbo contract. A contract with less than $250 million is referred to as a non-jumbo contract. VM-22 requires jumbo contract valuation rates to be updated daily and non-jumbo contracts to be updated quarterly.

Jumbo contracts mostly consist of pension risk transfers. Also, despite the daily update frequency, the calculations and applications of these rates are only performed at each valuation. Therefore, the requirement for daily updates is not expected to have a significant impact for most companies.

Rate Derivation

For each valuation rate bucket (A, B, C or D), the quarterly non-jumbo valuation rate is defined as

$I_q = R + S - D - E$ where:

- R is the reference rate;
- S is the spread;
- D is the default cost; and
- E is the spread deduction (defined as 0.25 percent).

For non-jumbo contracts, the quarterly statutory maximum valuation interest rate is the quarterly rate I_q rounded to the nearest one-fourth of 1 percent.

For jumbo policies, the daily valuation rate is defined as $I_d = I_q + C_{d-1} - C_q$ where:

- I_q is the quarterly valuation rate defined above for the quarter preceding the premium determination date;[1]
- C_{d-1} is the daily corporate rate for the business day immediately preceding the premium determination date; and
- C_q is the average daily corporate rate corresponding to the same period used to develop I_q.

For jumbo contracts, the daily statutory maximum valuation rate is the daily valuation rate I_d rounded to the nearest one-hundredth of 1 percent.

Each component of the above calculations as well as the final valuation rates are posted on the NAIC website, quarterly for non-jumbo rates and daily for jumbo rates. In general, the implementation is relatively straightforward and can simply use a "plug and play" approach based on issue age and reference period. Robust automated external tools can often be utilized to ease the recurring update.

Reference Period

The reference period is the length of time used in assigning the valuation rate buckets. Its determination is one of the more challenging aspects of VM-22. The reference period is determined and locked in at issue for both jumbo and non-jumbo contracts.

The reference period is determined as follows and rounded to the nearest integer year, based on whether a contract is life contingent and if the underlying payments are substantially similar.

1. For life-contingent contracts, the reference period is calculated from the premium determination date to the earlier of the date of the last non-life-contingent payment and the date of the first life-contingent payment.

2. For non-life-contingent contracts, the reference period is calculated from the premium determination date to the date

of the last non-life-contingent payment, which would be the last payment under the contract.

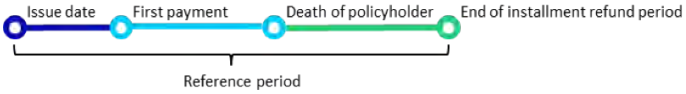
3. The above two approaches are intended for payments that are substantially similar. If this is not the case, Macaulay duration of the series of payments is used as the reference period. Actuaries are required to apply prudent judgment in its determination.

There are a few important details to note with regard to reference period. Reference period must be calculated at a contract level. For group annuities this means the reference period should be calculated separately at the certificate level under the group contract. Reference period is rounded to the nearest year before being used in rate bucket assignments.

The determination of reference period is further illustrated in the two examples shown in Figure 3. In Example 1, the reference period is calculated from the issue date to the last payment of the installment refunds. In Example 2, the reference period is the same as the deferral period since all cash flows are life contingent.

Figure 3
Examples Illustrating Determination of Reference Period

Example 1: An income annuity contract with installment refund feature



Example 2: An income annuity contract with premium refund upon death

Determining the correct reference period is a crucial aspect of VM-22. If the company's existing valuation system is not capable of performing such a calculation, it may be worthwhile to explore data processing options outside of the model to ensure correct implementation.

New York Regulation 213

New York has adopted Insurance Regulation 213 (NY Reg-213), Principle-Based Reserving, which includes the requirements for valuation of payout annuity reserves (as well as valuation requirements for term life and variable annuity contracts) for companies domiciled in New York.

For payout annuities, NY Reg-213 has similar requirements to VM-22 but has several differences as summarized in Figure 4.

Figure 4
NY Reg-213 vs. VM-22—Non-jumbo contracts

Feature	VM-22	NY Reg-213
Scope	Issued on or after Jan. 1, 2018	Issued on or after Jan. 1, 2019 Policies issued in 2019 have the option to apply either NY Reg-213 or existing requirements, or a modified version of existing requirements
Cap on spread	None	Table X spreads defined in Section 2.F of VM-22 shall each be capped at 200 basis points
Portfolio distribution	• 5% Treasuries • 15% Aa bonds (5% Aa1, 5% Aa2, 5% Aa3) • 40% A bonds (13.33% A1, 13.33% A2, 13.33% A3) • 40% Baa bonds (13.33% Baa1, 13.33% Baa2, 13.33% Baa3)	• 5% Treasuries • 45% Aa bonds (15% Aa1, 15% Aa2, 15% Aa3) • 50% A bonds (16.67% A1, 16.67% A2, 16.67% A3)

After taking spread cap and portfolio distribution into consideration, the difference between rates calculated from VM-22 and NY Reg-213 is rounded down to the nearest 0.25 percent, floored at zero, and finally subtracted from the rounded VM-22 rate. This results in a lower or equal valuation interest rate under NY Reg-213 compared to VM-22.

For jumbo contracts, the difference in daily maximum valuation interest rates is summarized in Figure 5.

Figure 5
NY Reg-213 vs. VM-22—Jumbo contracts

Feature	VM-22	NY Reg-213
Daily maximum valuation rate	I_d^2	I_q^2 less (R_{d-1} + 1.90% – D – E) where: • R is the daily reference rate[3] for the business day immediately preceding the premium determination date • D is the default cost[2] • E is the spread deduction[2]

Implementation of NY Reg-213 is expected to be more challenging than VM-22. Unlike VM-22, the maximum

valuation interest rates under NY Reg-213 are not published online at the time of this writing and require the development of a tool to calculate.

THE ROAD AHEAD

Insurance regulations are constantly evolving. There are already ongoing discussions within the NAIC subgroup to materially revise VM-22 in the near future. Some revisions are expected to define the minimum reserve requirements by incorporating aspects of the existing AG 9 methodology and mortality requirements. It is reasonable to expect that the final requirements under VM-22 will be much more granular and robust than what they currently are under AG 9.

Additionally, with life insurance principle-based reserving (PBR) and variable annuity PBR already in effect, the regulators have turned more attention to non-variable annuity PBR which will potentially be incorporated as part of VM-22. If so, it is expected that more complex products such as fixed indexed annuities and fixed annuities with guaranteed lifetime withdrawal benefit (GLWB) riders may also be included as part of VM-22.

As regulatory requirements continue to evolve, it will be important to stay close to emerging regulatory discussions. Creating optionality in modeling and product cycle will allow companies to remain agile and be able to react swiftly to potential changes in regulations. ■

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ENDNOTES

1 The premium determination date is generally the issue date. For supplementary contracts and annuitizations, it would be the date of election of the supplementary features.

2 As defined in rate derivation section above.

3 Calculated as the weighted average of the daily Treasury rates immediately preceding the premium determination date for two-year, five-year, 10-year and 30-year U.S. Treasuries.

IFRS 17: Risk Adjustment—A Numerical Example

By Nan Jiang

Under IFRS 17, the new International Financial Reporting Standard (IFRS) for insurance contracts, the total liability of insurance contracts is the sum of the best estimate liability (BEL), risk adjustment (RA) and contractual service margin (CSM). CSM represents the future profit margins from insurance contracts that will be released over the coverage period and it is solved at initial recognition such that the total liability is equal to zero, similar to the net to gross ratio concept under US GAAP Long Duration Targeted Improvements.

RA is needed under IFRS 17 to reflect the compensation that a company requires for bearing the uncertainty about the amount and timing of the cash flows that arises from non-financial risk. Companies are also required to disclose the method and confidence level used for the calculation of the RA. However, IFRS 17 doesn't specify a method and a confidence level, nor does it provide a list of specific risks that are considered to be non-financial risk. Companies need to define them based on their own preferences or existing practices. This article will introduce available approaches and discuss the confidence level approach with potential consideration stemming from industry preferences and illustrative examples.

THE APPROACH

The industry discussions are mainly focused on a prior exposure draft issued in 2010 that lists three techniques for estimating the RA:

a. Confidence level;
b. conditional tail expectation (CTE); and
c. cost of capital (CoC).

So far, the CTE is the least preferred method because it measures the expected loss on the portfolio as an average of outcomes occurring above the specified confidence level, requiring multiple scenarios or stochastic scenarios for each nonfinancial risk. It is therefore operationally more complex than the other two methods.

Both the confidence level and the CoC approaches are preferred, but the confidence level approach has some advantages. It is relatively easy to implement if the company already has a shock-based capital framework such as Solvency II or international capital standard (ICS), especially with an internal model method to derive its own stress factors, and no need to solve for a confidence level for disclosure. Results under the confidence level approach will also be relatively stable and smaller relative to the CoC approach, especially for long-duration portfolios. The confidence level approach is also less dependent on assumptions such as the cost of capital rate, capital projection approach and loss distribution.

KEY ISSUES

Despite the advantages, there will be four immediate items to consider with the confidence level approach:

1. Which risks shall be considered in RA? There is some clarity from the standard, such that operational risks should be excluded. Although nonfinancial risks are not clearly defined, similar standards can be referred to such as Solvency II, ICS or other capital regimes including companies' own economic capital. It might be worth mentioning that one reason the standard uses nonfinancial risks rather than insurance risks is that certain risks such as lapse or persistency risk are not considered as insurance risks under IFRS 17, but probably will be included in the RA calculation for most companies.

2. What confidence level should be used and how different will be the results? Industry-wide consensus so far is 70th to 80th percentiles, lower than what are required by capital requirements that are 99th or higher. ICS used to have a margin over current estimate (MOCE) which was around the 75th percentile. Hence, in the analyses shown in the next section, 70th, 75th and 80th are selected for confidence levels.

3. At which level is the RA calculated: policy level, company level or any level in between? In order to maximize the diversification benefits between risks, for example, mortality risk and longevity risk, companies may need to calculate the RA at a higher level. This will lead to the next question: how do they aggregate the policy level risks to the company level? For example, if one policy has positive mortality risk while the other has negative, there needs to be a determination whether there should be an offset. Also, how to calculate the correlation or diversification between risks is also important; for example, using a correlation matrix is probably common but how to set the correlation matrix requires judgment.

4. How is the RA allocated back to the group of contracts level? This consideration is necessary because the IFRS 17 level of aggregation requires contracts with different levels of profitability to be grouped separately. That is, onerous contracts and contracts with no significant probability of becoming onerous need to be grouped separately. Furthermore, groups by portfolio (high level product group) and issue year are also required under IFRS 17. The level at which profitability is determined varies by insurers. Some insurers will determine it at the policy level, and then they will need to allocate RA back to the policy level. Hence, how the RA is allocated will depend on the level at which the grouping is decided. The example in the next section uses policy level results for grouping, treating the base contract and associated riders to be one policy. Please note that whether base contracts and riders are considered as the same policy could be a separate topic.

RA APPROACH AND CONFIDENCE LEVEL

For the example, RA is calculated at the company level for a hypothetical company with a wide variety of products, including traditional life and annuity products, variable life and annuity products, as well as health products. Solvency II type risks including mortality, longevity, morbidity and lapses are considered except for expense risks, and they are calibrated to the 70th, 75th and 80th percentiles based on a normal distribution or historical experience. A correlation matrix is needed to aggregate all risks and calculate diversification benefits.

Figure 1 shows the comparison of 70th, 75th and 80th percentiles when using the confidence level approach, as well as a reference to a 99th percentile shock and CoC approach with a CoC rate of 6 percent and three types of capital run-off patterns: BEL, PV Outgo and Sum Assured (SA) projection.

Figure 1
Smaller RA Amounts From the Confidence Level Approach Than the CoC Approach

	BEL	Mortality	Longevity	Morbidity	Mass Lapse	Lapse	Pre-Diversified RA	Post-Diversified RA	% of RA to BEL	% of RA to PV Outgo	Diversification Ratio
70th Percentile	14,420	0.5	112	107	5	126	351	212	1.5%	0.8%	60%
75th Percentile	14,420	0.7	148	140	6	163	458	277	1.9%	1.0%	60%
80th Percentile	14,420	0.8	184	174	8	205	572	345	2.4%	1.3%	60%
99th Percentile	14,420	91	427	496	236	192	1,442	795	5.5%	2.9%	55%
CoC (BEL)	14,420	91	427	496	236	192	N/A	1,580	11.0%	5.8%	N/A
CoC (PV Outgo)	14,420	91	427	496	236	192	N/A	899	6.2%	3.3%	N/A
CoC (SA)	14,420	91	427	496	236	192	N/A	613	4.3%	2.3%	N/A

Figure 2
Validation of the Results of the Confidence Level Approach

	Post-Diversified	Difference (ratio to 70th)	z- Value (normal distribution)	Difference (ratio to 70th)
70th Percentile	212	1.00	0.52	1.00
75th Percentile	277	1.31	0.67	1.29
80th Percentile	345	1.63	0.84	1.60
99th Percentile	795	3.75	2.33	4.44

Figure 3
Different Diversification Benefits From the Three RA Risk Aggregation Methods

	BEL	Mortality	Longevity	Morbidity	Mass Lapse	Lapse	Pre-Diversified RA	Post-Diversified RA	% of RA to BEL	% of RA to PV Outgo	Diversi-fication Ratio
Company Level Aggregation	14,420	0.64	144	140	3	45	332	225	1.6%	0.8%	68%
Product Level Aggregation	14,420	0.64	145	140	5	106	396	245	1.7%	0.9%	62%
Policy Level Aggregation	14,420	0.67	148	140	6	163	458	277	1.9%	1.0%	60%

As a validation, the relationships of the post-diversification results between different percentiles as shown in Figure 1 is confirmed to fit a normal distribution as shown in Figure 2.

RA RISK AGGREGATION METHOD

Since we are calculating the RA at the company level in the example, three RA risk aggregation methods that have different degrees of potential offset benefits are tested:

1. Company level aggregation: allowing company level offsetting of "positive" and "negative" risks. Negative risk amount is never floored at zero. The offset impact is the largest.

2. Product level aggregation: allowing offsetting of "positive" and "negative" risks within a product. Once determined, negative risk at the product level is floored at zero. There are potential offset impacts.

3. Policy level aggregation: no offsetting allowed. All risks are floored at zero for each policy. There is no offset impact.

The floors are used in this example to avoid negative RAs at each aggregation level before they are aggregated at the company level. In our example, policy level pre-diversified RA is used for RA allocation and negative RA could create issues.

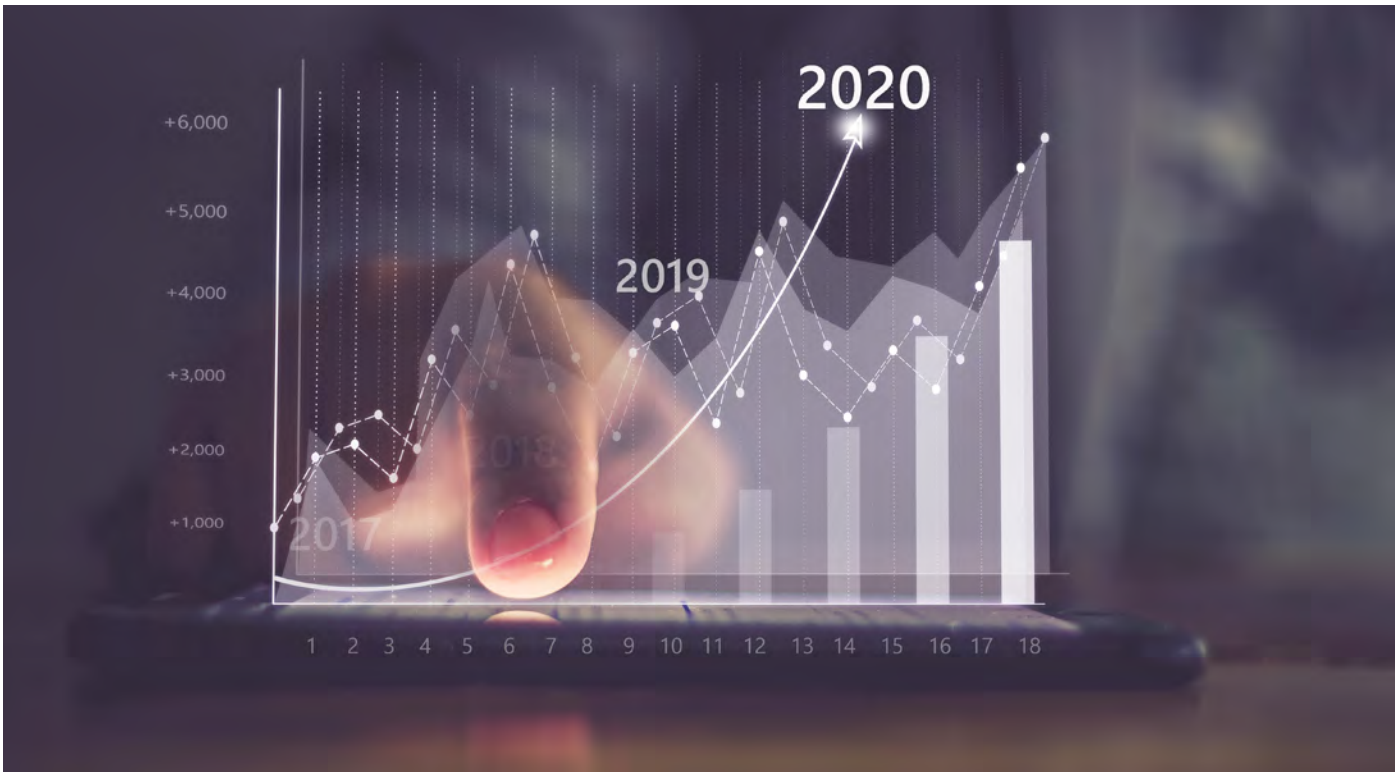
For example, let's consider a policy that has a mortality risk of 100, and a longevity risk of –150. Under the company level aggregation approach, the longevity risk of –150 is utilized to offset positive longevity risks from other product groups such as annuities. Under the product level aggregation approach, if the product group is life including life with annuitization options, –150 may be utilized as an offset of other policies within the product group. Or otherwise, if the product group does not have significant longevity risk, –150 may end up being floored at zero at the product level and the potential offsetting benefit is lost. The third approach will floor –150 at zero at the policy level resulting in losing the offset benefit. Thus, the difference between these three approaches will vary based on how much of the –150 risk could be used to offset the longevity risk.

Figure 3 shows the results of the three RA risk aggregation methods for the 75th percentile confidence level approach.

The diversification benefit is the largest under the company aggregation method as expected, but the differences are relatively small in this example. Thus, for this example, some deciding factors will be whether to keep consistency between a risk aggregation method and an RA allocation method, whether negative RA is allowed, and at which level the RA will be allocated back. The next section discusses further the RA allocation method assuming negative RA is not allowed.

RA ALLOCATION METHOD

There are different ways to allocate RA from the company level to groups of contracts or even to the policy level. I illustrate two methods of how to allocate RA to the policy level assuming negative RA is not allowed: 1) policy level pre-diversified RA



Ratio Method, and 2) marginal contribution to risk (MCTR) method.

The policy level pre-diversified RA ratio method is easy to understand, and it can be broken down into several steps:

Step 1: Calculate policy level pre-diversified RA and floor at zero;

Step 2: Aggregate policy level pre-diversified RA to have company level pre-diversified RA;

Step 3: Calculate the ratio of policy level pre-diversified RA to company level pre-diversified RA;

Step 4: Apply the ratio to company level post-diversified RA to calculate policy level post-diversified RA.

Marginal contribution to risk (MCTR) is a risk measure that is often used when assessing an asset portfolio's risks. Setting aside the detailed definition of MCTR itself, the allocation can be calculated as follows:

Step 1: Calculate company level diversification ratios for each risk;

Step 2: Apply the ratios to each corresponding policy level pre-diversified risk and sum up post-diversified risk amounts to determine the policy level RA.

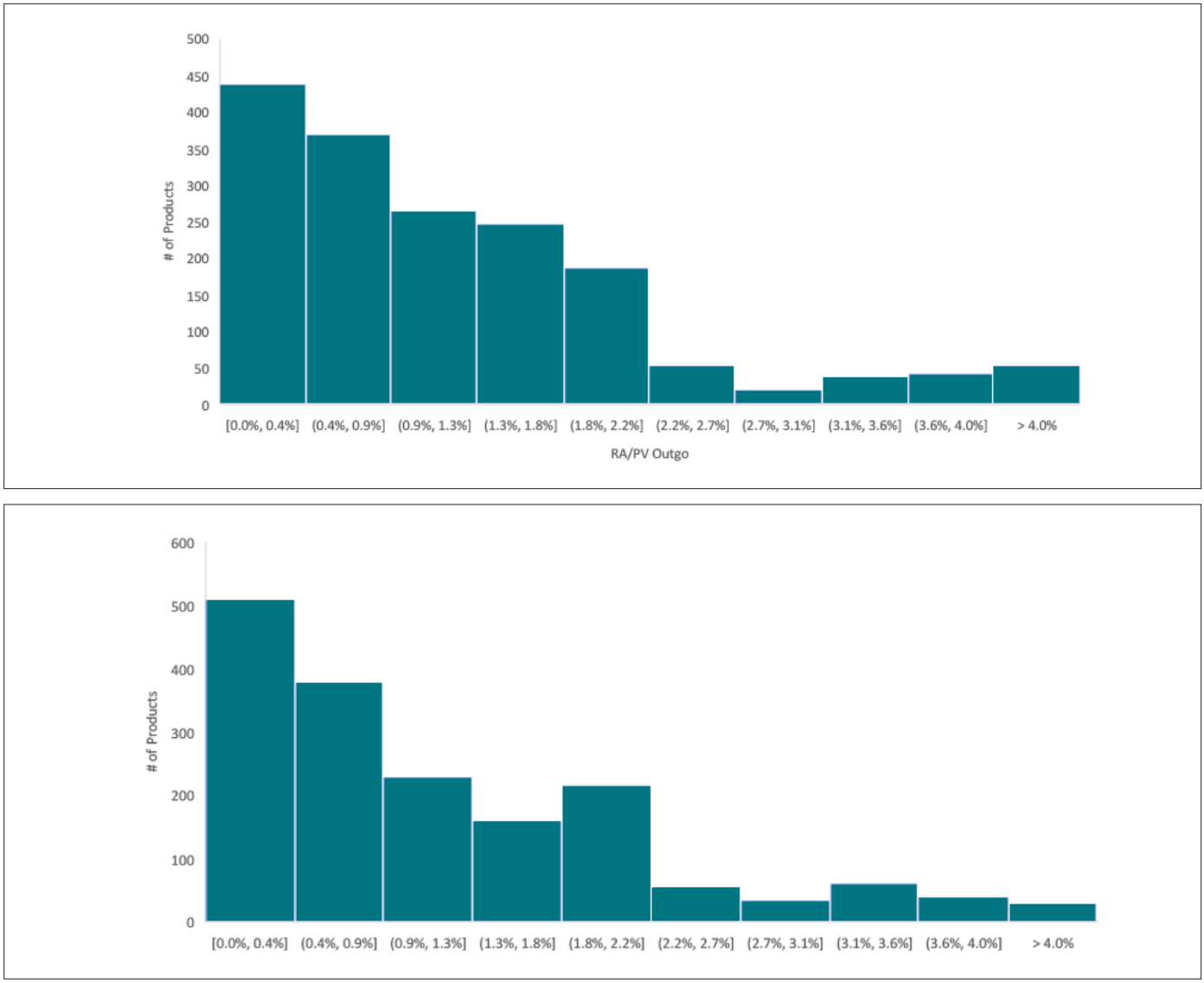
The difference from the policy level ratio method that applies one diversification ratio for pre-diversified RA is that the MCTR method will apply different diversification ratios to different risks as shown in Figure 4. Therefore, the MCTR method might be able to better reflect the risk profiles in allocating RA.

Figure 4
Risk Level Diversification Ratios Using MCTR Method for 75th Percentile Confidence Level

	Pre-Diversified	Post-Diversified	Diversification Ratio
Mortality	0.67	0.07	10%
Longevity	148	94	64%
Morbidity	140	86	61%
Mass Lapse	6	0.15	2%
Lapse	163	96	59%

In this example, the policy level post-diversified RA results as percentages of policy level RA to PV Outgo are similar under the two methods as shown in Figure 5. However, the policy level pre-diversified RA ratio method appears to generate a slightly heavier tail than the MCTR method, which may confirm the MCTR method's ability to reflect risk profiles to match risks represented in mortality, morbidity and lapse outgo. However, operationally the first method could be slightly less complex because only one factor is needed.

Figure 5
Comparison of the Two Methods to Allocate Company Level RA[1]



CONCLUSION

The RA is an important component of the total IFRS liability despite its potentially smaller amount. It represents nonfinancial risk explicitly. It will impact both new business grouping and subsequent measurement. RA allocation directly impacts new business grouping results and also the size of the CSM at issue. Releasing RA in the subsequent measurement is considered a profit driver in the income statement. Therefore, companies will need to decide which approach to use based on their own risk profile and risk appetite alongside with other strategies. Companies will also need to carefully calibrate the shocks for the RA calculation if they use the confidence level approach. This article demonstrated some approaches and available methods but there are other generic areas to address such as discount rates, correlation matrices, and so on.

I would like to give a special thank you to all of Prudential's IFRS team members, especially Prudential of Korea's IFRS team and its team lead Seung Hee Han for their dedicated help in generating ideas and discussing results. ■

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ENDNOTES

1 A product has multiple policies with similar specifications.

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